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Tonkin Highway Grade Separated Interchanges

Hale Road and Welshpool Road

Environmental Offset Strategy

Assessment Number: 2293

D21#910809
September 2022

Executive Summary

Main Roads Western Australia (Main Roads) is proposing to construct a single fly-over and grade-separated interchange at the existing intersections of Tonkin Highway and Hale Road in Forrestfield and Tonkin Highway and Welshpool Road in Wattle Grove, respectively. In addition, Tonkin Highway will be widened to a six-lane dual carriageway (the Proposal).

On 19 May 2021, the Chairman of the EPA determined the Proposal required further assessment based on referral information with additional information required under Section 40(2)(a) of the EP Act. In accordance with Section 40(2)(a) of the EP Act, the EPA requested Main Roads provide additional information to inform the environmental impact assessment of the Proposal, including the provision of this Offsets Strategy.

The Proposal has the potential to result in significant residual impacts to *Banskia attenuata* woodland over species rich dense shrublands (SCP20a) Threatened Ecological Community (TEC), *Banksia mimica*, *Conospermum undulatum*, *Johnsonia pubescens* subsp. *cygnorum,* Carnaby's Cockatoo, Forest Red-tailed Black Cockatoo (FRTBC), Baudin's Cockatoo, vegetation associated with Bush Forever Site No. 387 and 320, and native vegetation associated with Conservation Category Wetlands (CCWs) and the Guildford Complex, due to the following impacts:

- Clearing of 1.61 ha of SCP20a – Banksia attenuata woodlands over species rich dense shrublands TEC
- Loss of three individuals of *Banksia mimica*
- Loss of 62 individuals of *Conospermum undulatum*
- Loss of 119 individuals of *Johnsonia pubescens* subsp. *cygnorum*
- Clearing of 18.54 ha of moderate to low value foraging habitat for Carnaby's Cockatoo
- Clearing of 7.88 ha of high to moderate value foraging habitat and 11.06 ha of moderate to low value foraging habitat for FRTBC and Baudin's Cockatoo
- Clearing of 141 potential Black Cockatoo breeding trees, with no trees having potentially suitable hollows for Black Cockatoo nesting
- Clearing of 9.34 ha of native vegetation mapped within CCWs
- Clearing of 10.44 ha of vegetation (including 9.60 ha of native vegetation and 0.84 ha of landscaped vegetation) within two Bush Forever sites, Site no. 387 (Greater Brixton Street Wetlands) and Site no. 320 (Hartfield Park Bushland)
- Clearing of 4.42 ha of native vegetation (ranging from Excellent to Completely Degraded) mapped within the Guildford Complex.

Main Roads is currently investigating a number of options to develop a package of offsets to counterbalance potentially significant residual impacts associated with the Proposal. The options under investigation comprise direct offsets, including both land acquisition and rehabilitation. The options being considered by this strategy may be used individually or in combination to fully offset significant residual impacts of this Proposal.

The direct offsets involve acquisition of land by the Crown and land transfer to Department of Biodiversity, Conservation and Attractions (DBCA) management. For each of the land offsets acquired, Main Roads will fund seven years of DBCA land management activities. These land

management costs are negotiated on a site-by-site basis, and costs are formalised through a separate Memorandum of Understanding.

Details of Offsets 1 and 3 (including locality) remain confidential at this time and will be provided upon the outcome of commercial negotiations.

Overview of offset package under consideration

The table below provides a summary of the potential offset package to counterbalance the significant residual impacts to SCP20a TEC, *Banksia mimica*, *Conospermum undulatum*, *Johnsonia pubescens* subsp. *cygnorum,* Carnaby's Cockatoo, FRTBC, Baudin's Cockatoo, vegetation associated with Bush Forever Site No. 387 and 320, and native vegetation associated with CCWs and the Guildford Complex.

Preliminary offset calculations were completed using the Department of Water and Environmental Regulation (DWER) environmental offsets metric guideline (2021) to determine the offset packages being considered. These calculations indicate the offset package is expected to provide adequate compensation for the significant residual impacts arising from the Proposal (Table ES 1-1). The Offset Strategy will be refined subject to commercial negotiations with property owners, biological surveys and consultation with DBCA and EPA Services.

Table ES 1-1: Summary of the offset package

No.	Offset type	Offset summary	Property Location	Existing tenure
1. Mogumber offset	Direct	Land transfer to the DBCA	Confidential pending survey and negotiation with property owners Dandaragan Plateau	Freehold owned by third parties
2. Cowalla offset Lots 5324 & 8037 Duringen Rd Cowalla	Direct	Land transfer to the DBCA	Duringen Rd Cowalla Swan Coastal Plain	Freehold owned by third parties
3. Lot 579 offset	Direct	Land transfer to the DBCA	Confidential pending negotiation with property owners Lot 579 Northern Jarrah Forrest	Freehold owned by third parties
4. Greater Brixton Street Wetlands offset	Direct	Rehabilitation of DBCA managed land	South of Welshpool Road	Land vested with the DBCA
5. Clifford St Bushland offset	Direct	Rehabilitation of Bush Forever land	West of Tonkin Highway	Land vested with WAPC
6. Hartfield Park offset	Direct	Rehabilitation of Bush Forever land	West of Tonkin Highway	Land vested with WAPC

The proposed offset package has been prepared in accordance with the *WA Government's Environmental Offset Policy* (GoWA 2011). Table ES 1-2 provides a summary of the offset package to counterbalance the significant residual impacts to SCP20a, *Banksia mimica, Conospermum undulatum*, *Johnsonia pubescens* subsp. *cygnorum,* Carnaby's Cockatoo, FRTBC, Baudin's Cockatoo, vegetation associated with Bush Forever Site No. 387 and 320, and native vegetation associated with CCW and the Guildford Complex.

Table ES 1-2 Summary of preliminary offset calculations

Residual impacts to Key Environmental Factors	Offset 1 Mogumber offset	Offset 2 Cowalla offset	Offset 3 Lot 579	Offset 4 Rehabilitation of sections of Greater Brixton Street Wetlands	Offset 5 Rehabilitation of Clifford St Bushland	Offset 6 Rehabilitation of Hartfield Park
Key Environmental Factors confirmed	**Inferred, to be surveyed**	**Inferred, to be surveyed**	**Inferred, to be surveyed**	**Rehabilitation plan to be developed**	**Rehabilitation plan to be developed**	**Rehabilitation plan to be developed**
Guilford Complex vegetation Total quantum of impact = 1.33 ha				15.55 ha of rehabilitation = 100.0% of impact offset		
Bush Forever Total quantum of impact = 5.22 ha				20.87 ha of rehabilitation = 100.0% of impact offset		
SCP20a TEC Total quantum of impact = 1.13 ha	May contain TEC, not accounted for in this offset				May contain TEC, not accounted for in this offset	13.66 ha of rehabilitation = 100.0% of impact offset
Banksia mimica Total quantum of impact = 3 individuals	21 individuals = 104.6% of impact offset					
Conospermum undulatum Total quantum of impact = 62 individuals					312 individuals of *Conospermum undulatum* – 100.4% of impact offset	
Johnsonia pubescens* subsp. *cygnorum Total quantum of impact = 119 individuals					262 individuals of *Johnsonia pubescens* subsp. *cygnorum* = 100.1% of impact offset	
Carnaby's Cockatoo Total quantum of impact = 11.12 ha	May contain habitat, not accounted for in this offset	83.50 ha = 100.0% of impact offset				
FRTBC Total quantum of impact = 11.36 ha	May contain habitat, not accounted for in this offset		83.60 ha = 100.0% of impact offset			
Baudin's Cockatoo Total quantum of impact = 11.36 ha			85.30 ha = 100.0% of impact offset			
CCWs Total quantum of impact = 5.60 ha				54.30 ha of rehabilitation = 100.0% of impact offset		

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Document Control

Revision	Date	Name	Signature
0	08/09/2022	S Goldsworthy (GHD), D Farrar (GHD)	Authors
0	09/09/2022	J Braid (Main Roads), S Venkatasamy (Main Roads)	Reviewer and Approver

1 INTRODUCTION

1.1 Proposal background

Main Roads Western Australia (Main Roads) proposes to upgrade Tonkin Highway from south of Roe Highway to approximately 1 km north of Kelvin Road, within the City of Kalamunda and City of Gosnells (the Proposal). The Proposal location and Development Envelope (DE) are shown in Figure 1-1.

Tonkin Highway is a major arterial highway in the Perth metropolitan area that links Perth Airport and Kewdale with south-eastern and north-eastern suburbs. Welshpool Road is a major arterial road intersecting Tonkin Highway in Wattle Grove. Hale Road is a minor arterial road that currently provides alternative access to Tonkin Highway from Forrestfield and Wattle Grove.

The Proposal aims to improve the efficiency of Tonkin Highway by grade separating Hale and Welshpool Roads allowing a continuous flow of traffic. The Proposal will alleviate the pressure on the existing transport network, as both the intersections of Welshpool Road and Hale Road experience significant volumes of heavy freight traffic. The Proposal also aims to improve pedestrian safety and reduce congestion and potential vehicular conflict.

This Offset Strategy relates to the predicted significant residual environmental impacts of the Proposal.

1.2 Description and key Proposal characteristics

The Proposal includes construction and operation of a dual carriageway (three lanes in each direction), a fly-over at the intersection with Hale Road and a grade separated interchange at the intersection with Welshpool Road.

The Proposal includes:

- Widening of a 4.2 km section of Tonkin Highway from four to six lanes from south of Roe Highway to approximately 1 km north of Kelvin Road
- Single fly-over (half diamond with North facing ramps) at the intersection with Hale Road
- Grade separated interchange at Welshpool Road
- Principal Shared Path (PSP) on the eastern side of the Tonkin Highway for the full length and grade separation at interchanges
- Concrete footpath on side roads with link to the PSP
- Installation of associated road infrastructure, such as lighting, noise and retaining walls, safety barriers, stopping bays and traffic monitoring devices, signs and landscaping
- Drainage basins, drains and other associated infrastructure.

The DE comprises an area of approximately 51.5 ha and represents the maximum construction impact footprint. All ground disturbing activities will be contained within the DE and be minimised as much as practicable to mitigate impacts to environmental factors (Figure 1-1). Key Proposal characteristics are presented in Table 1-1 and Table 1-2. The significant residual impacts of the Proposal to be offset are detailed in Table 1-3.

Paper Size ISO A3

0 100 200 300 400 500

Metres

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

N

GHD

Main Roads WA
Tonkin Highway Grade Separated Interchanges (Hale Road and Welshpool Road)

Proposal location and Development Envelope

Project No. **12530063**
Revision No. **0**
Date **25/11/2020**

FIGURE 1-1

G:\61\12530063\GIS\Maps\Working\12530063_EPA.aprx\12530063_1-1_ProjectLocation_Rev0
Print date: 25 Nov 2020 - 10:15

Data source: MRWA: Development envelope - 2020; Landgate: Roads, Suburbs - 2020; Landgate_Subscription_Imagery\WANow: Landgate / SLIP. Created by: mmikkonen

Table 1-1: Summary of the Proposal

Proposal title	Tonkin Highway Grade Separation Interchanges (Hale Road and Welshpool Road)
Proponent name	Main Roads Western Australia
Short description	Main Roads is proposing to upgrade Tonkin Highway from south of Roe Highway to approximately 1 km north of Kelvin Road to a six-lane dual carriageway. The Proposal will include construction of a half diamond with north facing ramps at Hale Road intersection in Forrestfield and a grade separated interchange at the intersection of Tonkin Highway and Welshpool Road in Wattle Grove.

Table 1-2: Location and proposed extent of physical elements

Proposal element	Location	Maximum extent or range
Physical elements		
Clearing and disturbance for road construction and associated infrastructure	Proposal DE in Figure 1-1	The Proposal comprises a total area of approximately 51.5 ha, including clearing or disturbance of up to 20.22 ha of native vegetation and 1.80 ha of non-native vegetation suitable for fauna habitat.

Table 1-3: Significant residual impacts to be offset

Element	Residual Impacts
Clearing of SCP20a – *Banksia attenuata* woodlands over species rich dense shrublands TEC	Up to 1.61 ha
Clearing of *Conospermum undulatum*	No more than 62 individuals
Clearing of *Banksia mimica*	No more than 3 individuals
Clearing of *Johnsonia pubescens* subsp. *cygnorum*	No more than 119 individuals
Clearing of native vegetation within Guildford Complex	Up to 4.42 ha
Clearing of vegetation within Bush Forever sites	Up to 10.44 ha
Clearing of native vegetation within Conservation Category Wetlands	Up to 9.34 ha
Clearing of foraging habitat for Carnaby's cockatoo (*Calyptorhynchus latirostris*)	Up to 18.54 ha
Clearing of foraging habitat for FRTBC (*Calyptorhynchus banksii naso*)	Up to 18.94 ha
Clearing of foraging habitat for Baudin's cockatoo (*Calyptorhynchus baudinii*)	Up to 18.94 ha
Clearing of black cockatoo potential breeding trees	No more than 141 trees

1.3 Purpose of this strategy

In October 2019, Main Roads referred the Proposal to the Environmental Protection Authority (EPA) for assessment under Section 38 of the *Environmental Protection Act 1986* (EP Act). Main Roads requested the EPA to suspend the public comment period for the Referral in November 2019 to allow more stakeholder engagement and environmental assessments to occur.

An updated referral was submitted to the EPA in March 2021, which was published for public review and comment on 30 March 2021. The referral included an EPA Referral Supporting Document that described the Proposal, the local environmental values present, the potential environmental impacts of the Proposal, and the management and mitigation strategies to address the identified impacts. On 19 May 2021, the Chairman of the EPA determined the Proposal required further assessment based on referral information with additional information required under Section 40(2)(a) of the EP Act.

In accordance with Section 40(2)(a) of the EP Act, the EPA requested Main Roads provide additional information to inform the environmental impact assessment of the Proposal, including the provision of an Offsets Strategy.

This Offset Strategy has been prepared to address the EPA's Section 40(2)(a) request. This document:

- Identifies, describes and quantifies the potential residual impacts (direct, indirect and cumulative) on the identified key environmental factors (Flora and Vegetation, Terrestrial Fauna and Inland Waters) that will occur following implementation of the Proposal after consideration of potential impacts and applying avoidance and minimisation measures
- Determines the significance of any residual impacts on the identified key environmental factors using the *WA Environmental Offsets Metric Guideline* (DWER 2021) and application of the Residual Impact Assessment Model
- Proposes an offset strategy to counterbalance significant residual impacts of the proposal consistent with the *WA Environmental Offsets Policy* (GoWA, 2011) and *WA Environmental Offsets Metric Guideline* (DWER 2021) and where residual impacts relate to threatened species or communities the *Environmental Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DSEWPaC, 2012a).

1.4 Impact avoidance

The *WA Environmental Offsets Policy* notes environmental offsets will only be considered after avoidance and mitigation options have been pursued.

In response to community and stakeholder consultation on the original referral in October 2019, Main Roads refined the concept design to amend the form of the interchanges. Main Roads also undertook further environmental assessments to further define and minimise environmental and heritage impacts whilst maintaining safety and construction standards. A revised DE was presented in the updated referral that was submitted to the EPA in March 2021 and published on 30 March 2021. This document provides an assessment of the environmental impact of the Proposal, as amended.

As a result, the area required for the Proposal and the amount of native vegetation clearing required have been reduced, altering the potential impacts on key environmental features including:

- *Banksia attenuata* woodland over species rich dense shrublands (SCP20a) TEC
- Black Cockatoo habitat

- CCWs.

Main Roads has modified a drainage basin located to the north and west of Welshpool Road to avoid all 11 individuals of one Threatened species, *Andersonia gracilis* (Slender Andersonia) mapped within the DE. In addition, a minimum buffer of 10 m has also been included to minimise indirect impacts to this species. A vegetation retention zone that encompasses the 11 plants of *A. gracilis* as well as a patch of SCP10a TEC and adjoining vegetation was also established. The objective of setting up this vegetation retention zone is to avoid any impacts to *A. gracilis* and SCP10a. The indicative footprint is constrained in this location and cannot be decreased further without poor design and associated safety outcomes.

Main Roads is committed to the application of the mitigation hierarchy throughout project design. Where practicable, Main Roads will avoid and minimise unnecessary clearing of native vegetation and significant fauna habitat through applying various design measures.

Table 1-4 provides a summary of the design improvements to the Proposal. These improvements resulted in a reduction in the potential environmental impact to native vegetation, ecological communities, and flora and fauna taxa. Refer to the ERD for further information regarding impact avoidance and mitigation actions associated with the Proposal.

Table 1-4: Design and management measures implemented to avoid or minimise impact

Design/Management Measure	Discussion and Justification
DE alignment	The DE has been aligned where possible to minimise the impact on significant vegetation (e.g. *Banksia attenuata* woodland over species rich dense shrublands (SCP20a) TEC) by avoiding patch fragmentation and retaining an area of TEC that is contiguous. The DE avoids additional disruption of linkages between TEC patches and wider vegetation and fauna corridors at Hartfield Park and Greater Brixton Street Wetlands. The DE incorporates a predominantly cleared corridor about Tonkin Highway, Hale Road and Welshpool Road, including an existing stormwater infiltration basin. The DE represents the maximum extent of disturbance, noting that the final impact will be less as the design is refined during the detailed design phase. The option of south bound ramps at the Hale Road intersection was discarded to reduce the size of the intersection and to minimise impacts to the Hartfield Park Bush Forever site and a registered Aboriginal heritage site south of Hale Road.
Surface drainage	Surface runoff within the DE will drain into infiltration basins and/or swales constructed within the DE. The infiltration basins/swales will be designed to capture and infiltrate runoff, to prevent stormwater runoff into adjacent areas of native vegetation. The infiltration basins/swales will be landscaped with native vegetation to assist with nutrient stripping of stormwater during infiltration. The impacts of clearing for the proposed drainage are considered to be conservative given many of the basins will be located in already cleared areas.
Steepen batter slopes	The design has sought to reduce earthworks (fill height/cut depth) in areas where native vegetation exists. Any embankments above 2.5 m have been steepened to 3:1 with an additional 1 m of barrier earthworks required for barrier protection. Without the proposed wire-rope barrier, the minimum slope would be 4:1, requiring a larger clearing footprint.
Installation of safety barriers	Any embankments above 2.5 m have been steepened to 3:1. Without the wire rope barrier, the minimum slope would be 4:1, requiring a larger clearing footprint.
Installation of kerbing	Kerbing has been considered and will be implemented in the design where appropriate, reducing the need for table drains, which typically require a larger clearing footprint.

Design/Management Measure	Discussion and Justification
Preferential use of existing cleared areas for access tracks, construction storage and stockpiling	All laydowns, 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.
Drainage modification	A preliminary drainage design has proposed various drainage basins along the length of the Proposal to capture run-off. The impacts of clearing for the proposed drainage are considered to be conservative given many of the basins will be located in areas already cleared. The drainage design has been modified to avoid direct impacts to 11 individuals of *Andersonia gracilis* recorded within the DE.

The design improvements have resulted in the DE incorporating the predominantly cleared corridor along Tonkin Highway, Hale Road and Welshpool Road, to reduce potential impacts to key environmental factors.

1.5 Summary of offset requirement

Offset requirements have been determined through assessment of the direct residual impacts of the Proposal based on the revised design, field survey and site assessment. Details of the residual impacts are summarised in Sections 2, 3 and 4 below. Table 1-5 presents a summary of the significant residual impacts this Offset Strategy proposes to offset.

Table 1-5: Offset requirements

Item	Details
Title of Proposal	Tonkin Highway Grade Separated Interchanges (Hale Road and Welshpool Road)
Proponent name	Main Roads Western Australia
EPA Assessment Number	2293
Purpose of this strategy	This strategy is submitted to address the EPA request for additional information in respect to environmental offsets.
Significant residual impacts	To counterbalance significant residual impacts to: • Clearing of 4.42 ha of native vegetation (ranging from Excellent to Completely Degraded) within the Guildford Complex • Clearing of 10.44 ha of vegetation (including 9.60 ha of native vegetation and 0.84 ha of landscaped vegetation) within two Bush Forever sites, Site no. 387 (Greater Brixton Street Wetlands) and Site no. 320 (Hartfield Park Bushland) • Clearing of 1.61 ha of SCP20a – *Banksia attenuata* woodlands over species rich dense shrublands TEC • Loss of three individuals of *Banksia mimica* • Loss of 62 individuals of *Conospermum undulatum* • Loss of 119 individuals of *Johnsonia pubescens* subsp. *cygnorum* • Clearing of 18.54 ha of moderate to low value foraging habitat for Carnaby's Cockatoo • Clearing of 7.88 ha of high to moderate value foraging habitat and 11.06 ha of moderate to low value foraging habitat for FRTBC and Baudin's Cockatoo • Clearing of 141 potential Black Cockatoo breeding trees, with no trees having potentially suitable hollows for Black Cockatoo nesting • Clearing of 9.34 ha of native vegetation mapped within CCWs.

Item	Details
Proposed offsets	The offset sites proposed within this Offset Strategy may be used individually or in combination to fully offset significant residual impacts of this proposal. The offset sites currently under investigation by Main Roads include: • Offset 1 (Mogumber offset) – *Banksia mimica* and potentially suitable for Carnaby's Cockatoo, FRTBC and SCP20a • Offset 2 (Cowalla offset) – Carnaby's Cockatoo habitat • Offset 3 (Lot 579 offset) –FRTBC and Baudin's Cockatoo habitat • Offset 4 (Greater Brixton Street Wetlands offset) – Bush Forever, Guildford Complex and CCWs • Offset 5 (Clifford St Bushland offset) – *Conospermum undulatum* and *Johnsonia pubescens* subsp. *cygnorum* and potentially suitable for SCP20a • Offset 6 (Hartfield Park offset) – SCP20a and *Johnsonia pubescens* subsp. *cygnorum*.

1.6 Consultation

The proposed offset measures and approach detailed in this Offset Strategy have been discussed with DBCA, particularly in relation to suitable offset properties. Main Roads will continue these discussions with DBCA to further assess these properties, acquisition, and management.

2 FLORA AND VEGETATION ASSESSMENTS AND IMPACTS

2.1 Environmental surveys

The flora and vegetation surveys undertaken to inform the Proposal are shown in Table 2-1. These investigations and the refinement of the Proposal design have been used to define the residual impacts, and consequently used as the basis for determining the environmental offset requirements summarised in the following sections. Refer to the ERD for further information regarding flora and vegetation assessment and impacts, impact significance and impact avoidance associated with the Proposal.

Table 2-1: Studies and surveys relevant to the Proposal

Survey/report	Details
Tonkin Highway/Hale Road, Tonkin Highway/Welshpool Road and Tonkin Highway/Kelvin Road Biological Assessment (AECOM, 2015)	Scope: Level 1 flora and vegetation survey, including a desktop assessment and field survey to map vegetation communities and condition and undertake targeted searches for Threatened and Priority (P1 and P2) flora species. The assessment was completed in accordance with Guidance Statement No. 51 (EPA, 2004a) during October 2014 and included traversing the survey area on foot. Sampling included 23 relevés and traverses approximately 10 m apart for targeted flora searches in suitable habitat. Additional targeted searches for *Drakaea elastica* were completed in August 2015 in the Tonkin Highway-Hale Road interchange area. Survey dates: 10, 12-13 and 21 October 2014, 18 August 2015. Survey area: The AECOM survey area covered 43.78 ha and overlaps with the DE.
Tonkin Highway Welshpool Road to Hale Road Vegetation Condition Assessment (Strategen JBS&G, 2019)	Scope: Vegetation condition assessment of roadside vegetation. The assessment was completed in accordance with Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016a) and included traversing the survey area by vehicle and foot. Vegetation condition was assessed using the scale for the South West Botanical Province, with an additional category 'Cleared' used for areas of infrastructure, cleared areas of managed grassland or areas of non-native vegetation. Survey date: 28 May 2019 Survey area: The Strategen JBS&G survey area covered 57.1 ha and is wholly within the DE.
Biological Survey and Targeted Black Cockatoo Habitat Assessment, (Woodman Environmental, 2021)	Scope: Detailed and targeted vegetation and flora survey, including a desktop assessment and field surveys to identify, describe and map vegetation types and condition, identify and map significant flora through targeted searching and identify and map significant vegetation through floristic community type (FCT) analysis. The assessment was completed in accordance with Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016a) and included traversing the survey area by vehicle and foot. Sampling included 33 non-permanent quadrats, 48 relevés and traverses spaced 5-10 m in appropriate habitat for significant flora taxa. A targeted Black Cockatoo habitat assessment was also completed. Survey dates: 27 and 29 August 2019, 17-20 September 2019, 1-3, 16 and 22 October 2019, 26-28 November 2019, 17-18 December 2019 and 17-19 March 2020. Survey area: The Woodman survey area was 1,068.98 ha, however due to access constraints and the survey covered 193.64 ha (referred to as the Assessed Area) which included the DE as well as areas of adjacent vegetation.

Survey/report	Details
Tonkin Highway Corridor, Hale Road Vegetation Assessment (GHD 2020a)	Scope: Site visit to assess the ecological values of areas not previously surveyed by Woodman (2021). The assessment was completed with reference to Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016a) and include traversing the survey area by foot. Vegetation types and condition were described and aligned with Woodman (2021). A Black Cockatoo habitat assessment was also completed. Survey date: 8 July 2020. Survey area: Three small areas located in the vicinity of the Hale Road/Tonkin Highway intersection. The GHD survey area covered 0.73 ha and is wholly within the DE.
Tonkin Highway Corridor, Targeted Flora and Black Cockatoo Hollow Assessment (GHD, 2021)	Scope: Targeted flora survey to identify and map significant flora not previously recorded by Woodman (2021). The assessment was completed in accordance with Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016a) and included systematic searches of suitable habitat on foot. Survey dates: 2-3 September 2020 and 5-6 November 2020. Survey area: The DE and areas south of Welshpool Road. The GHD targeted survey area covered 83.6 ha and includes the entire DE.
Phytophthora Dieback Occurrence Assessment (Glevan Consulting, 2020)	Scope: Assessment for the presence of Phytophthora Dieback. Phytophthora Dieback detection, diagnosis and mapping was conducted to standards and procedures defined in *FEM047 Phytophthora Dieback Interpreter's Manual for lands managed by the department* (DPaW, 2015). Assessment dates: Between 27 September 2019 and 29 June 2020. Survey area: The assessment area was largely aligned with the current DE and extended south of the current DE.
FCT Analysis of TGSI Floristic Data Tonkin Highway Grade Separated Interchanges (Umwelt, 2022)	Scope: Re-assessment of FCT analysis of quadrat data within the TGSI (Hale Rd and Welshpool Rd) DE Assessment date: 2 May to 27 June 2022 Survey area: Assessment area covered 194 ha which included the DE as well as areas of adjacent vegetation.

2.2 Vegetation within the Guildford Complex

At SCP scale the Proposal will require the clearing of 4.42 ha of native vegetation associated with the Guildford Complex, representing a reduction of 0.10% of the current extent on the SCP. At the LGA scale the Proposal will result in a reduction of less than 7% of the current extent of the Guildford Complex, with the exception of the Guildford Complex in the City of Kalamunda, where the reduction is 32.70% (Table 2-2).

Table 2-2: Clearing impacts to vegetation complexes mapped within the DE

Vegetation complex	Pre-European extent (ha)	Current extent (ha)	% Remaining	Extent within DE (ha) (%)	Current extent remaining after Proposal clearing ha) (%)
SCP					
Guildford Complex	90,513.13	4,607.91	5.09%	4.42 (0.10%)	4,603.49 (5.09%)
City of Gosnells					
Guildford Complex	1,966.15	162.44	8.26%	1.65 (1.02%)	160.79 (8.18%)
City of Kalamunda					
Guildford Complex	77.51	8.47	10.93%	2.77 (32.70%)	5.70 (7.35%)

Clearing within the Guildford Complex both at LGA and SCP scales is considered significant as this complex is one of five complexes below 10% of its pre-European extent.

The extent and condition of the native vegetation within the Guildford Complex which is required to be cleared for the Proposal is provided in Table 2-3.

Table 2-3: Area and condition of Guildford Complex within the DE

Vegetation complex	Extent of native vegetation within the Guildford Complex in the DE (ha)	Vegetation condition
Guildford Complex	4.42	Good: 0.23 ha Completely Degraded: 4.19 ha

Main Roads proposes to counterbalance the significant residual impacts of the Proposal on native vegetation within the Guildford Complex through the provision of an environmental offset. As described in Section 1.4, the Proposal has been designed to avoid impacts to native vegetation where possible.

2.3 Banksia attenuata woodland over species rich dense shrublands (SCP20a) TEC

The Proposal will result in the clearing of up to 20.22 ha of native vegetation of which 1.61 ha is representative of *Banksia attenuata* woodland over species rich dense shrublands (SCP20a) TEC. Clearing of 1.61 ha equates to 0.28% of the reported remaining extent of SCP20a.

The extent and vegetation condition of the TEC within the DE and addressed by this Offset Strategy are provided in Table 2-4.

Table 2-4: Area and condition of SCP20a TEC within the DE

TEC	Conservation status	Extent of TEC in DE (ha)	Vegetation condition
Banksia attenuata woodlands over species rich dense shrublands (SCP20a) TEC	Endangered under the BC Act and forms a component of the Banksia Woodlands of the SCP Commonwealth TEC listed as Endangered under EPBC Act	1.61	Excellent: 0.64 ha Very Good: 0.53 ha Good: 0.44 ha

Main Roads proposes to counterbalance the significant residual impacts of the Proposal on SCP20a through the provision of an environmental offset. As described in Section 1.4, the Proposal has been designed to avoid impacts to SCP20a where possible.

2.4 Significant flora

Three Threatened and five Priority taxa occur within the DE. *Andersonia gracilis* (Slender Andersonia) occurs within the DE, however as Section 1.4 outlines, impact to this species has been avoided through design modification.

The Proposal will impact two Threatened flora taxa and five Priority flora taxa, including:

- *Banksia mimica* (Vulnerable)
- *Conospermum undulatum* (Vulnerable)
- *Johnsonia pubescens* subsp. *cygnorum* (Priority 2)
- *Isopogon autumnalis* (Priority 3)
- *Jacksonia gracillima* (Priority 3)
- *Styphelia filifolia* (Priority 3)
- *Verticordia lindleyi* subsp. *lindleyi* (Priority 4)

The residual impacts to *Isopogon autumnalis*, *Jacksonia gracillima, Styphelia filifolia* and *Verticordia lindleyi* subsp. *lindleyi* are not considered significant and therefore Main Roads is not proposing to offset impacts to these flora species.

This Offset Strategy aims to counterbalance the significant residual impacts of the Proposal to the two Threatened flora taxa (*Conospermum undulatum* and *Banksia mimica*) and one Priority flora taxa (*Johnsonia pubescens* subsp. *cygnorum*). Table 2-5 provides a summary of *Conospermum undulatum*, *Banksia mimic*a and *Johnsonia pubescens* subsp. *cygnorum* individual numbers within the DE, population estimate within 5 km of the DE and the total estimated population.

Table 2-5: Summary of impacts to Threatened flora from the Proposal

Taxon	Status	No of individuals (% impact)		
		Within the DE	Within 5 km of the DE	Total estimated population
Banksia mimica	Threatened (Vulnerable)	3	103 (2.91%)	7,300 (0.04%)
Conospermum undulatum	Threatened (Vulnerable)	62	8,321 (0.75%)	14,888 (0.42%)
Johnsonia pubescens subsp. *cygnorum*	Priority 2	119	286 (41.61%)	2,240 (5.31%)

2.5 Bush Forever Sites

The Proposal will result in the clearing of 10.44 ha of vegetation (of which 9.60 ha is native vegetation and 0.84 ha is landscaped vegetation) within two Bush Forever sites:

- Site no. 387 (Greater Brixton Street Wetlands)
- Site no. 320 (Hartfield Park Bushland).

The Proposal will clear 3.05 ha of vegetation in Degraded condition along the north eastern boundary of Bush Forever Site no. 387 (Greater Brixton Street Wetlands) and 6.55 ha of vegetation in Excellent to Degraded condition within Bush Forever Site no. 320 (Hartfield Park Bushland).

The extent and condition of the native vegetation within the two Bush Forever sites, addressed by this Offset Strategy, are provided in Table 2-6.

Table 2-6: Area and condition of Bush Forever within the DE

Bush Forever sites	Extent of vegetation within Bush Forever sites in the DE (ha)	Vegetation condition
Site no. 387 (Greater Brixton Street Wetlands)	3.05	Degraded: 3.05 ha
Site no. 320 (Hartfield Park Bushland).	6.55	Excellent: 2.48 ha Very Good: 1.92 ha Good: 1.46 ha Degraded: 0.69 ha

Main Roads proposes to counterbalance the significant residual impacts of the Proposal on Bush Forever sites through the provision of an environmental offset. As described in Section 1.4, the Proposal has been designed to avoid impacts to Bush Forever where possible.

3 FAUNA ASSESSMENTS AND IMPACTS

3.1 Environmental surveys

Main Roads has commissioned various surveys to gain an understanding of the terrestrial fauna values within and surrounding the Proposal. These have included basic (Level 1) surveys and targeted assessments undertaken in accordance with relevant EPA and Commonwealth guidance.

Terrestrial fauna surveys undertaken to inform the Proposal are outlined in Table 3-1. The results from the Woodman (2021) and GHD (2021) assessments supersede the results from AECOM (2015) and Strategen JBS&G (2019) assessments.

Table 3-1: Summary of terrestrial fauna surveys previously conducted in the DE

Survey/report	Details
Tonkin Highway/Hale Road, Tonkin Highway/Welshpool Road and Tonkin Highway/Kelvin Road Biological Assessment (AECOM 2015)	Scope: Level 1 fauna survey, including a desktop assessment and field survey to map fauna habitat and undertake a targeted Black Cockatoo survey. The assessment was completed in accordance with Guidance Statement No. 56 (EPA 2004b) and included traversing the survey area on foot. Micro habitat searches were conducted and bird counts recorded. Black cockatoo trees were visually examined and foraging habitat defined by the presence of one or more known foraging species and based on the flora and vegetation results. Survey dates: 10, 12-13 and 21 October 2014, 18 August 2015. Survey area: The AECOM survey area covered 43.78 ha and overlaps with the DE.
Biological Survey and Targeted Black Cockatoo Habitat Assessment, (Woodman Environmental 2021)	Scope: Level 1 (reconnaissance) survey, including a desktop assessment and field surveys to identify vegetation and substrate associations (habitats for fauna), search for suitable vegetation and habitat that could support conservation significant fauna, record signs of conservation significant fauna and opportunistic fauna observations. The assessment was completed in accordance with Technical Guidance - Sampling methods for terrestrial vertebrate fauna (EPA 2016b) and Technical Guidance - Terrestrial Fauna Surveys (EPA 2016c). The assessment included traversing the survey area by vehicle and foot. The black cockatoo habitat assessment was completed in accordance with DSEWPaC (2012b). A detailed and targeted vegetation and flora survey was also completed. Survey dates: 13 September 2019, 2, 3, 7 and 8 October 2019, 14 and 19 November 2019. Survey area: The survey area was 1,068.98 ha, however due to access constraints the survey covered 193.64 ha (referred to as the Assessed Area) which included the DE as well as areas of adjacent vegetation.
Tonkin Highway Corridor, Hale Road Vegetation Assessment (GHD 2020a)	Scope: Site visit to assess the ecological values of areas not previously surveyed by Woodman (2021). A Black Cockatoo habitat assessment was completed in accordance with DSEWPaC (2012b) and involved traversing the survey area by foot. Potential and actual breeding habitat and foraging habitat for Black Cockatoos was recorded and mapped. Survey date: 8 July 2020. Survey area: Three small areas located in the vicinity of the Hale Road/Tonkin Highway intersection. The survey area covered 0.73 ha and is wholly within the DE.
Tonkin Highway Corridor, Targeted Flora and Black Cockatoo Hollow Assessment (GHD 2021)	Scope: Assessment of trees which contained potential Black Cockatoo hollows identified by Woodman (2021) to verify suitability for Black Cockatoo nesting. The assessment involved re-location the relevant Woodman (2021) trees and inspecting the hollows via binoculars and a pole camera. The assessment was completed with reference to DSEWPaC (2012b). Survey dates: 9 December 2020.

Survey/report	Details
	Survey area: Relevant Woodman (2021) trees located in the DE.
Tonkin Grade Separated Interchanges (Hale Road and Welshpool Road): Targeted Invertebrate Fauna Survey (Biologic 2022)	Scope: Desktop assessment and field survey targeting significant and SRE invertebrate fauna. The aim of the survey was to identify the possible occurrence of significant and SRE invertebrate fauna and their habitats within the survey area. Survey dates: 21-22 March 2022 and 3 April 2022. Survey area: TGSI (Hale Rd and Welshpool Rd) DE and adjacent areas

The assessment of the broader fauna values of the DE are provided in the ERD, with the outcomes of these assessments, as they relate to offsets, summarised below.

The residual impacts to Priority and Other Specially Protected fauna are not considered significant and therefore Main Roads is not proposing to offset these impacts. Main Roads is, however, proposing to offset the significant residual impacts to the three listed Black Cockatoo species.

3.2 Black Cockatoo

The Proposal will result in the clearing of 18.54 ha of moderate to low value foraging habitat for Carnaby's Cockatoo, and 7.88 ha of high to moderate value and 11.06 ha of moderate to low value foraging habitat for Baudin's Cockatoo and Forest Red-tailed Black Cockatoo (FRTBC), as described in the ERD.

The clearing of 18.54 ha of potential foraging habitat for Carnaby's Cockatoo represents a 0.71% reduction in local habitat (within 5 km of DE) and a 0.003% reduction in regional habitat (within the SCP). Additionally, clearing of 18.94 ha of potential foraging habitat represents a 0.73% reduction in local habitat (within 5 km of DE) and a 0.009% reduction in regional habitat (within the SCP) for FRTBC, and a 0.73% reduction in local habitat and a 0.024% reduction in regional habitat for Baudin's Cockatoo.

Up to 141 trees with a Diameter Breast Height (DBH) of 500 mm or greater (potential breeding trees) will be cleared as a result of the Proposal. No known breeding trees or trees with hollows potentially suitable for nesting by Black Cockatoos will be cleared for the Proposal.

Table 3-2 provides a summary of predicted significant residual impacts of the Proposal to terrestrial fauna.

Table 3-2: Predicted significant residual impacts to Black Cockatoos

Aspect	Summary of predicted residual impacts
Carnaby's Cockatoo (*Calyptorhynchus latirostris*, Endangered)	Loss of: • 18.54 ha moderate to low value foraging habitat for Carnaby's Cockatoo.
FRTBC (*Calyptorhynchus banksii naso*) (Vulnerable)	Loss of: • 7.88 ha of high to moderate value foraging habitat • 11.06 ha of moderate to low value foraging habitat.
Baudin's Cockatoo (*Calyptorhynchus baudinii*, Endangered)	Loss of: • 7.88 ha of high to moderate value foraging habitat • 11.06 ha of moderate to low value foraging habitat.
Black Cockatoo breeding	Loss of: • 141 potential breeding trees for Black Cockatoos, with no trees having potentially suitable hollows for Black Cockatoo nesting.

Main Roads proposes to counterbalance the significant residual impacts of the Proposal on the three species of Threatened Black Cockatoo through the provision of an environmental offset.

Section 1.4 outlines measures taken by Main Roads to avoid impacts to Black Cockatoos.

4 INLAND WATERS ASSESSMENTS AND IMPACTS

4.1 Receiving environment

The DE intersects the north eastern part of the Greater Brixton Street Wetlands. The Wetlands are recognised as a Bush Forever site and its significance has also been recognised through its inclusion in the Australian Directory of Important Wetlands (as the Brixton Street Swamps (WA074)).

Based on the DBCA geomorphic wetland mapping, 13 wetlands intersect the DE, including:

- Seven CCWs
- Three Multiple Use Wetlands
- Three Resource Enhancement Wetlands.

The implementation of the Proposal will result in clearing 33.07 ha of wetland areas, comprising 13.61 ha of native vegetation. This includes:

- 16.54 ha of CCWs comprising 9.34 ha of native vegetation
- 5.91 ha of Multiple Use Wetlands comprising 1.94 ha of native vegetation
- 10.62 ha of Resource Enhancement Wetlands comprising 2.33 ha of native vegetation.

The residual impacts to Resource Enhancement and Multiple Use wetlands are not considered significant and therefore Main Roads is not proposing to offset these impacts. Main Roads is, however, proposing to offset the significant residual impacts to CCWs.

Refer to the ERD for further information regarding wetland assessment and impacts, and impact avoidance associated with the Proposal. The residual impacts on CCWs is discussed in the following section.

4.2 Conservation Category Wetlands

CCWs are defined as wetlands that support a high level of ecological attributes and functions (generally having intact vegetation and natural hydrological processes), or that have a reasonable level of functionality and are representative of wetland types that are rare or poorly protected.

Direct impacts from the Proposal will reduce the overall physical extent of wetland areas and may reduce their environmental value and function (such as loss of habitat and water retention capacity). Construction of the Proposal will involve the loss of 16.54 ha of mapped CCWs within the DE. Of this, 9.34 ha is mapped as native vegetation, 0.01 ha is mapped as non-native vegetation and 1.13 ha is mapped as landscaped vegetation. The remaining 6.06 ha is cleared land. The condition of the native vegetation within these CCWs are detailed in Table 4-1.

Table 4-1 Condition of native vegetation within Conservation Category Wetlands

Wetland Classification	Extent within DE (native vegetation)	Vegetation condition (ha)
Conservation Category	9.34	Excellent: 2.54 Very Good: 1.61 Good: 0.87 Degraded: 4.32

Main Roads intends to counterbalance significant residual impacts to CCWs through the implementation of an environmental offset. Section 1.4 outlines measures taken by Main Roads to avoid impacts to CCWs.

5 ENVIRONMENTAL OFFSETS

5.1 Background

Environmental offsets are conservation actions that provide environmental benefits intended to counterbalance the significant residual environmental impacts associated with a Proposal (GoWA 2014). Main Roads intend to counterbalance the residual impact of the Proposal through implementation of an environmental offset strategy. The strategy has be prepared in accordance with the *WA Government's Environmental Offset Policy* (GoWA 2011) and *WA Environmental Offsets Metric Guideline* (DWER 2021); with consideration also to the *Australian Government's EPBC Act Environmental Offset Policy* (DSEWPaC 2012a). The offset will be proportionate to the level of impact and significance of the environmental impact.

Mitigation of environmental impacts from this Proposal have been assessed through a hierarchy of avoid, minimise, reduce, rehabilitate and offset environmental impacts. This hierarchy is achieved primarily through changes in scope and design to avoid and minimise impacts; development and implementation of management plans in order to mitigate and manage environmental impacts during construction and operation and finally, an offset to mitigate any significant residual environmental impacts. Application of the management hierarchy has been summarised in this Offset Strategy and is detailed in the ERD.

5.2 WA Environmental Offsets Policy (GoWA 2011)

The *WA Environmental Offsets Policy* (GoWA 2011) requires the following Principles are considered when developing an offset proposal:

- Environmental offsets will only be considered after avoidance and mitigation options have been pursued
- Environmental offsets are not appropriate for all projects
- Environmental offsets will be cost-effective, as well as relevant and proportionate to the significance of the environmental value being impacted
- Environmental offsets will be based on sound environmental information and knowledge
- Environmental offsets will be applied within a framework of adaptive management
- Environmental offsets will be focussed on longer term strategic outcomes.

5.3 Significant residual impact

Residual impacts associated with the Proposal have been determined through application of the residual impact significance model detailed in the *WA Environmental Offsets Metric Guideline* (DWER 2021). Significant residual impacts for which Main Roads proposes environmental offsets are detailed in Table 5-1. Residual impacts that are not significant have also been summarised in Table 5-1 for completeness, with discussion on these contained in the ERD.

Table 5-1: Residual Impact Significance Model for the Proposal

EPA Factor	Flora and Vegetation					Terrestrial Fauna	Inland Waters
Aspect	**Native vegetation extent**	**Vegetation complexes**	**Threatened ecological communities**	**Vegetation in conservation areas**	**Significant flora**	**Habitat for fauna**	**Native vegetation associated with wetlands**
Residual impact that is environmentally unacceptable or cannot be offset	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Significant residual impacts that will require an offset – All significant residual impacts to species and ecosystems protected by statute or where the cumulative impact is already at a critical level	N/A	Loss of 4.42 ha of native vegetation (ranging from Excellent to Completely Degraded) within the Guildford Complex which contains less than 10% of the pre-European extent.	Loss of 1.61 ha of Banksia attenuata woodlands over species rich dense shrublands (SCP20a) TEC	Loss of 10.44 ha of vegetation (including 9.60 ha of native vegetation and 0.84 ha of landscapedvegetation) within two Bush Forever sites, Site no. 387 (Greater Brixton Street Wetlands) and Site no. 320 (Hartfield Park Bushland).	Loss of: • 62 individuals of *Conospermum undulatum* (Threatened) • 3 individuals of *Banksia mimica* (Threatened) • 119 individuals of *Johnsonia pubescens* subsp. *cygnorum* (Priority 2).	Loss of: • 18.54 ha moderate to low value foraging habitat for Carnaby's Cockatoo • 7.88 ha of high to moderate value foraging habitat and 11.06 ha of moderate to low value foraging habitat for Baudin's Cockatoo and FRTBC • 141 potential breeding trees for Black Cockatoos, with no trees having potentially suitable hollows for Black Cockatoo nesting.	Loss of 9.34 ha of native vegetation within 16.54 ha of mapped CCW.
Residual impacts that are not significant	Loss of up to 20.22 ha of native vegetation, of which 14.80 ha is remnant native vegetation and 5.42 ha is highly modified (native) vegetation. No significant residual impacts are anticipated as a consequence of the Proposal.	Loss of vegetation (ranging from Excellent to Completely Degraded) in the Southern River Complex that has >10% of its pre-European extent remaining No significant residual impacts are anticipated to the Southern River Complex as a consequence of the Proposal.	N/A	N/A	Loss of: • 7 individuals of *Isopogon autumnalis* (Priority 3) • Loss of 155 individuals of *Jacksonia gracillima* (Priority 3) • 11 individuals of *Styphelia filifolia* (Priority 3) • 160 individuals of *Verticordia lindleyi* subsp. *lindleyi* (Priority 4).	Loss of: • 22.02 ha of fauna habitat • 22.02 ha of suitable habitat for Quenda • 19.33 ha of suitable habitat for Perth Lined Lerista.	Loss of: • 2.33 ha of native vegetation within 10.62 ha of mapped Resource Enhancement Wetlands • 1.94 ha of native vegetation within 5.91 ha of mapped Multiple Use Wetlands.

5.4 Overview of offset package

Main Roads is investigating a number of options to develop an offsets package to counterbalance the significant residual impacts to SCP20a TEC, *Conospermum undulatum*, *Banksia mimica*, *Johnsonia pubescens* subsp. *cygnorum*, Carnaby's Cockatoo, FRTBC, Baudin's Cockatoo, vegetation associated with Bush Forever Site No. 387 and 320, and native vegetation associated with CCWs and the Guildford Complex.

The options being considered by this strategy may be used individually or in combination to fully offset significant residual impacts of this proposal. This offset strategy has considered the potential environmental values of each offset site to determine the percentage offset that may be afforded by the site. In some instances this will need to be verified through detailed survey effort to finalise the final offset arrangements. Main Roads will utilise the proposed offset sites in a manner to achieve the most efficient consideration of the environmental values present within the site, so as to offset the significant residual impacts of this proposal.

The options under investigation comprise acquisition of several parcels of land (with land management funding) and rehabilitation of specific areas of Greater Brixton Street Wetlands, Clifford St Bushland and Hartfield Park. Table 5-2 provides an overview of the offset package under investigation.

The direct offsets involve acquisition of land by the Crown and land transfer to DBCA management, which will enable land management by DBCA. DBCA is the WA State Government agency responsible for the management of conservation land throughout the state. DBCA manages conservation land through the implementation of the *Conservation and Land Management Act 1984* (CALM Act). Land vested with DBCA, either through a reserve vesting or a management order on freehold estate, is their responsibility to manage for the purposes of conservation. Land managed by the DBCA provides a high level of security to maintain the offset ecological values and DBCA manages the land in perpetuity.

DBCA has developed a *Corporate Guideline No. 14 – Environmental Offsets – Proponent Land Management Contributions* that outlines how proponents are to contribute management funding to DBCA for a land offset. This guideline specifies that DBCA seek payment from proponents for reasonable management expenses to establish and maintain offset properties for the first five to seven years (procedure 6.1 I). The purpose of this procedure is that after the initial set-up costs for active management, regular routine maintenance becomes the responsibility for DBCA (i.e. after seven years). DBCA will then continue to manage the site in perpetuity in accordance with the CALM Act. This ensures the land offset is of an appropriate quality to be handed over for ongoing management by DBCA after seven years. Where the proposed offset is solely for the acquisition and protection of land with ecological values, and no improvement of the quality of the offset is proposed, Main Roads considers that funding the initial set up costs and seven years of ongoing management costs in line with the DBCA Corporate Guideline 14 is adequate to set up the property for ongoing management by DBCA. Where an improvement (ie revegetation) to the offset property is proposed, it is likely that more than seven years of funding will be required in order to achieve the outcome.

For each of the land offsets acquired, Main Roads will fund seven years of DBCA land management activities. These land management costs are negotiated on a site-by-site basis, and costs are formalised through a separate Memorandum of Understanding. Main Roads and DBCA have agreed to this approach on at least five land acquisition offsets over the past four years.

Main Roads is liaising with DBCA regarding acquisition of suitable land in order to meet Main Roads offset requirements and DBCA's requirements for a comprehensive and representative

reserve system. Main Roads intends to have all acquisition offsets in place within 24 months of approval under the *Environmental Protection Act 1986*.

Main Roads and DBCA are currently liaising regarding rehabilitating specific areas of the Greater Brixton Street Wetlands, the Clifford St Bushland and Hartfield Park. The rehabilitation of the Greater Brixton Street Wetlands is expected to achieve an improved ecosystem within the wetland area. The rehabilitation of the Clifford St Bushland is expected to increase the number of *Conospermum undulatum* and *Johnsonia pubescens* subsp. *cygnorum* individuals.

In addition, rehabilitation of Hartfield Park is expected to increase the number of *Johnsonia pubescens* subsp. *cygnorum* individuals and offset potential impacts to SCP20a.

Table 5-2: Overview of offset package under consideration

No.	Offset type	Offset summary	Property Location	Existing tenure
1. Mogumber offset	Direct	Land transfer to the DBCA	Confidential pending survey and negotiation with property owners Dandaragan Plateau	Freehold owned by third parties
2. Cowalla offset Lots 5324 & 8307 Duringen Rd Cowalla	Direct	Land transfer to the DBCA	Duringen Rd Cowalla Swan Coastal Plain	Freehold owned by third parties
3. Lot 579 offset	Direct	Land transfer to the DBCA	Confidential pending negotiation with property owners Lot 579 Northern Jarrah Forest	Freehold owned by third parties
4. Greater Brixton Street Wetlands offset	Direct	Rehabilitation of DBCA managed land	South of Welshpool Road	Land vested with the DBCA
5. Clifford St Bushland offset	Direct	Rehabilitation of Bush Forever land	West of Tonkin Highway	Land vested with WAPC
6. Hartfield Park offset	Direct	Rehabilitation of Bush Forever land	West of Tonkin Highway	Land vested with WAPC

5.5 Description of offsets

The proposed components of the offset package are described below and these options may be used individually or in combination to fully offset significant residual impacts of this proposal. The values of Offset 1 and Offset 3 will be determined by a biological assessment, which will be undertaken once the properties are confirmed for acquisition. Offset 2 has been subject to a biological survey to determne the environmental values of the site. Offset 4 involves the rehabilitation of the Greater Brixton Street Wetlands, Offset 5 involves the rehabilitation of the Clifford St Bushland and Offset 6 involves the rehabilitation of Hartfield Park.

Main Roads will confirm the values of Offsets 1 and 3 through detailed surveys, as required, and via consultation with DBCA.

On behalf of Main Roads, further investigations are currently being undertaken by Emerge Associates to identify potential offset sites for SCP20a. An analytical approach using GIS software

applications will be used to predict the location of SCP20a across most of the Swan Coastal Plain as well as adjacent sections of the Darling Scarp foothills. Ground-truthing of the potential SCP20a sites will be conducted by experienced botanists in order to assess the accuracy of the spatial model predictions and map SCP20a where relevant. Emerge Associates have successfully applied this approach to predict the occurrence or likelihood of SCP20a and other FCTs across the East Wanneroo district structure plan area. This method offers a practical and faster option of identifying potential SCP20a sites or detecting likely SCP20a sites that could benefit from rehabilitation efforts (Appendix 1). Any sites identified with potential SCP20a will be verified initially through consultation with DBCA and (if acquired) subject to detailed survey.

The location of the offset site for which land acquisition has already been completed (Cowalla Offset) is illustrated in Figure 5-1. Figure 5-2, Figure 5-3 and Figure 5-4 provides the boundary of the Greater Brixton Street Wetlands, the Clifford St Bushland and Hartfield Park, resepectively. Consultation between Main Roads and other government organisations (DBCA and Local Government Authorities) will confirm which areas within the Greater Brixton Street Wetlands, the Clifford St Bushland and Hartfield Park will be rehabilitated.

Figures showing the offset sites which have a confidential status will be provided to the EPA as a separate, confidential document.

5.5.1 Offset 1 – Confidential property acquisition (Mogumber offset)

Offset 1 comprises a property currently under investigation by DBCA, which is yet to be negotiated with land owners or subject to biological surveys. Based on consultation with DBCA, the location of the property and vegetation expected to be present, the property is expected to comprise sufficient individuals of *Banksia mimica* (and a suitable buffer), to offset the significant residual impact to this species in full.

Offset 1 lies on the Dandaragan Plateau north of the Perth Metropolitan Region. Additionally, Offset 1 may potentially contain SCP20a TEC, and habitat for Carnaby's Cockatoo and FRTBC, depending on their location. At present the ecological values of the property remains to be confirmed. Accordingly, offset of the TEC, Carnaby's Cockatoo and FRTBC is not accounted for in the preliminary offset calculation.

The land area of Offset 1 will depend on the presence and distribution of *Banksia mimica* populations on the property, with a suitable buffer to protect the threatened flora populations from edge effects on the offset boundaries. The buffer will be determined in consultation with DBCA, but is expected to be at least 50 m, subject to land availability.

Main Roads is consulting with DBCA to confirm the availability and commercial terms to acquire the property. Should the property be suitable for acquisition, Main Roads will arrange for surveys to confirm the ecological values present, including habitat for the SCP20a TEC, Black Cockatoos and populations of *Banksia mimica*.

The location of the Mogumber offset will be provided to the EPA in a separate, confidential document.

5.5.2 Offset 2 – Property acquisition (Cowalla offset)

Offset 2 comprises two lots that extend over 1,384 ha within the Perth subregion in Cowalla (Figure 5-1). These lots are located approximately 105 km north of Perth within the Shire of Gingin. Main Roads has consulted with the DBCA to ascertain that the properties can be acquired and to confirm the associated commercial terms. A biological survey was undertaken in October 2021 to determine the ecological values present, including the habitat extent and quality for Black Cockatoos.

5.5.3 Offset 3 – Confidential property acquisition (Lot 579 offset)

Offset 3 comprises one lot covering 85.30 ha within the Shire of Harvey and located approximately 130 km south-east of Perth. This lot adjoins the Harris River State Forest and lies within the Northern Jarrah Forest subregion. The property comprises remnant native vegetation that supports habitat for FRTBC and Baudins Cockatoo. If the property can be acquired, a biological survey will be undertaken to evaluate the ecological values present in Lot 579. Findings of the biological survey will determine whether Lot 579 can be used to offset impacts to Black Cockatoo habitat. It is highly likely to contain habitat for FRTBC and Baudins Cockatoo.

The location of the Lot 579 offset will be provided to the EPA in a separate, confidential document.

5.5.4 Offset 4 – Rehabilitation of sections of Greater Brixton Street Wetlands

In collaboration with the DBCA, Main Roads is exploring the possibility of rehabilitating specific areas of the Greater Brixton Street Wetlands to achieve an improved and functional ecosystem at these locations. The Greater Brixton Street Wetlands is classified as Bush Forever (Site 387), and is associated with the Guildford Complex and CCWs. It is proposed that the rehabilitation works would offset the significant residual impacts to these environmental factors. The sections of the Greater Brixton Street Wetlands to be rehabilitated is shown on Figure 5-2 (note that specific sections of this wetland area will be rehabilitated in consultation with the DBCA).

A rehabilitation plan that includes realistic and measurable completion criteria will be developed in consultation with the DBCA. Rehabilitation works within the Greater Brixton Street Wetlands will target weed control, planting of selected plant species, closure of existing track and fencing. These works will be additional to DBCA's standard management regime for these sites. An annual monitoring program will also be implemented to assess the effectiveness of the management measures and inform the need for adaptive management. A detailed rehabilitation plan will be developed in consultation with DBCA.

5.5.5 Offset 5 – Rehabilitation of sections of Clifford St Bushland

In collaboration with the City of Gosnells, Main Roads is exploring the possibility of rehabilitating the Clifford St Bushland area to increase the number of *Conospermum undulatum* and *Johnsonia pubescens* subsp. *cygnorum* individuals within this area. The Clifford St Bushland is classified as Bush Forever (Site 53), and currently contains *Conospermum undulatum* and *Johnsonia pubescens* subsp. *cygnorum* individuals. It is proposed that rehabilitation works would offset the significant residual impact to *Conospermum undulatum* and a portion of the significant residual impact to *Johnsonia pubescens* subsp. *cygnorum*. The section of the Clifford St Bushland to be rehabilitated is shown on Figure 5-3.

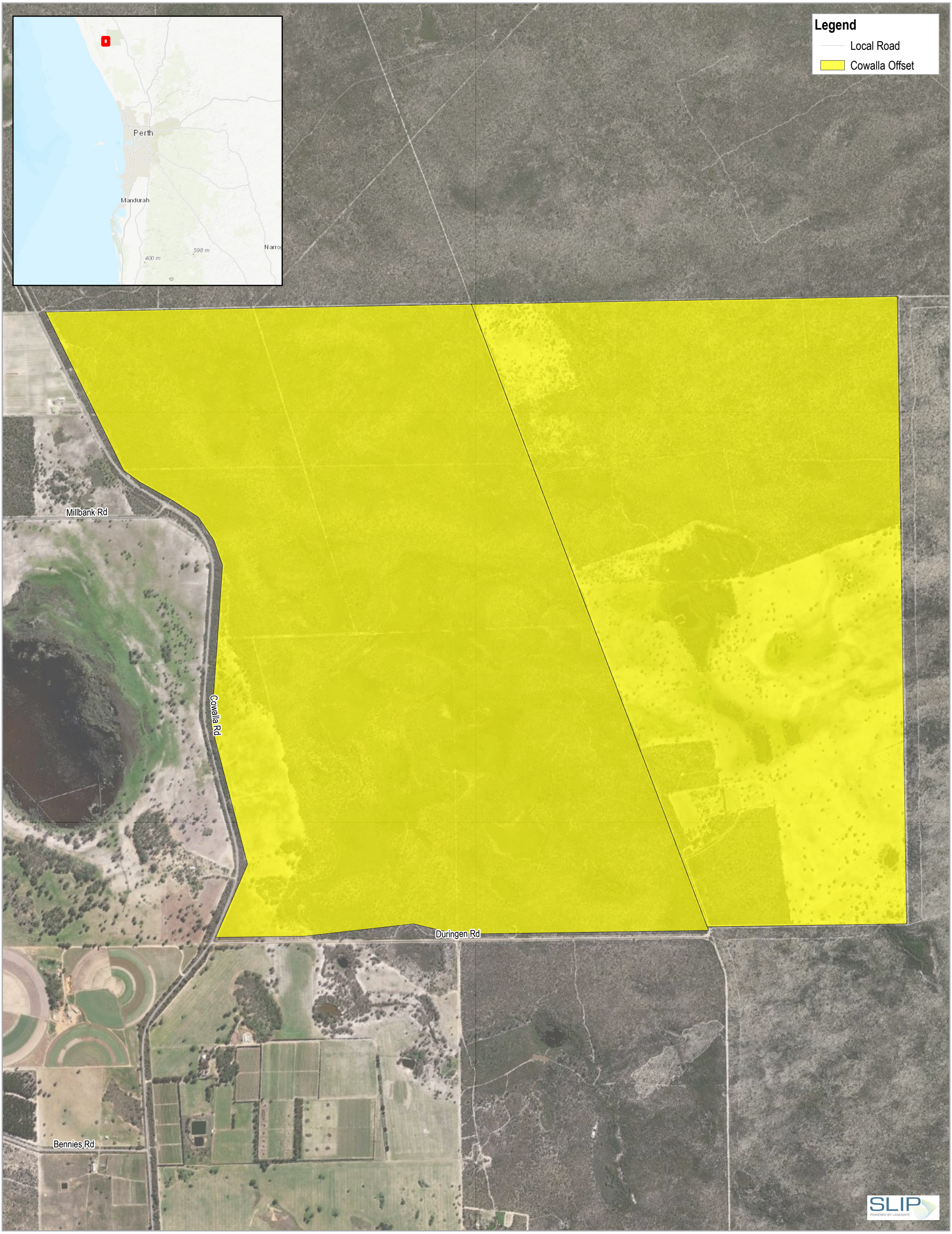
A rehabilitation plan that includes realistic and measurable completion criteria will be developed in consultation with the DBCA. Rehabilitation works within the Clifford St Bushland will target weed control, closure of existing track and fencing among others. An annual monitoring program will also be implemented to assess the effectiveness of the management measures and inform the need for adaptive management.

5.5.6 Offset 6 – Rehabilitation of sections of Hartfield Park

Main Roads is exploring the option of rehabilitating areas within Hartfield Park, to offset potential impacts to SCP20a and to increase the number of *Johnsonia pubescens* subsp. *cygnorum* individuals present in the area. This rehabilitation will be undertaken in collaboration with the City of Kalamunda. Hartfield Park currently contains SCP20a and individuals of *Johnsonia pubescens* subsp. *cygnorum*. It is proposed that rehabilitation works would offset the significant residual impacts to

SCP20a and a proportion of the significant residual impact to *Johnsonia pubescens* subsp. *cygnorum*. The section of Hartfield Park proposed to be rehabilitated is shown on Figure 5-4.

A rehabilitation plan that includes realistic and measurable completion criteria will be developed in consultation with the DBCA. Rehabilitation works within Hartfield Park will target weed control, planting of native species , closure of existing track and fencing. An annual monitoring program will also be implemented to assess the effectiveness of the management measures and inform the need for adaptive management.



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Kilometres

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

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GHD

Main Roads Western Australia
Tonkin Highway Grade Separated Interchanges
(Hale Road and Welshpool Road)

Property Acquisition
(Cowalla Offset)

Project No. **12553076**
Revision No. **0**
Date **8/09/2022**

FIGURE 5-1

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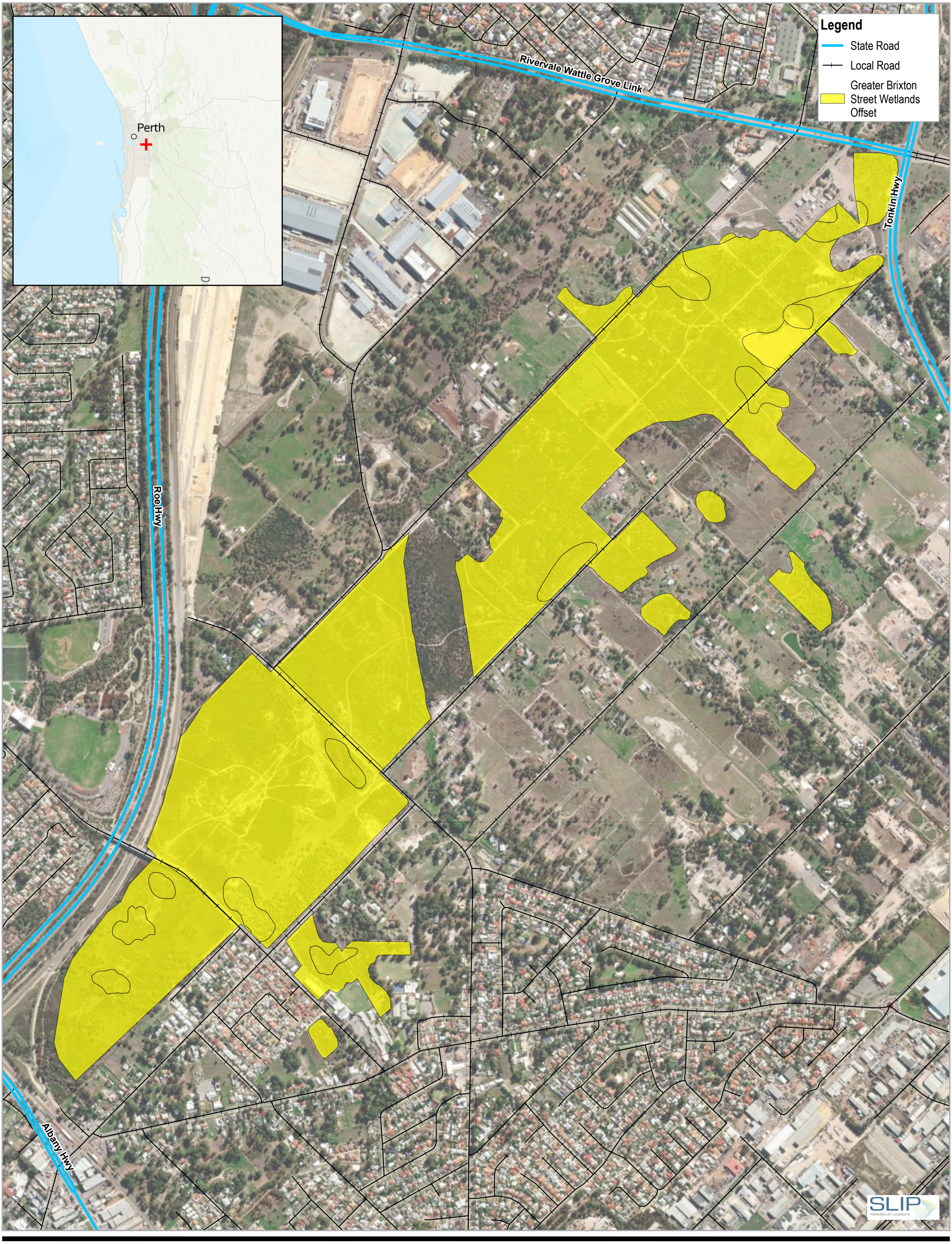
World Imagery: Earthstar Geographics. Created by: rbrown3



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

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Main Roads Western Australia
Tonkin Highway Grade Separated Interchanges (Hale Road and Welshpool Road)

Rehabilitation of the Greater Brixton Street Wetlands

Project No. **12553076**
Revision No. **0**
Date **8/09/2022**

FIGURE 5-2

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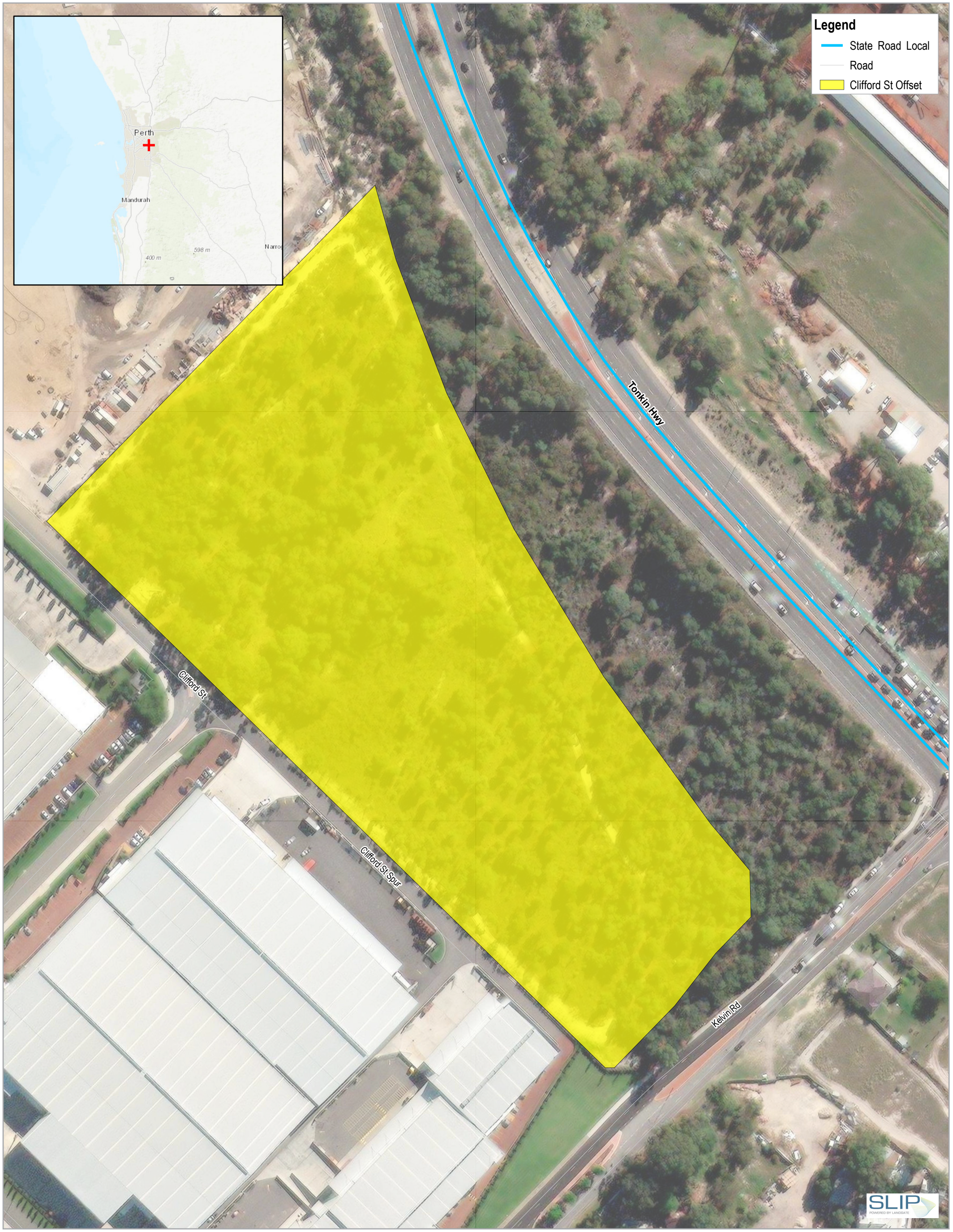
World Imagery: Maxar
World Hillshade: Esri, USGS. Created by: rbrown3



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Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
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GHD

Main Roads Western Australia
Tonkin Highway Grade Separated Interchanges
(Hale Road and Welshpool Road)

Rehabilitation of Clifford St Bushland

Project No. **12553076**
Revision No. **0**
Date **8/09/2022**

FIGURE 5-3

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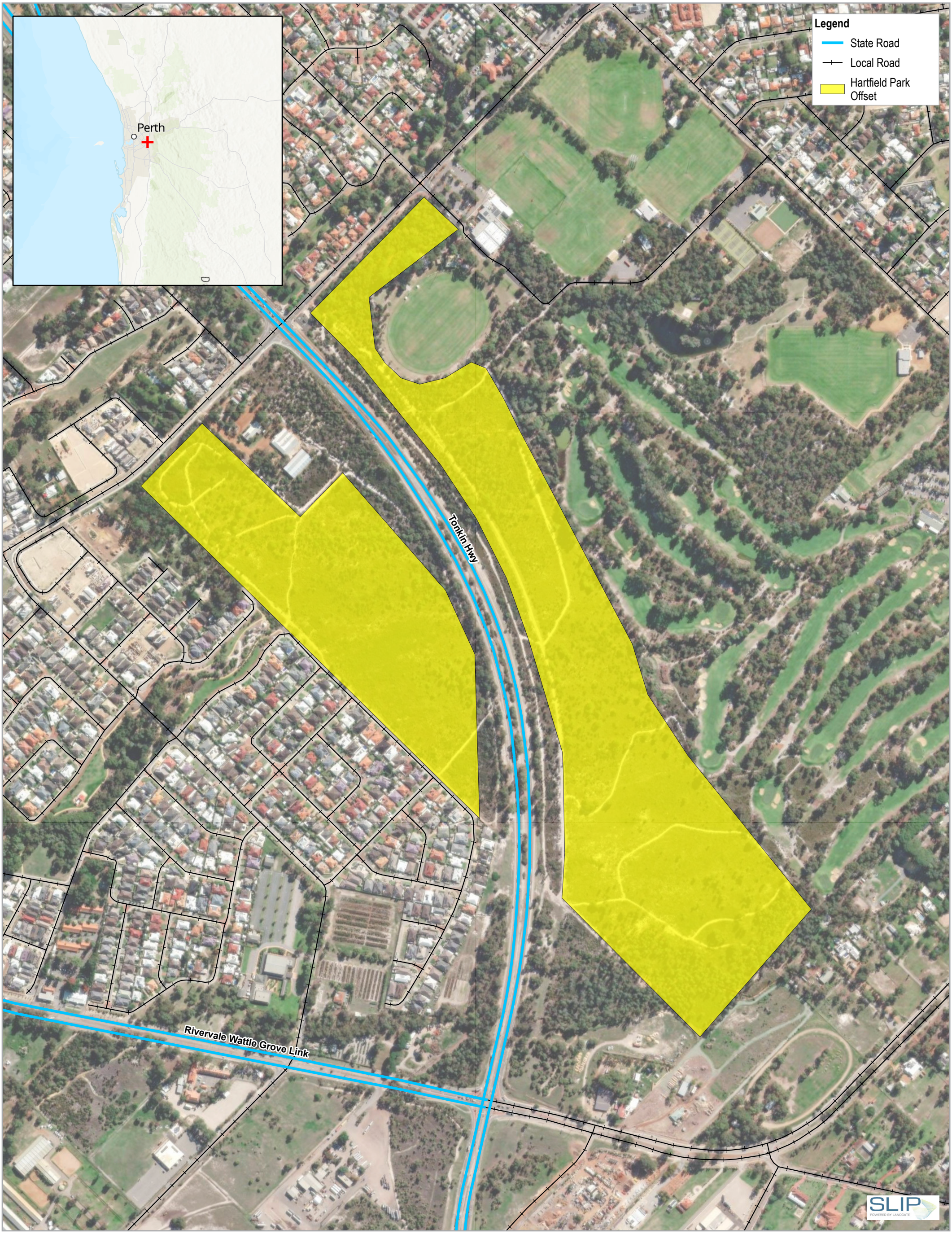
Print date: 08 Sep 2022 - 13:29

Data source: World Topographic Map: Esri, HERE, Garmin, FAO, USGS
World Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community. Created by: rbrown3



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Meters

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

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GHD

Main Roads Western Australia
Tonkin Highway Grade Separated Interchanges
(Hale Road and Welshpool Road)

Rehabilitation of Hartfield Park

Project No. **12553076**
Revision No. **0**
Date **8/09/2022**

FIGURE 5-4

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Print date: 08 Sep 2022 - 13:40

Data source: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Imagery: Maxar
World Hillshade: Esri, USGS. Created by: rbrown3

6 OFFSET GUIDE INPUTS AND JUSTIFICATION

Environmental offsets for the Proposal have been considered in accordance with the WA Environmental Offsets Policy (GoWA, 2011) and the *WA Environmental Offsets Metric Guideline* (DWER, 2021). The WA Environmental Offsets template has been completed for each proposed offset (Appendix 2). Preliminary offset calculations have been based on the *DWER WA Environmental Offsets Calculator*. The strategy will be prepared in accordance with the *WA Government's Environmental Offset Policy* (GoWA, 2011) and *WA Environmental Offsets Metric Guideline* (DWER, 2021).

Preliminary offset calculations were undertaken for Offsets 1-3 and have been based on the available information for the properties. Offset 4 involves the rehabilitation of the Greater Brixton Street Wetlands, Offset 5 involves the rehabilitation of the Clifford St Bushland and Offset 6 involves the rehabilitation of Hartfield Park.

The suitability of each Offset site to address the significant residual significant impacts identified in Section 5.3 and summarised in Table 5-1 has been assessed:

- Offset 1 – *Banksia mimica* and potentially suitable for SCP20a, Carnaby's Cockatoo and FRTBC
- Offset 2 – Carnaby's Cockatoo habitat
- Offset 3 –FRTBC and Baudin's Cockatoo habitat
- Offset 4 – Bush Forever, Guildford Complex and native vegetation associated with CCWs
- Offset 5 – *Conospermum undulatum* and *Johnsonia pubescens* subsp. *cygnorum*
- Offset 6 – SCP20a and *Johnsonia pubescens* subsp. *cygnorum*.

The suitability of Offsets 1 to 6 will be confirmed through biological surveys and/or consultation with DBCA.

The offset calculation inputs and justification of values are provided in Appendix 3.

7 SUMMARY OF OFFSET PACKAGE

Table 7-1 provides a summary of the offset package to counterbalance the significant residual impacts to SCP20a, *Banksia mimica, Conospermum undulatum*, *Johnsonia pubescens* subsp. *cygnorum*, Carnaby's Cockatoo, FRTBC, Baudin's Cockatoo, Bush Forever sites, the Guildford Complex and CCWs vegetation.

Table 7-1 is based on preliminary offset calculations using the *WA Environmental Offsets Metric Guideline* as presented in Appendix 3.

The offset package is expected to provide adequate compensation for significant residual impacts as a result of implementation of the Proposal. Main Roads is currently investigating additional offset options in consultation with DBCA.

In developing the proposed offset package, Main Road has taken into account the Principles of the *WA Environmental Offsets Policy* (GoWA 2011) as summarised in Table 7-2.

Table 7-1 Summary of preliminary offset calculations

Residual impacts to Key Environmental Factors	Offset 1 Mogumber offset	Offset 2 Cowalla offset	Offset 3 Lot 579	Offset 4 Rehabilitation of sections of Greater Brixton Street Wetlands	Offset 5 Rehabilitation of Clifford St Bushland	Offset 6 Rehabilitation of Hartfield Park
Key Environmental Factors confirmed	**Inferred, to be surveyed**	**Inferred, to be surveyed**	**Inferred, to be surveyed**	**Rehabilitation plan to be developed**	**Rehabilitation plan to be developed**	**Rehabilitation plan to be developed**
Guilford Complex vegetation Total quantum of impact = 1.33 ha				15.55 ha of rehabilitation = 100.0% of impact offset		
Bush Forever Total quantum of impact = 5.22 ha				20.87 ha of rehabilitation = 100.0% of impact offset		
SCP20a TEC Total quantum of impact = 1.13 ha	May contain TEC, not accounted for in this offset				May contain TEC, not accounted for in this offset	13.66 ha of rehabilitation = 100.0% of impact offset
Banksia mimica Total quantum of impact = 3 individuals	21 individuals = 104.6% of impact offset					
Conospermum undulatum Total quantum of impact = 62 individuals					312 individuals of *Conospermum undulatum* – 100.4% of impact offset	
Johnsonia pubescens* subsp. *cygnorum Total quantum of impact = 119 individuals					262 individuals of *Johnsonia pubescens* subsp. *cygnorum* = 100.1% of impact offset	
Carnaby's Cockatoo Total quantum of impact = 11.12 ha	May contain habitat, not accounted for in this offset	83.50 ha = 100.0% of impact offset				
FRTBC Total quantum of impact = 11.36 ha	May contain habitat, not accounted for in this offset		83.60 ha = 100.0% of impact offset			
Baudin's Cockatoo Total quantum of impact = 11.36 ha			85.30 ha = 100.0% of impact offset			
CCWs Total quantum of impact = 5.60 ha				54.30 ha of rehabilitation = 100.0% of impact offset		

Table 7-2: Assessment of offsets against the principles of the WA Environmental Offsets Policy (2011)

Principle	Assessment
Environmental offsets will only be considered after avoidance and mitigation options have been pursued	The potential impacts from the Proposal have been significantly reduced as a result of the efforts applied during the detailed design phase and during environmental assessment. This reduction has been largely achieved through the additional avoidance and mitigation measures that have been developed for the Proposal. Where appropriate, local technical expertise for key species and habitats has been sought to ensure the effectiveness of proposed management measures. Main Roads anticipates that the social and environmental impacts of the Proposal can be appropriately managed through the measures to be implemented in conjunction with the Proposal (as detailed in the Environmental Review Document (ERD)).
Environmental offsets are not appropriate for all projects	Main Roads operates on a hierarchy of avoid, minimise, reduce, rehabilitate and offset environmental impacts. This hierarchy is achieved primarily through changes in scope and design, development and implementation of management measures and finally, an offset proposal. Application of the management hierarchy has been summarised in this Offset Strategy and is detailed in ERD. Main Roads has proposed offsets to counterbalance significant residual impact to *Banskia attenuata* woodland over species rich dense shrublands (SCP20a) TEC, *Banksia mimica, Conospermum undulatum*, *Johnsonia pubescens* subsp. *cygnorum,* Carnaby's Cockatoo, FRTBC, Baudin's Cockatoo, Bush Forever sites, the Guildford Complex and CCW vegetation. This decision is based on the quantum of impacts, conservation status, and local context of the ecological communities and faunal habitats impacted by the Proposal.
Environmental offsets will be cost-effective, as well as relevant and proportionate to the significance of the environmental value being impacted	Main Roads has pursued a number of options in developing a package of offsets to counterbalance residual impacts that are relevant and appropriate for the locality and quantum of impact for each environmental value impacted. The options investigated have comprised acquisition and rehabilitation of land providing SCP20a TEC, Threatened and Priority flora, fauna habitat and CCW vegetation. Several of the proposed offset sites will address the requirement for more than one offset attribute i.e. provision of SCP20a TEC and habitat for Black Cockatoos.
Environmental offsets will be based on sound environmental information and knowledge	The offset values for Offsets 1 and 3 have been based on the available information for each of the proposed offset properties. These sites are yet to be surveyed to confirm the ecological values. However, based on consultation with DBCA, the location and vegetation expected to be present, the properties are expected to comprise habitat for FRTBC and Baudin's Cockatoo, and *Banksia mimica*. Offset 2 has been subject to a biological survey to determine the presence of Carenaby's Cockatoo habitat. The offsets involving rehabilitation (i.e. Greater Brixton Street Wetlands, Clifford St Bushland and Hartfield Park), will be undertaken in accordance with a rehabilitation plan developed in consultation with DBCA.
Environmental offsets will be applied within a framework of adaptive management	The proposed offsets will be subject to long term monitoring and ongoing adaptive management, as required, to ensure the anticipated values and effectiveness criteria for each offset is achieved. Where at variance to the objectives of the offset strategy, advice and management consultation with DBCA and other relevant key stakeholders will be undertaken.
Environmental offsets will be focussed on longer term strategic outcomes.	Offset sites 1 to 4 will be managed by DBCA through conservation tenure. Offset sites 5 and 6 will be managed by the City of Kalamunda and the City of Gosnells, respectively.

Principle	Assessment
	The Offset Proposal will be based on a Memorandum of Understanding between Main Roads and DBCA, including requirements for land management and monitoring.

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9 APPENDICES

Appendix	Title
Appendix 1	SCP20a modelling offset calculations
Appendix 2	WA offset template
Appendix 3	Offset calculations

Appendix 1: SCP20a modelling

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Document Reference: EP21-072(01)--001A

Emerge contact: Tom Atkinson

7 September 2021

Attention: John Braid
Main Roads Western Australia
34 - 50 Stirling Street
Perth WA 6000

Delivered by email to: john.braid@mainroads.wa.gov.au

Dear John

SCP20A DESKTOP ASSESSMENT – OUTCOMES OF GROUNDTRUTHING

Emerge Associates has been engaged by Main Roads Australia (Main Roads WA) to identify potential offset sites for the '*Banksia attenuata* woodland over species rich dense shrublands' threatened ecological community (SCP20a). This letter provides an update on the outcomes of the SCP20a investigation completed from July to August 2021.

Introduction

Main Roads WA seeks to identify potential offset sites for SCP20a to assist with environmental approvals for a range of projects.

Emerge Associates have developed an analytical approach to predict the location of floristic community types (FCTs) on the Swan Coastal Plain using GIS software and publicly available spatial data. Our spatial model generates a polygon that is attributed to indicate native vegetation with higher or lower probability of comprising an FCT.

In 2019/2020 we applied this approach to predict the occurrence of SCP20a and local FCTs across the East Wanneroo district structure plan area, as part of work undertaken for the Department of Planning, Lands and Heritage. We completed ground-truthing at a number of East Wanneroo sites and were able to confirm SCP20a occurred or was likely to occur at predicted locations, as shown in **Plate 1**.

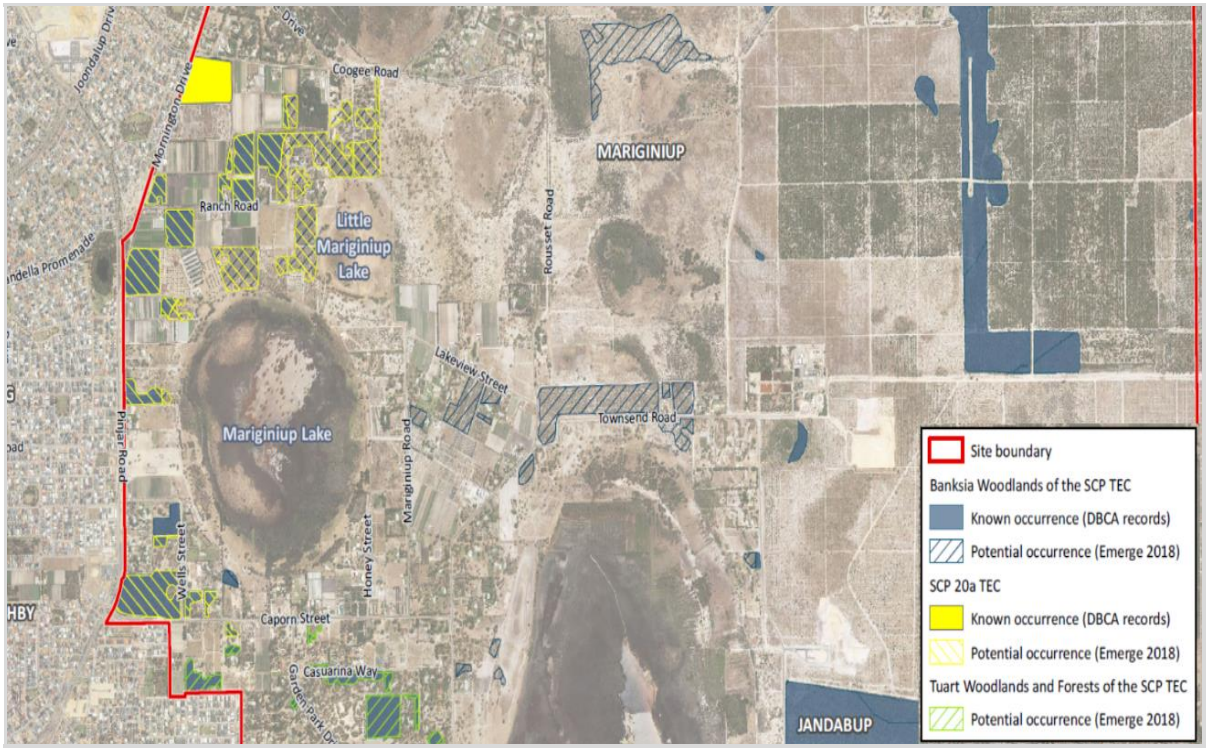

Plate 1: Example of SCP20a prediction in East Wanneroo.

Using our spatial model extensive occurrences of SCP20a were predicted to occur in the north-eastern Swan Coastal Plain. Main Roads WA requested that Emerge conduct a reconnaissance level survey of selected locations within Shire of Chittering to ground-truth the spatial model outputs and provide preliminary indication of whether SCP20a is likely to occur. Methods and results of our recent investigation are outlined below.

Methods

A field survey was conducted in August 2021 during which two experienced ecologists visited 22 locations within publicly owned land at which the spatial model predicted SCP20a occurred. At each location relevés were completed to rapidly collect an inventory of flora taxa equivalent to 10 x 10 m quadrats, along with notes and photographic images.

Sample data was then compared to the regional 'floristic community type' (FCT) dataset *A floristic survey of the southern Swan Coastal Plain* by Gibson *et al.* (1994). The sample data (presence/absence) was reconciled with Gibson *et al.* (1994) by standardising the names of taxa with those used in the earlier study. This was necessary due to changes in nomenclature in the intervening period. Taxa that were only identified to genus level were excluded, while some infra-species that have been identified since 1994 were reduced to species level. The combined dataset was then imported into the statistical analysis package PRIMER v6 (Clarke and Gorley 2006).

Each sample was compared to Gibson *et al.* (1994) separately (single site insertion). A resemblance matrix was calculated using the Bray-Curtis distance measure that provided a percentage similarity between all pairs of samples. Subsequently, a cluster analysis was completed using the resemblance matrix and hierarchical agglomerative clustering (group average), to produce a dendrogram.

Results

Excerpts from the dendrograms of a selection of reconnaissance samples are provided in **Attachment 1**.

FCT 20a is the Gibson *et al.* (1994) FCT which defines SCP20a. Three samples showed strong resemblance to and clustered with FCT 20a in the dendrogram (1RAWb, 5TAA and 7TAA with between 38 and 43% similarity).

Two samples clustered with FCT 20b (including 7RAW in **Attachment 1**) and two samples clustered with FCT 28 (including 1TAA in **Attachment 1**). The analysis of other samples was generally inclusive as they clustered with a wide range of FCTs, albeit often including FCT 20a.

The general locations where samples indicate that SCP20a occur are shown on **Figure 1**.

Discussion

The preliminary results are extremely promising as they indicate that SCP20a is likely to occur in the Shire of Chittering. While, the vegetation sampled as part of the current survey was limited to that within publicly owned land, a large quantum of remnant native vegetation also occurs on adjacent land parcels which are privately owned. It is therefore likely that suitable offset options for SCP20a could be identified in nearby privately owned land.

One of the samples from the current survey that clustered with FCT 20a was recorded within an area of vegetation along Ioppolo Road, Chittering. The DBCA TEC database shows two records for SCP20a within the Ioppolo Road vegetation, as shown on **Figure 1**.

Woodman Environmental reviewed these records as part of the approval process for Main Roads WA Northlink WA project and concluded that SCP20a does not occur and instead favoured a classification for this vegetation as FCT 28 (Coffey Environments 2015; Woodman Environmental 2015). Two other samples from Ioppolo Road from the current survey also clustered with FCT 28. However, rather than being definitive, we consider that the clustering with FCT 28 warrants further scrutiny.

The samples from the current survey specifically clustered with a five Gibson *et al.* (1994) sites for FCT 28 that occur in Bullsbrook, on the eastern side of the Swan Coastal Plain. The Bullsbrook FCT 28 sites in Gibson et al. (1994) are difficult to reconcile, given they do not cluster with any of the other FCT 28 sites in the Gibson et al. (1994) dataset. They may therefore be better understood as being representative of a separate FCT (that is something other than FCT 28).

When these Bullsbrook FCT 28 sites are removed from the Gibson et al. (1994) dataset prior to analysis in PRIMER, the samples from the current survey clustered with FCT 20a sites or sites for the closely related FCT 20b. Clearly therefore the vegetation in Ioppolo Road has some affinity with FCT 20a. The similarity shown to the Bullsbrook FCT 28 sites may also be better understood as being indicative of similarity to eastern coastal plain vegetation generally, rather than FCT 28, which is typically associated with the western side of the Swan Coastal Plain.

Despite the promise shown by results, it should also be noted that a large proportion of samples collected as part of the current survey yielded inconclusive results from the PRIMER analysis. This is likely due to the fact rapidly collected relevés did not provide enough information to allow a clear outcome to be achieved. Relevés are also not considered to provide as reliable results when used in FCT classification. Further detailed sampling will be completed in spring 2021 using 10 x 10 m quadrats to ensure a comprehensive inventory of taxa at sampled locations is recorded and improve confidence in the FCT assignment of sampled vegetation.

Summary and closing

Ground-truthing indicates that SCP20a is likely to occur at select locations across the Shire of Chittering. Additional surveys are planned for spring 2021 to collect more comprehensive data for further floristic analysis.

We trust that this letter provides sufficient update on the SCP20a investigation that Emerge Associates is undertaking for Main Roads WA. Should you have any further queries please don't hesitate to contact the undersigned.

Yours sincerely
Emerge Associates

Tom Atkinson
PRINCIPAL ENVIRONMENTAL CONSULTANT – ECOLOGY

cc: Nil
Encl: Figure 1: Preliminary SCP20a Occurrence
Attachment 1 – Dendrogram Excerpts

References

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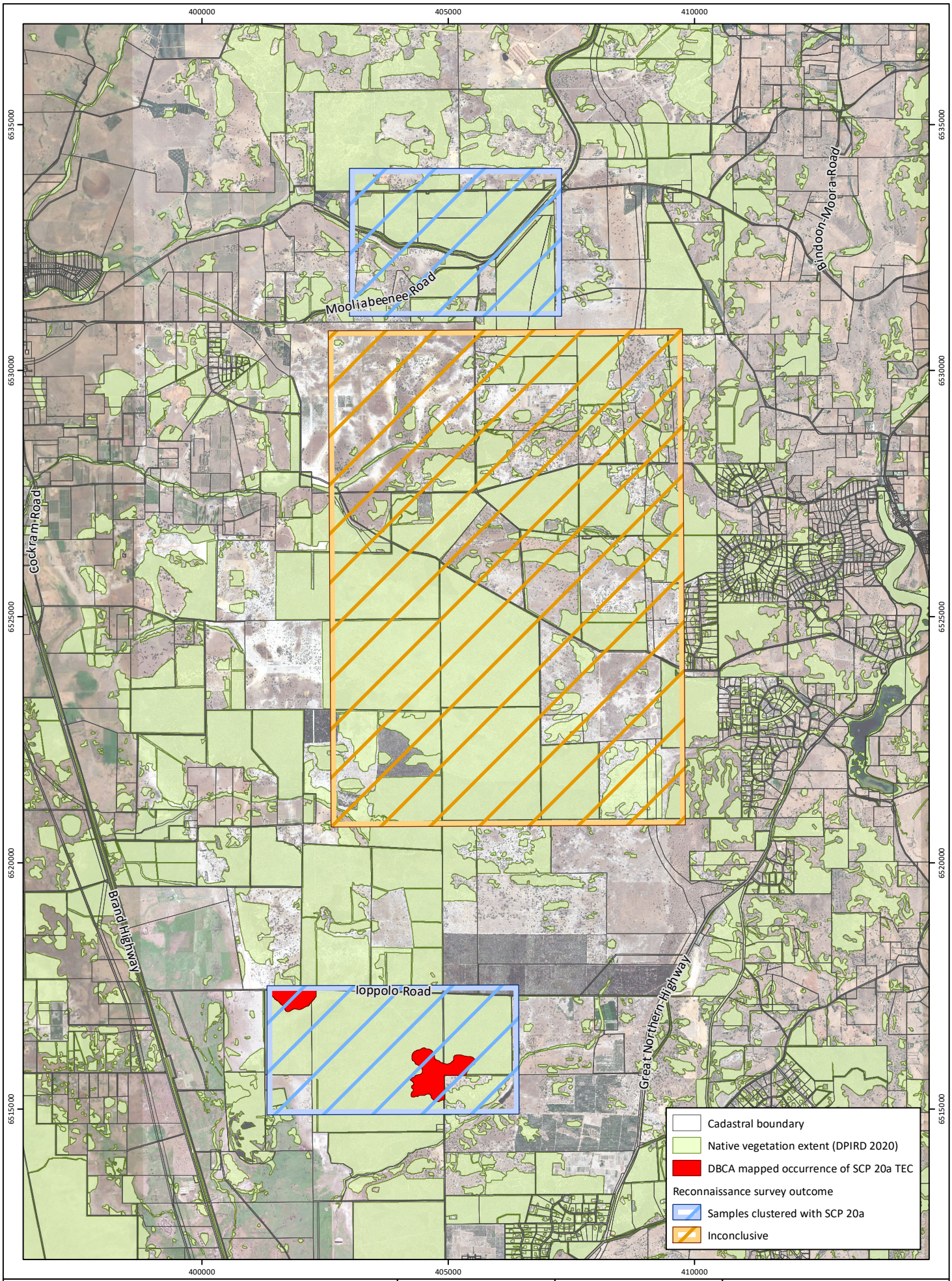

Figure 1: SCP20a Occurrence

Project: Main Roads WA Environmental Approvals Support
SCP20a Desktop Assessment

Client: Main Roads WA

Plan Number:
EP21-072(01)--F01

Drawn:	GAR
Date:	06/09/2021
Checked:	TAA
Approved:	TAA
Date:	06/09/2021

N

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Kilometers

Scale: 1:100,000@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used.
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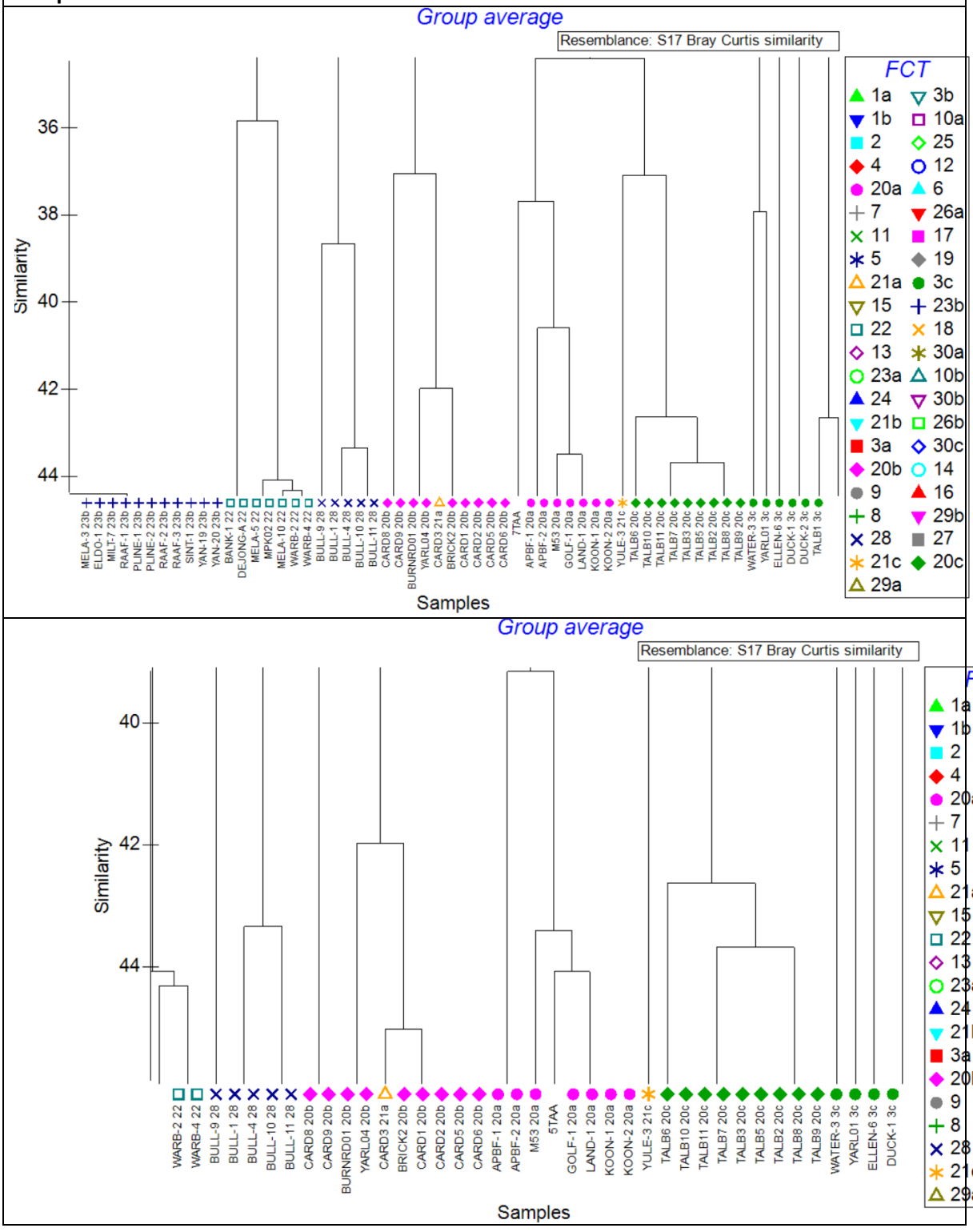
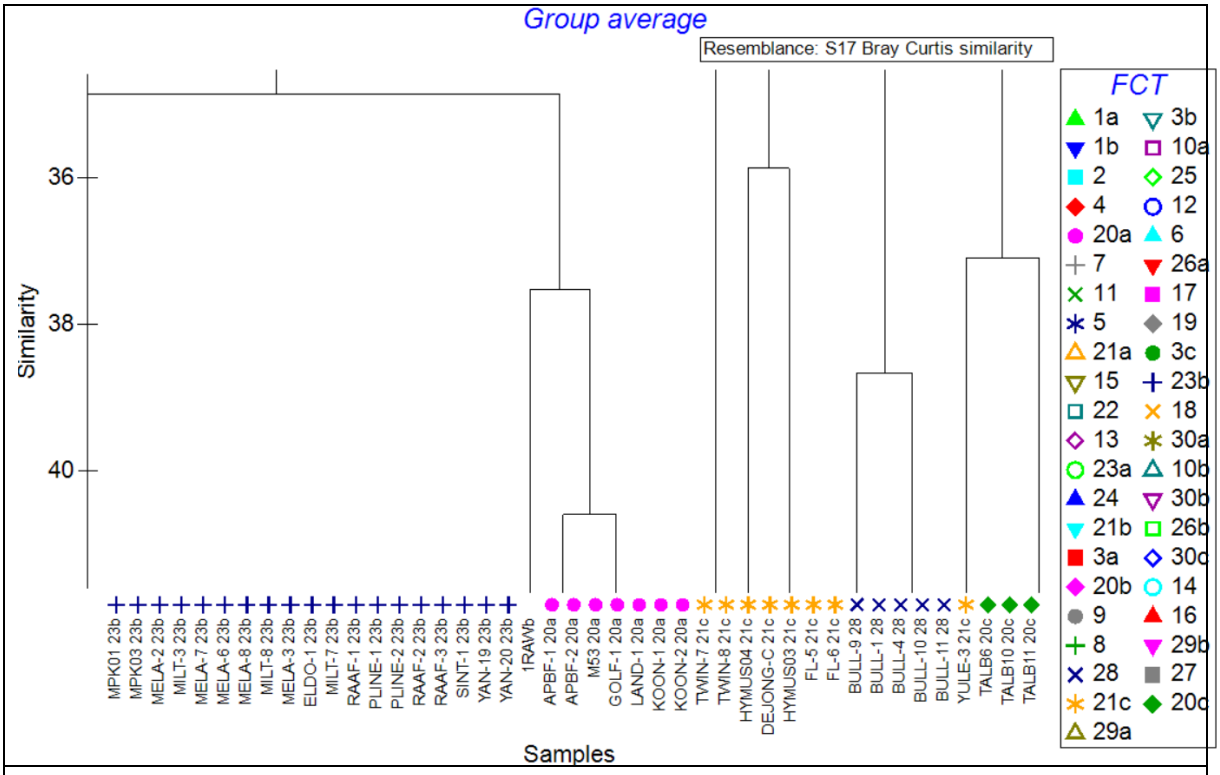
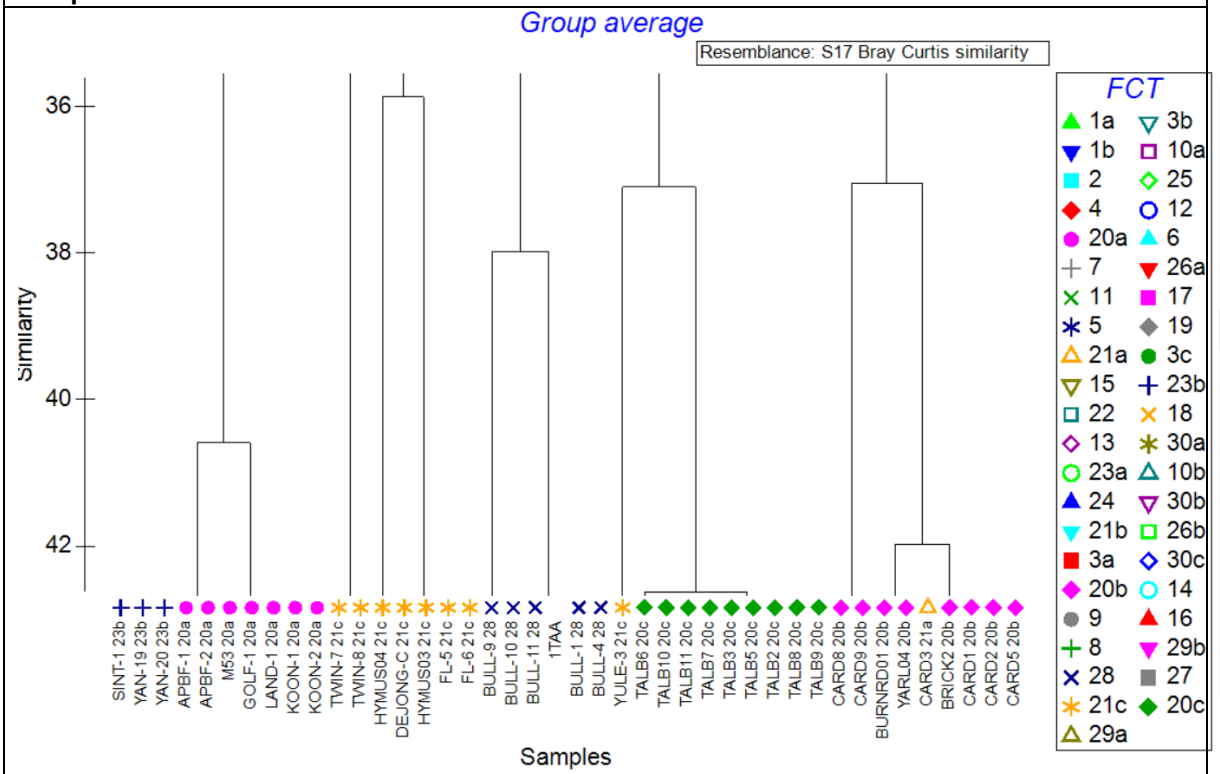
Samples that clustered with FCT 20a

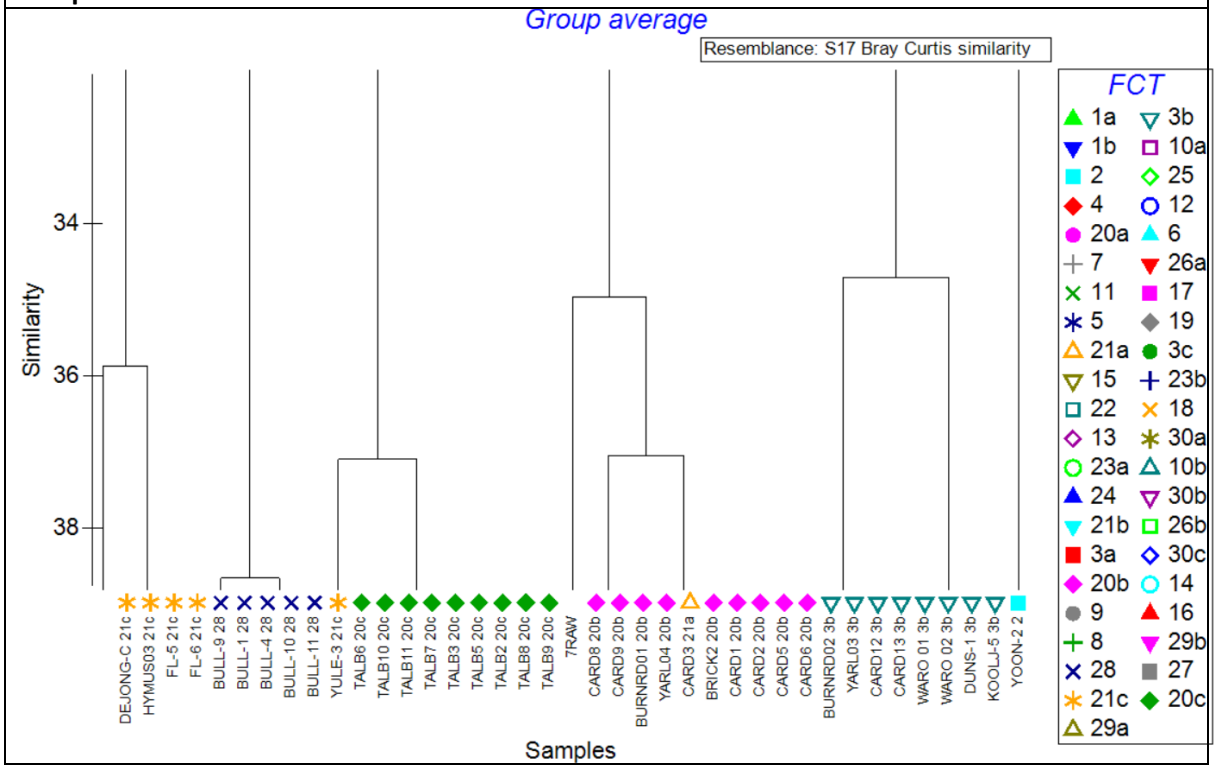




Sample that clustered with FCT 28



Sample that clustered with FCT 20b



Appendix 2: WA offset template

Project Name - Tonkin Highway Grade Separated Interchanges Hale and Welshpool Road

Existing environment/ Impact	*Mitigation*			*Significant Residual Impact*	*Offset Calculation Methodology*				
	Avoid and minimise	*Rehabilitation Type*	*Likely Rehab Success*		*Type*	*Risk*	*Likely offset success*	*Time Lag*	*Offset Quantification*
Woodman (2021) and Umwelt (2022) mapped approximately 1.61 ha of *Banksia attenuata* woodlands over species rich dense shrublands (SCP 20a) TEC within the DE. A total of 19.20 ha of this TEC was mapped across seven patches within the Assessed Area (Umwelt, 2022), with the majority (approximately 12.97 ha, three patches) occurring within Bush Forever Site no. 320 (Hartfield Park) . There is 1.61 ha of this TEC mapped within the DE, with the DE intersecting three of the seven recorded patches. The majority of the TEC mapped within the DE is located within Bush Forever Site no. 320 (Hartfield Park). Within the DE, SCP20a TEC occurrences ranged from Excellent to Good in condition. Clearing for the Proposal will be limited to the edges of each SCP20a TEC patch (i.e. not bisect any patch).	Main Roads has designed the Proposal to avoid areas of SCP20a where possible and minimise impacts to this community through aligning the Development Envelope to the existing Tonkin Highway as far as practicable. The DE avoids patch fragmentation and retains an area of TEC that is contiguous, in addition, the DE avoids disruption of linkages between TEC patches and wider vegetation and fauna corridors at Hartfield Park and Greater Brixton Street Wetlands.	Areas cleared for the Proposal, that are no longer required for future infrastructure or management access, will be revegetated, with consideration of operational safety requirements.	Rehabilitation will be undertaken using appropriate locally endemic native species. Disturbance following construction will be kept to a minimum and therefore it is considered the rehabilitation will be successful.	Extent 1.61 ha of SCP20a. Quality Of the 1.61 ha of SCP20a TEC recorded within the DE, all is in Good or better condition, with 0.44 ha in Good condition, 0.53 ha in Very Good condition and 0.64 ha in Excellent condition. Conservation Significance High significance- the impacts are to vegetation listed as Endangered under the EPBC Act and BC Act. Land Tenure The alignment of the Proposal will not be fully located within land currently reserved under the MRS for Primary Regional Roads or Other Regional Roads. Following completion of the Proposal all areas outside the existing Primary Regional Roads reservation will be incorporated into Primary Regional Roads, or zoned appropriately, through an ominibus amendment to the MRS pursuant to section 28 (1) of the Land Administration Act 1997. Time Scale Permanent. As per the significance framework, the residual impact is significant as the impacts are on vegetation listed as Endangered under the EPBC Act and BC Act. Recent data obtained from the DBCA indicates that the remaining extent of the community is approximately 585 ha, including 290.5 ha in Crown reserves. The clearing of 1.61 ha for the Proposal will result in a reduction of 0.28% of the reported TEC extent.	Rehabilitation of Hartfield Park.	Low risk as the area to be rehabilitated is located within Hartfield Park and subject to conservation protection.	Can the values be defined and measured? Yes - vegetation condition and extent can be measured. Operator experience/Evidence? The offset site will be managed by the City of Gosnells. What is the type of vegetation being offset? *Banksia attenuata* woodlands over species rich dense shrublands (SCP 20a) TEC.	Main Roads intends to have all acquisition offsets in place within 24 months of approval.	Offset package has not been finalised. The rehabilitation is expected to comprise 13.66 ha to counterbalance impacts to SCP20a TEC. Main Roads will revise offset extents in the final offset package.
Woodman (2021) and GHD (2021) identified three Threatened flora and five Priority flora taxa occur within the DE. The residual impacts to Is*opogon autumnalis, Jacksonia gracillima, Styphelia filifolia* and *Verticordia lindleyi* subsp. *lindleyi* are not considered significant and therefore Main Roads is not proposing to offset impacts to these flora species. Main Roads has modified a drainage basin located to the north and west of Welshpool Road to avoid one Threatened species, *Andersonia gracilis* mapped within the DE. The Offset Strategy aims to counterbalance the significant residual impacts of the Proposal to the two Threatened flora taxa (Con*ospermum undulatum* and *Banksia mimica*) and one Priority flora taxa (*Johnsonia pubescens* subsp. *cygnorum*). The Proposal will remove three individuals of *Banksia mimica* , sixty-two individuals of *Conospermum undulatum* and 119 individuals of *Johnsonia pubescens* subsp. *cygnorum* .	Main Roads has designed the Proposal to avoid the clearing of Threatened and Priority flora where possible and minimise impacts to these taxa through aligning the Development Envelope to the existing Tonkin Highway as far as practicable. Main Roads has modified a drainage basin located to the north and west of Welshpool Road to avoid the clearing of *Andersonia gracilis* within the DE.	Areas cleared for the Proposal, that are no longer required for future infrastructure or management access, will be revegetated, with consideration of operational safety requirements.	Rehabilitation will be undertaken using appropriate locally endemic native species. Disturbance following construction will be kept to a minimum and therefore it is considered the rehabilitation will be successful.	Extent Three *Banksia mimica* individuals. 62 *Conospermum undulatum* individuals. 119 *Johnsonia pubescens* subsp. *cygnorum* individuals. Conservation Significance High significance - the impacts are to *Banksia mimica* which is listed as Endangered under the EPBC Act and Vulnerable under the BC Act, and to *Conospermum undulatum* which is listed as Vulnerable under the EPBC Act and Vulnerable under the BC Act. *Johnsonia pubescens* subsp. *cygnorum* is listed as Priority 2 by the DBCA. Land Tenure The alignment of the Proposal will not be fully located within land currently reserved under the MRS for Primary Regional Roads or Other Regional Roads. Following completion of the Proposal all areas outside the existing Primary Regional Roads reservation will be incorporated into Primary Regional Roads, or zoned appropriately, through an ominibus amendment to the MRS pursuant to section 28 (1) of the Land Administration Act 1997. Time Scale Permanent. As per the significance framework, the residual impact is significant as the impacts are on Threatened flora listed under the EPBC Act and BC Ac and Priority flora listed by the DBCA. The Proposal will remove three individuals of *B. mimica* which is approximately 0.04% of the total estimated population of the taxon (of approximately 7,300 individuals). The Proposal will remove 62 individuals of *C. undulatum* , which comprises 0.45% of the total estimated population of the taxon (of approximately 13,650 individuals). The Proposal will remove 119 individuals of *J. cygnorum* , which represents a 5.31% of the total estimated population of the taxon (of approximately 2,240 individuals).	Land acquisition and land management funding for *Banksia mimica.* Acquisition of land by the Crown and land transfer to DBCA management. Seven years of funding for DBCA management. Rehabilitation of Clifford St Bushland and Hartfield Park for *Conospermum undulatum* and *Johnsonia pubescens subsp. cygnorum* .	Low risk. Site will be transferred to DBCA management and the area to be rehabilitated is located within Hartfield Park and Clifford St Bushland and subject to conservation protection.	Can the values be defined and measured? Yes - number of individuals can be counted. Operator experience/Evidence? DBCA is an experienced land manager.The rehabilitation offset sites will be managed by the City of Gosnells and the City of Kalamunda. What is the type of vegetation being offset? No vegetation to be offset, however land will be allocated containing *Bankisia mimica* and rehabilitated to contain *Conospermum undulatum* and *Johnsonia pubescens* subsp. *cygnorum* individuals.	Main Roads intends to have all acquisition offsets in place within 24 months of approval.	Offset package has not been finalised. The offset extent is expected to be land allocated which contains at least 21 *Banksia mimica* individuals. The rehabilitation is expected to increase the number of *Conospermum undulatum* individuals to 312 and the number of *Johnsonia pubescens* subsp. *cygnorum* individuals to 262 . Main Roads will revise offset extents in the final offset package.
Across the Development Envelope and Footprint there are large amounts of negligible value foraging habitat for all three black cockatoo species. The Proposal will result in the clearing of 18.54 ha of moderate to low value foraging habitat for Carnaby's Cockatoo, and 7.88 ha of high to moderate value and 11.06 ha of moderate to low value foraging habitat for Baudin's Cockatoo and Forest Red-tailed Black Cockatoo (FRTBC). 141 potential Black Cockatoo breeding trees (DBH>500 mm) have beed recorded in the DE, including no trees containing potentially suitable hollows for Black Cockatoo nesting. The Proposal will not result in clearing of known breeding trees or hollows.	Main Roads has designed the Proposal to avoid the clearing of fauna habitat where possible and minimise impacts to this community through aligning the Development Envelope to the existing Tonkin Highway as far as practicable. The DE avoids habitat fragmentation and retains areas of fauna habitat that is contiguous, in addition, the DE avoids disruption of linkages between fauna corridors at Hartfield Park and Greater Brixton Street Wetlands. The Proposal has been designed to incorporate existing cleared areas as much as possible.	Areas cleared for the Proposal, that are no longer required for future infrastructure or management access, will be revegetated, with consideration for operational safety requirements.	Rehabilitation will be undertaken using appropriate locally endemic native species. Disturbance following construction will be kept to a minimum and therefore it is considered the rehabilitation will be successful.	Extent 18.54 ha moderate to low value foraging habitat for Carnaby's Cockatoo 7.88 ha of high to moderate value foraging habitat for FRTBC and Baudin's Cockatoo. 11.06 ha of moderate to low value (score 2-4) foraging habitat for FRTBC and Baudin's Cockatoo. Quality Low to high. Conservation Significance High significance - Carnaby's and Baudin's cockatoos are listed as Endangered and forest red-tailed black cockatoos are listed as Vulnerable under the EPBC Act and BC Act. Land Tenure The alignment of the Proposal will not be fully located within land currently reserved under the MRS for Primary Regional Roads or Other Regional Roads. Following completion of the Proposal all areas outside the existing Primary Regional Roads reservation will be incorporated into Primary Regional Roads, or zoned appropriately, through an ominibus amendment to the MRS pursuant to section 28 (1) of the Land Administration Act 1997. Time Scale Permanent. As per the significance framework, the residual impact is significant as the impacts are on habitat for species listed as Endangered or Vulnerable under the EPBC Act and the BC Act.	Land acquisition and land management funding. Acquisition of land by the Crown and land transfer to DBCA management. Seven years of funding for DBCA management. Potential offset sites include: Offset 2 (Cowalla offset) - Carnaby's Cockatoo. Offset 3 (Lot 579) - FRTBC and Baudin's Cockatoo.	Low risk. Sites will be transferred to DBCA management.	Can the values be defined and measured? Yes - black cockatoo foraging habitat quality and extent and potential breeding trees can be measured. Operator experience/Evidence? DBCA is an experienced land manager. What is the type of vegetation being offset? Black cockatoo foraging habitat.	Main Roads intends to have all acquisition offsets in place within 24 months of approval.	Offset package has not been finalised. The offset extent is expected to be an approximate 83.50 ha portion of offset properties to counterbalance impacts to Carnaby's Cockatoo, 83.60 ha to counterbalance impacts to Forest Red-tailed Black Cockatoo and an approximate 85.30 ha portion of offset properties to counterbalance impacts to Baudin's Cockatoo. Main Roads will revise offset extents in the final offset package.

A total of 33.07 ha of mapped geomorphic wetlands are intersected by the Development Envelope, with 13.61 ha mapped as native vegetation. This includes the loss of 9.34 ha of native vegetation within 16.54 ha of mapped CCWs. The vegetation within the CCWs ranged from Excellent to Degraded.	Main Roads has designed the Proposal to avoid the clearing of geomorphic wetlands where possible and minimise impacts to these areas through aligning the Development Envelope to the existing Tonkin Highway as far as practicable. Main Roads will investigate opportunities during detailed design and construction planning to reduce impacts on CCWs further.	Areas cleared for the Proposal, that are no longer required for future infrastructure or management access, will be revegetated, with consideration for operational safety requirements.	Rehabilitation will be undertaken using appropriate locally endemic native species. Disturbance following construction will be kept to a minimum and therefore it is considered the rehabilitation will be successful.	<u>Extent</u> 9.34 ha of native vegetation within 16.74 ha of mapped CCWs. <u>Conservation Significance</u> CCWs are wetlands which support a high level of attributes and functions and are considered significant at State level. Due to the disturbance of wetlands in the local areas, wetlands containing intact native vegetation and ecosystems retain wetland values and are of elevated conservation significance. <u>Land Tenure</u> The alignment of the Proposal will not be fully located within land currently reserved under the MRS for Primary Regional Roads or Other Regional Roads. Following completion of the Proposal all areas outside the existing Primary Regional Roads reservation will be incorporated into Primary Regional Roads, or zoned appropriately, through an ominibus amendment to the MRS pursuant to section 28 (1) of the Land Administration Act 1997. <u>Time Scale</u> Permanent. As per the significance framework, the residual impact is significant as the impacts are on wetlands listed by the State as the highest priority for protection.	Main Roads are proposing rehabilitation of sections of the Greater Brixton Street Wetlands, in collaboration with DBCA.	Low risk. Sites will be transferred to DBCA management.	<u>Can the values be defined and measured?</u> Yes - wetlands values can be measured. <u>Operator experience/Evidence?</u> DBCA is an experienced land manager. <u>What is the type of vegetation being offset?</u> Conservation Category Wetlands.	Main Roads intends to have all acquisition offsets in place within 24 months of approval.	Offset package has not been finalised. The offset extent is expected to be an approximate 54.30 ha of rehabilitation to offset impacts to CCWs. Main Roads will revise offset extents in the final offset package.
The Proposal will result in the clearing of up to 4.42 ha of native vegetation within the Guildford Complex.The Guildford Complex has limited remaining extents at all scales. The complex is already below the now rescinded 10% target the EPA used as a guide for retention of vegetation complexes within constrained areas of the SCP (EPA 2008). The Proposal would result in further a reduction of 4.42 ha (or 0.1%) of the Guildford complex, reducing the percentage remaining from 5.09% to 5.08%. The Proposal will result in the permanent loss of 9.60 ha of native vegetation within two Bush Forever sites, Site no. 387 (Greater Brixton Street Wetlands) and Site no. 320 (Hartfield Park Bushland).	The Proposal was designed to prioritise placement within existing linear infrastructure corridors where practicable, avoiding clearing of native vegetation within the Bush Forever sites. Main Roads has designed the Proposal to avoid vegetation within Bush Forever where possible. Construction and operational access tracks will be designed to coincide with existing tracks or aligned along cleared areas where practicable.	Areas cleared for the Proposal, that are no longer required for future infrastructure or management access, will be revegetated, with consideration for operational safety requirements.	Rehabilitation will be undertaken using appropriate locally endemic native species. Disturbance following construction will be kept to a minimum and therefore it is considered the rehabilitation will be successful.	<u>Extent</u> 4.42 ha of native vegetation within the Guildford Complex. 9.60 ha of native vegetation across Bush Forever Site No. 387 and 320. <u>Conservation Significance</u> HIgh significance - the impacts involve the clearing of vegetation within the Guildford Complex which is already below the 10% target. The impacts ar also to vegetation listed by the State as Bush Forever, which is considered to be regionally significant bushland. <u>Land Tenure</u> The alignment of the Proposal will not be fully located within land currently reserved under the MRS for Primary Regional Roads or Other Regional Roads. Following completion of the Proposal all areas outside the existing Primary Regional Roads reservation will be incorporated into Primary Regional Roads, or zoned appropriately, through an ominibus amendment to the MRS pursuant to section 28 (1) of the Land Administration Act 1997. <u>Time Scale</u> Permanent. As per the significance framework, the residual impact is significant as the impacts are on the Guildford Compex (which is already below 10% target) and Bush Forever, listed by the State as regionally significant bushland.	Main Roads are proposing rehabilitation of sections of the Greater Brixton Street Wetlands, in collaboration with DBCA.	Low risk. Rehabilitation will be in collaboration with DBCA.	<u>Can the values be defined and measured?</u> Yes - vegetation condition and extent can be measured. <u>Operator experience/Evidence?</u> DBCA is experienced land manager. Revegetation or on-ground activities may be undertaken in house, by local land care groups, contractors or consultants. Main Roads will ensure a suitable operator is engaged to undertake on-ground management and revegetation works. <u>What is the type of vegetation being offset?</u> Native vegetation.	Main Roads intends to have all acquisition offsets in place within 24 months of approval.	Offset package has not been finalised. The impact is expected to be offset via the rehabilitation of the Greater Brixton Street Wetlands which will account for 100% of impact to the Guildford complex and native vegetation within Bush Forever. Main Roads will revise offset extents in the final offset package.

Appendix 3: Offset calculations

Guilford Complex vegetation

WA Environmental Offsets calculator

PLEASE ENABLE MACROS FOR THIS SPREADSHEET

Produced by:

The Department of Water and Environmental Regulation (DWER) in consultation with stakeholder working groups

Purpose:

Use the WA Envirionmental Offsets calculator in conjunction with the *Environmental offsets metric: Quantifying environmental offsets in Western Australia* guideline. Together, they form a supplement to section 4 of the *WA Environmental Offsets Guidelines* and provide information to help decision-makers, government officers, industry and the community to quantify environmental offsets.

Data currency:

The correct application of the WA Environmental Offsets Calculator relies on access to current datasets (such as vegetation extent and land tenure).

Process for using the WA Environmental Offsets Calculator		
Step	**Worksheet**	**Component**
Step 1: Determining conservation significance	**Step1_ConservationSignificance**	**Conservation significance determination**
		Combined *area* /*feature*
Step 2: Calculating significant residual impact	**Step2_SignificantResidualImpact**	**Part A: Significant impact calculation**
		Separate *area* or *feature* calculations
		Part B: Rehabilitation credit calculation
		Separate *area* or *feature* calculations
		Part C: Significant residual impact calculation
		Separate a*rea* or *feature* calculations
Step 3: Calculating offsets	**Step3_Offsets**	**Offsets calculation**
		Separate a*rea* or *feature* calculations
Rationale for scores used in the Offsets Calculator	**Rationale**	**All**

WA Environmental Offsets Calculator

Step 1: Determining conservation significance

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

(Or, if appropriate, manual data entry permitted)

Area / feature **(Impact site)**

Conservation significance		
Conservation significance determination for the environmental value impacted		
	Description	Native vegetation within the Guildford Complex.
	Type of environmental value	Vegetation/habitat
	Conservation significance of environmental value	Terrestrial native vegetation complex - <10% extent remaining in a constrained area
	Conservation significance score	**0.1%**

Please select *area* or *feature* for the calculations	**Area**

WA Environmental Offsets Calculator

Step 2: Calculating significant residual impact

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

Environmental value (step 1)	Native vegetation within the Guildford Complex.

Area **(impact site)**

Part A: Significant impact calculation *Area*			
Significant impact	**Description**	**Quantum of impact**	
	Clearing of 4.42 ha of native vegetation within the Guildford Complex.	**Significant impact (hectares)**	4.42
		Quality (scale)	3.00
		Total quantum of impact	**1.33**

Part B: Rehabilitation credit calculation *Area* **(onsite)**					
Rehabilitation Credit	**Description**	**Proposed rehabilitation (area in hectares)**		**Time until ecological benefit (years)**	
	None proposed.	**Current quality of rehabilitation site (scale)**		**Confidence in rehabilitation result (%)**	
		Future quality WITHOUT rehabilitation (scale)		**Rehabilitation credit**	**0.00**
		Future quality WITH rehabilitation (scale)			

Part C: Significant residual impact calculation *Area*		
Significant residual impact	**Total quantum of impact**	**1.33**
	Rehabilitation credit	**0.00**
	Significant residual impact	**1.33**

WA Environmental Offsets Calculator

Step 3: Calculating offsets

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

Environmental value (step 1)	Native vegetation within the Guildford Complex.	Significant impact (step 2, part A)	4.42
		Rehabilitation credit (step 2, part B)	0.00
		Significant residual impact (step 2, part C)	1.33

Area **(offset site)**

Offset calculation
Area

Offsets calculation

Description	**Proposed offset (area in hectares)**	15.55	**Duration of offset implementation (maximum 20 years)**	3.00	**Offset value** (applied to step 2, part C)	**1.33**
Rehabilitation of the Greater Brixton Street Wetlands	**Current quality of offset site (scale)**	5.00	**Time until offset site secured (years)**	2.00		**100.0%**
	Future quality WITHOUT offset (scale)	5.00	**Risk of future loss WITHOUT offset (%)**	5.0%		
	Future quality WITH offset (scale)	6.00	**Risk of future loss WITH offset (%)**	5.0%		
	Time until ecological benefit (years)	3.00				
	Confidence in offset result (%)	90.0%			**OFFSET ADEQUATE?**	**NO**

WA Environmental Offsets Calculator

Rationale for scores used in the offsets calculator

Environmental value to be offset			
Calculation	***Score (Area)***		***Rationale***
Conservation significance			
Description	Native vegetation within the Guildford Complex.		The proposed clearing will impact on 4.42 ha of native vegetation within the Guildford Complex.
Type of environmental value	Vegetation/habitat		The proposed clearing will impact on native vegetation within the Guildford Complex.
Conservation significance of environmental value	Terrestrial native vegetation complex - <10% extent remaining in a constrained area		The Guildford Complex is one of five complexes below 10% of its pre-European extent.
Landscape-level value impacted	yes/no		N/A
Significant impact			
Description	Clearing of 4.42 ha of native vegetation within the Guildford Complex.		Native vegetation that is within the Guildford Complex is proposed to be cleared for the purpose of the Tonkin Highway upgrade.
Significant impact (hectares) / Type of feature	4.42		4.42 ha of native vegetation withinthe Guildford Complex is mapped within the Development Envelope (GoWA 2021).
Quality (scale) / Number	3.00		Low score based on an area-weighted scoring of Guildford Complex vegetation condition across the Development Envelope, as follows: •Pristine – score 10 x 0% of Guildford Complex area •Excellent – score 9 x 0% of Guildford Complex area •Very Good – score 7 x 0% of Guildford Complex area •Good – score 5 x 5% of Guildford Complex area •Degraded – score 3 x 95% of Guildford Complex area •Completely Degraded – score 1 x 0% of Guildford Complex area. The area-weighted score is 3. The Development Envelope contains Guildford Complex vegetation that has been previously fragmented upon development of Tonkin Highway.
Rehabilitation credit			
Description	None proposed.		None proposed.
Proposed rehabilitation (area in hectares)	0.00		
Current quality of rehabilitation site / Start number (of type of feature)	0.00		
Future quality WITHOUT rehabilitation (scale) / Future number WITHOUT rehabilitation	0.00		
Future quality WITH rehabilitation (scale) / Future number WITH rehabilitation	0.00		
Time until ecological benefit (years)	0.00		
Confidence in rehabilitation result (%)	0		
Offset			
Description	Rehabilitation of the Greater Brixton Street Wetlands		A offset involving the rehabilitation of areas of the Great Brixton Street Wetlands to achieve an improved and functional ecosystem at these locations.
Proposed offset (area in hectares)	15.55		An approximate 15.55 ha portion of the Greater Brixton Street Wetlands may be rehabilitated primarily to counterbalance impacts to native vegetation within the Guildford Complex.
Current quality of offset site / Start number (of type of feature)	5.00		Desktop review and consultation with DBCA indicates that the areas to be rehabilitated are in moderate condition.
Future quality WITHOUT offset (scale) / Future number WITHOUT offset	5.00		Without rehabilitation and management, these areas will not improve in condition.
Future quality WITH offset (scale) / Future number WITH offset	6.00		A Revegetation Management Plan will be prepared in consultation with DBCA including agreed upon completion criteria. It is assumed that vegetation will be condition 6 or higher upon meeting these completion criteria
Time until ecological benefit (years)	3.00		It is assumed that it will take approximately 3 years to achieve the desired species diversity, vegetation cover and weed density. For the purposes of the calculation, it is assumed that ecological benefit will be achieved at 3 years.
Confidence in offset result (%)	90%		High degree of confidence. DBCA is an experienced land manager and will provide expertise regarding the required completion criteria.
Duration of offset implementation (maximum 20 years)	3.00		Main Roads will implement rehabilitation for three years, or until compleition criteria identified in the Revegetation Management Plan have been met (if prior to 3 years).
Time until offset site secured (years)	2.00		Rehabilitation of suitable areas will begin within 24 months of approval.
Risk of future loss WITHOUT offset (%)	5.0%		Risk of loss without offset has been set at 5%, as the area to be cleared is within the Brixton Street Wetlands (Nationally Important Wetland) and subject to conservation protection.

Risk of future loss WITH offset (%)	5.0%		Risk of loss with offset has been set at 5%, as the area to be cleared is within the Brixton Street Wetlands (Nationally Important Wetland) and subject to conservation protection.
Offset ratio (Conservation area only)	N/A		N/A

Bush Forever

WA Environmental Offsets calculator

PLEASE ENABLE MACROS FOR THIS SPREADSHEET

Produced by:

The Department of Water and Environmental Regulation (DWER) in consultation with stakeholder working groups

Purpose:

Use the WA Envirionmental Offsets calculator in conjunction with the *Environmental offsets metric: Quantifying environmental offsets in Western Australia* guideline. Together, they form a supplement to section 4 of the *WA Environmental Offsets Guidelines* and provide information to help decision-makers, government officers, industry and the community to quantify environmental offsets.

Data currency:

The correct application of the WA Environmental Offsets Calculator relies on access to current datasets (such as vegetation extent and land tenure).

Process for using the WA Environmental Offsets Calculator		
Step	**Worksheet**	**Component**
Step 1: Determining conservation significance	**Step1_ConservationSignificance**	**Conservation significance determination**
		Combined *area* /*feature*
Step 2: Calculating significant residual impact	**Step2_SignificantResidualImpact**	**Part A: Significant impact calculation**
		Separate *area* or *feature* calculations
		Part B: Rehabilitation credit calculation
		Separate *area* or *feature* calculations
		Part C: Significant residual impact calculation
		Separate a*rea* or *feature* calculations
Step 3: Calculating offsets	**Step3_Offsets**	**Offsets calculation**
		Separate a*rea* or *feature* calculations
Rationale for scores used in the Offsets Calculator	**Rationale**	**All**

WA Environmental Offsets Calculator

Step 1: Determining conservation significance

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

(Or, if appropriate, manual data entry permitted)

Area / feature **(Impact site)**

Conservation significance determination for the environmental value impacted	
Description	Vegetation within Bush Forever.
Type of environmental value	Conservation area
Conservation significance of environmental value	Bush Forever site
Conservation significance score	**A conservation significance score does not apply in this case; an offset ratio may be appropriate (step 3)**

Please select *area* or *feature* for the calculations	**Area**

WA Environmental Offsets Calculator

Step 2: Calculating significant residual impact

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

Environmental value (step 1)	Vegetation within Bush Forever.

Area **(impact site)**

Part A: Significant impact calculation *Area*			
Significant impact	**Description**	**Quantum of impact**	
	Clearing of 10.44 ha of vegetation within two Bush Forever sites, Site no. 387 (Greater Brixton Street Wetlands) and Site no. 320 (Hartfield Park Bushland).	**Significant impact (hectares)**	10.44
		Quality (scale)	5.00
		Total quantum of impact	**5.22**

Part B: Rehabilitation credit calculation *Area* **(onsite)**					
Rehabilitation Credit	**Description**	**Proposed rehabilitation (area in hectares)**		**Time until ecological benefit (years)**	
	None proposed.	**Current quality of rehabilitation site (scale)**		**Confidence in rehabilitation result (%)**	
		Future quality WITHOUT rehabilitation (scale)		**Rehabilitation credit**	**0.00**
		Future quality WITH rehabilitation (scale)			

Part C: Significant residual impact calculation *Area*		
Significant residual impact	**Total quantum of impact**	**5.22**
	Rehabilitation credit	**0.00**
	Significant residual impact	**5.22**

WA Environmental Offsets Calculator

Step 3: Calculating offsets

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

Environmental value (step 1)	Vegetation within Bush Forever.	Significant impact (step 2, part A)	10.44
		Rehabilitation credit (step 2, part B)	0.00
		Significant residual impact (step 2, part C)	5.22

Area **(offset site)**

Offset calculation
Area

Offsets calculation

Description	**Proposed offset (area in hectares)**	20.87	**Duration of offset implementation (maximum 20 years)**	3.00		
Rehabilitation of the Greater Brixton Street Wetlands.	**Current quality of offset site (scale)**	5.00	**Time until offset site secured (years)**	2.00		
	Future quality WITHOUT offset (scale)	4.00	**Risk of future loss WITHOUT offset (%)**	5.0%	**Offset value Conservation area** (applied to step 2, part A)	**2**
	Future quality WITH offset (scale)	5.00	**Risk of future loss WITH offset (%)**	5.0%		**100.0%**
	Time until ecological benefit (years)	3.00				
	Confidence in offset result (%)	90.0%			**OFFSET ADEQUATE?**	**NO**

WA Environmental Offsets Calculator

Rationale for scores used in the offsets calculator

Environmental value to be offset			
Calculation	***Score (Area)***		***Rationale***
Conservation significance			
Description	Vegetation within Bush Forever.		The proposed clearing will impact on 10.44 ha of vegetation within two Bush Forever sites, Site no. 387 (Greater Brixton Street Wetlands) and Site no. 320 (Hartfield Park Bushland).
Type of environmental value	Conservation area		Clearing will impact on a Conservation area (Bush Forever).
Conservation significance of environmental value	Bush Forever site		Clearing will impact on a Conservation area (Bush Forever).
Landscape-level value impacted	yes/no		N/A
Significant impact			
Description	Clearing of 10.44 ha of vegetation within two Bush Forever sites, Site no. 387 (Greater Brixton Street Wetlands) and Site no. 320 (Hartfield Park Bushland).		Vegetation that is within two Bush Forever sites (No. 387 and 320) is proposed to be cleared for the purpose of the Tonkin Highway upgrade.
Significant impact (hectares) / Type of feature	10.44		10.44 ha of vegetation within two Bush Forever sites (No. 387 and 320) is mapped within the Development Envelope (GoWA 2021).
Quality (scale) / Number	5.00		Moderate score based on an area-weighted scoring of Bush Forever vegetation condition across the Development Envelope, as follows: •Pristine – score 10 x 0% of Bush Forever area •Excellent – score 9 x 25% of Bush Forever area •Very Good – score 7 x 18% of Bush Forever area •Good – score 5 x 14% of Bush Forever area •Degraded – score 3 x 35% of Bush Forever area •Completely Degraded – score 1 x 8% of Bush Forever area. The area-weighted score is 5.0. The Development Envelope is subject to threatening processes including Phytophthora dieback and weeds. The Development Envelope contains Bush Forever areas that has been previously fragmented upon development of Tonkin Highway.
Rehabilitation credit			
Description	None proposed.		None proposed.
Proposed rehabilitation (area in hectares)	0.00		
Current quality of rehabilitation site / Start number (of type of feature)	0.00		
Future quality WITHOUT rehabilitation (scale) / Future number WITHOUT rehabilitation	0.00		
Future quality WITH rehabilitation (scale) / Future number WITH rehabilitation	0.00		
Time until ecological benefit (years)	0.00		
Confidence in rehabilitation result (%)	0		
Offset			
Description	Rehabilitation of the Greater Brixton Street Wetlands.		A offset involving the rehabilitation of areas of the Great Brixton Street Wetlands to achieve an improved and functional ecosystem at these locations.
Proposed offset (area in hectares)	20.87		An approximate 20.87 ha portion of the Greater Brixton Street Wetlands may be rehabilitated primarily to counterbalance impacts to vegetation within Bush Forever areas.
Current quality of offset site / Start number (of type of feature)	5.00		Desktop review and consultation with DBCA indicates that the areas to be rehabilitated are in moderate condition.
Future quality WITHOUT offset (scale) / Future number WITHOUT offset	4.00		Without rehabilitation and management, these areas will not improve in condition.
Future quality WITH offset (scale) / Future number WITH offset	5.00		A Revegetation Management Plan will be prepared in consultation with DBCA including agreed upon completion criteria. It is assumed that vegetation will be condition 5 or higher upon meeting these completion criteria
Time until ecological benefit (years)	3.00		It is assumed that it will take approximately 3 years to achieve the desired species diversity, vegetation cover and weed density. For the purposes of the calculation, it is assumed that ecological benefit will be achieved at 3 years.
Confidence in offset result (%)	90%		High degree of confidence. DBCA is an experienced land manager and will provide expertise regarding the required completion criteria.

Duration of offset implementation (maximum 20 years)	3.00		Main Roads will implement rehabilitation for three years, or until compleition criteria identified in the Revegetation Management Plan have been met (if prior to 3 years).
Time until offset site secured (years)	2.00		Rehabilitation of suitable areas will begin within 24 months of approval.
Risk of future loss WITHOUT offset (%)	5.0%		Risk of loss without offset has been set at 5%, as the area to be cleared is within the Brixton Street Wetlands (Nationally Important Wetland) and subject to conservation protection.
Risk of future loss WITH offset (%)	5.0%		Risk of loss with offset has been set at 5%, as the area to be cleared is within the Brixton Street Wetlands (Nationally Important Wetland) and subject to conservation protection.
Offset ratio (Conservation area only)	2		Appendix 4 of the State Planning Policy 2.8 provides a summary of the offset criteria according to conservation significance. This appendix states that at least 2 times the calculated loss in habitat hectares must be met for the offset requirement, as the conservation significance of the Bush Forever sites is very high due to the presense of native vegetation, TEC vegetaton and vegetation suitable for Threatened flora and fauna.

SCP20a TEC

WA Environmental Offsets calculator

PLEASE ENABLE MACROS FOR THIS SPREADSHEET

Produced by:

The Department of Water and Environmental Regulation (DWER) in consultation with stakeholder working groups

Purpose:

Use the WA Envirionmental Offsets calculator in conjunction with the *Environmental offsets metric: Quantifying environmental offsets in Western Australia* guideline. Together, they form a supplement to section 4 of the *WA Environmental Offsets Guidelines* and provide information to help decision-makers, government officers, industry and the community to quantify environmental offsets.

Data currency:

The correct application of the WA Environmental Offsets Calculator relies on access to current datasets (such as vegetation extent and land tenure).

Process for using the WA Environmental Offsets Calculator		
Step	**Worksheet**	**Component**
Step 1: Determining conservation significance	**Step1_ConservationSignificance**	**Conservation significance determination**
		Combined *area* /*feature*
Step 2: Calculating significant residual impact	**Step2_SignificantResidualImpact**	**Part A: Significant impact calculation**
		Separate *area* or *feature* calculations
		Part B: Rehabilitation credit calculation
		Separate *area* or *feature* calculations
		Part C: Significant residual impact calculation
		Separate a*rea* or *feature* calculations
Step 3: Calculating offsets	**Step3_Offsets**	**Offsets calculation**
		Separate a*rea* or *feature* calculations
Rationale for scores used in the Offsets Calculator	**Rationale**	**All**

WA Environmental Offsets Calculator

Step 1: Determining conservation significance

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

(Or, if appropriate, manual data entry permitted)

Area / feature **(Impact site)**

Conservation significance determination for the environmental value impacted		
Conservation significance	**Description**	Vegetation representative of the Banksia attenuata woodlands over species rich dense shrublands (SCP20a) Threatened Ecological Community.
	Type of environmental value	Ecological community
	Conservation significance of environmental value	Threatened ecological community - endangered
	Conservation significance score	**1.2%**

Please select *area* or *feature* for the calculations	**Area**

WA Environmental Offsets Calculator

Step 2: Calculating significant residual impact

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

Environmental value (step 1)	Vegetation representative of the Banksia attenuata woodlands over species rich dense shrublands (SCP20a) Threatened Ecological Community.

Area **(impact site)**

Part A: Significant impact calculation
Area

	Description	Quantum of impact	
Significant impact	Clearing of 1.61 ha of Banksia attenuata woodlands over species rich dense shrublands (SCP20a) TEC for the upgrade of Tonkin Highway.	**Significant impact (hectares)**	1.61
		Quality (scale)	7.00
		Total quantum of impact	**1.13**

Part B: Rehabilitation credit calculation
Area **(onsite)**

	Description				
Rehabilitation Credit	None proposed.	**Proposed rehabilitation (area in hectares)**		**Time until ecological benefit (years)**	
		Current quality of rehabilitation site (scale)		**Confidence in rehabilitation result (%)**	
		Future quality WITHOUT rehabilitation (scale)		**Rehabilitation credit**	**0.00**
		Future quality WITH rehabilitation (scale)			

Part C: Significant residual impact calculation ***Area***

Significant residual impact	**Total quantum of impact**	**1.13**
	Rehabilitation credit	**0.00**
	Significant residual impact	**1.13**

WA Environmental Offsets Calculator

Step 3: Calculating offsets

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

Environmental value (step 1)	Vegetation representative of the Banksia attenuata woodlands over species rich dense shrublands (SCP20a) Threatened Ecological Community.	Significant impact (step 2, part A)	1.61
		Rehabilitation credit (step 2, part B)	0.00
		Significant residual impact (step 2, part C)	1.13

Area **(offset site)**

Offset calculation
Area

Offsets calculation

Description		**Proposed offset (area in hectares)**	13.66	**Duration of offset implementation (maximum 20 years)**	3.00	**Offset value** (applied to step 2, part C)	**1.13**
Rehabilitation of Hartfield Park		**Current quality of offset site (scale)**	5.00	**Time until offset site secured (years)**	2.00		**100.0%**
		Future quality WITHOUT offset (scale)	4.00	**Risk of future loss WITHOUT offset (%)**	5.0%		
		Future quality WITH offset (scale)	5.00	**Risk of future loss WITH offset (%)**	5.0%		
		Time until ecological benefit (years)	3.00				
		Confidence in offset result (%)	90.0%			**OFFSET ADEQUATE?**	**YES**

WA Environmental Offsets Calculator

Rationale for scores used in the offsets calculator

Environmental value to be offset			
Calculation	***Score (Area)***		***Rationale***
Conservation significance			
Description	Vegetation representative of the Banksia attenuata woodlands over species rich dense shrublands (SCP20a) Threatened Ecological Community		The proposed clearing will impact on 1.61 ha of vegetation representative of the Banksia attenuata woodlands over species rich dense shrublands (SCP20a) TEC.
Type of environmental value	Ecological community		The Banksia attenuata woodlands over species rich dense shrublands (SCP20a) TEC is listed as Endangered under the BC Act and forms a component of the Banksia Woodlands of the SCP Commonwealth TEC listed as Endangered under EPBC Act.
Conservation significance of environmental value	Threatened ecological community - endangered		The Banksia attenuata woodlands over species rich dense shrublands (SCP20a) TEC is listed as Endangered under the BC Act and forms a component of the Banksia Woodlands of the SCP Commonwealth TEC listed as Endangered under EPBC Act.
Landscape-level value impacted	yes/no		N/A
Significant impact			
Description	Clearing of 1.61 ha of Banksia attenuata woodlands over species rich dense shrublands (SCP20a) TEC for the upgrade of Tonkin Highway.		Native vegetation that is representative of the Banksia attenuata woodlands over species rich dense shrublands (SCP20a) TEC is proposed to be cleared for the purpose of the Tonkin Highway upgrade.
Significant impact (hectares) / Type of feature	1.61		1.61 ha of native vegetation that is representative of the Banksia attenuata woodlands over species rich dense shrublands (SCP20a) TEC is mapped within Development Envelope according to mapping from the ecological surveys (Woodman, 2021; Umwelt 2022).
Quality (scale) / Number	7.00		Moderate score based on an area-weighted scoring of TEC vegetation condition across the Development Envelope, as follows: •Pristine – score 10 x 0% of TEC area •Excellent – score 9 x 40% of TEC area •Very Good – score 7 x 33% of TEC area •Good – score 5 x 27% of TEC area •Degraded – score 3 x 0% of TEC area •Completely Degraded – score 1 x 0% of TEC area. The area-weighted score is 7.0. The Development Envelope is subject to threatening processes including Phytophthora dieback and weeds. The Development Envelope contains three TEC patches that have been previously fragmented upon development of Tonkin Highway.
Rehabilitation credit			
Description	None proposed.		None proposed.
Proposed rehabilitation (area in hectares)	0.00		
Current quality of rehabilitation site / Start number (of type of feature)	0.00		
Future quality WITHOUT rehabilitation (scale) / Future number WITHOUT rehabilitation	0.00		
Future quality WITH rehabilitation (scale) / Future number WITH rehabilitation	0.00		
Time until ecological benefit (years)	0.00		
Confidence in rehabilitation result (%)	0		
Offset			
Description	Rehabilitation of Hartfield Park		A offset involving the rehabilitation of areas of Hartfield Park to achieve the presence of native vegetation that is representative of the Banksia attenuata woodlands over species rich dense shrublands (SCP20a) TEC.
Proposed offset (area in hectares)	13.66		An approximate 13.66 ha portion of Hartfield Park may be rehabilitated to counterbalance impact to SCP20a TEC.
Current quality of offset site / Start number (of type of feature)	5.00		Desktop review and consultation with DBCA indicates that the areas to be rehabilitated are in moderate condition.
Future quality WITHOUT offset (scale) / Future number WITHOUT offset	4.00		Without rehabilitation and management, the area will not improve in condition.

Future quality WITH offset (scale) / Future number WITH offset	5.00		A Revegetation Management Plan will be prepared in consultation with DBCA including agreed upon completion criteria. It is assumed that vegetation will be condition 5 or higher upon meeting these completion criteria.
Time until ecological benefit (years)	3.00		It is assumed that it will take approximately 3 years to achieve the desired species diversity, vegetation cover and weed density. For the purposes of the calculation, it is assumed that ecological benefit will be achieved at 3 years.
Confidence in offset result (%)	90%		High degree of confidence. DBCA is an experienced land manager and will provide expertise regarding the required completion criteria.
Duration of offset implementation (maximum 20 years)	3.00		Main Roads will implement rehabilitation for three years, or until compleition criteria identified in the Revegetation Management Plan have been met (if prior to 3 years).
Time until offset site secured (years)	2.00		Rehabilitation of suitable areas will begin within 24 months of approval.
Risk of future loss WITHOUT offset (%)	5.0%		Risk of loss without offset has been set at 5%, as the area to be cleared is within Hartfield Park and subject to conservation protection.
Risk of future loss WITH offset (%)	5.0%		Risk of loss with offset has been set at 5%, as the area to be rehabilitated is located within Hartfield Park and subject to conservation protection.
Offset ratio (Conservation area only)	1.13		Offset ratio adequate to counterbalance significant residual impact to SCP20a TEC.

Banksia mimica

WA Environmental Offsets calculator

PLEASE ENABLE MACROS FOR THIS SPREADSHEET

Produced by:

The Department of Water and Environmental Regulation (DWER) in consultation with stakeholder working groups

Purpose:

Use the WA Envirionmental Offsets calculator in conjunction with the *Environmental offsets metric: Quantifying environmental offsets in Western Australia* guideline. Together, they form a supplement to section 4 of the *WA Environmental Offsets Guidelines* and provide information to help decision-makers, government officers, industry and the community to quantify environmental offsets.

Data currency:

The correct application of the WA Environmental Offsets Calculator relies on access to current datasets (such as vegetation extent and land tenure).

Process for using the WA Environmental Offsets Calculator		
Step	**Worksheet**	**Component**
Step 1: Determining conservation significance	**Step1_ConservationSignificance**	**Conservation significance determination**
		Combined *area* /*feature*
Step 2: Calculating significant residual impact	**Step2_SignificantResidualImpact**	**Part A: Significant impact calculation**
		Separate *area* or *feature* calculations
		Part B: Rehabilitation credit calculation
		Separate *area* or *feature* calculations
		Part C: Significant residual impact calculation
		Separate a*rea* or *feature* calculations
Step 3: Calculating offsets	**Step3_Offsets**	**Offsets calculation**
		Separate a*rea* or *feature* calculations
Rationale for scores used in the Offsets Calculator	**Rationale**	**All**

WA Environmental Offsets Calculator

Step 1: Determining conservation significance

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

(Or, if appropriate, manual data entry permitted)

Area / feature **(Impact site)**

Conservation significance determination for the environmental value impacted		
Conservation significance	**Description**	Individuals of Banksia mimica.
	Type of environmental value	Species (flora/fauna)
	Conservation significance of environmental value	Rare/threatened Species - vulnerable
	Conservation significance score	**0.2%**

Please select *area* or *feature* for the calculations	**Feature**

WA Environmental Offsets Calculator

Step 2: Calculating significant residual impact

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

Environmental value (step 1)	Individuals of Banksia mimica.

(SCROLL DOWN FOR FEATURE CALCULATION)

Feature **(impact site)**

Part A: Significant impact calculation *Feature*			
Significant impact	**Description**	**Quantum of impact**	
		Type of feature	**Number**
	Clearing of Banksia mimica individuals.		3.00
		Total quantum of impact	**3.00**

Part B: Rehabilitation credit calculation *Feature* (onsite)					
Rehabilitation credit	**Description**	**Start number (of type of feature)**		**Time until ecological benefit (years)**	
	None proposed.	**Future number WITHOUT rehabilitation**		**Confidence in rehabilitation result (%)**	
		Future number WITH rehabilitation		**Rehabilitation credit**	**0.00**

Part C: Significant residual impact calculation *Feature*		
Significant residual impact	**Total quantum of impact**	**3.00**
	Rehabilitation credit	**0.00**
	Significant residual impact	**3.00**

WA Environmental Offsets Calculator

Step 3: Calculating offsets

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

Environmental value (step 1)	Individuals of Banksia mimica.	Significant impact (step 2, part A)	3.00
		Rehabilitation credit (step 2, part B)	0.00
		Significant residual impact (step 2, part C)	3.00

(SCROLL DOWN FOR FEATURE CALCULATION)

Feature **(offset site)**

Offset calculation *Feature*							
Offsets calculation	**Description**	**Start number (of type of feature)**	21.00	**Time until ecological benefit (years)**	2.00	**Offset value** (applied to step 2, part C)	**3.14**
	Land acquisition.	**Future number WITHOUT offset**	0.00	**Confidence in offset result (%)**	15.0%		**104.6%**
		Future number WITH offset	21.00				
						OFFSET ADEQUATE?	**YES**

WA Environmental Offsets Calculator

Rationale for scores used in the offsets calculator

Environmental value to be offset			
Calculation		***Score (Feature)***	***Rationale***
Conservation significance			
Description		Individuals of Banksia mimica.	The proposed clearing will impact on 3 individuals of Banksia mimica.
Type of environmental value		Species (flora/fauna)	Banksia mimica is listed as Vulnerable by state ranking.
Conservation significance of environmental value		Rare/threatened Species - vulnerable	Banksia mimica is listed as Vulnerable by state ranking.
Landscape-level value impacted		yes/no	N/A
Significant impact			
Description		Clearing of Banksia mimica individuals.	Individuals of Banksia mimica are proposed to be cleared for the purpose of the Tonkin Highway upgrade.
Significant impact (hectares) / Type of feature		0	Individuals of Banksia mimica.
Quality (scale) / Number		3.00	Three individuals of Banksia mimica are proposed to be cleared for the purpose of the Tonkin Highway upgrade.
Rehabilitation credit			
Description		None proposed.	None proposed.
Proposed rehabilitation (area in hectares)		N/A	
Current quality of rehabilitation site / Start number (of type of feature)		0.00	
Future quality WITHOUT rehabilitation (scale) / Future number WITHOUT rehabilitation		0.00	
Future quality WITH rehabilitation (scale) / Future number WITH rehabilitation		0.00	
Time until ecological benefit (years)		0.00	
Confidence in rehabilitation result (%)		0	
Offset			
Description		Land acquisition.	A offset involving the purchase and transfer to DBCA management of an offset site that includes individuals of Banksia mimica.
Proposed offset (area in hectares)		N/A	N/A
Current quality of offset site / Start number (of type of feature)		21.00	The portion of land to be allocated to the offset will contain at least 21 Banksia mimica plants.
Future quality WITHOUT offset (scale) / Future number WITHOUT offset		0.00	Rural freehold land. Plants are expected to be lost in the event that the portion of land is developed and may also be lost due to indirect impacts from adjacent agricultural land. Site will benefit from transfer to DBCA management.
Future quality WITH offset (scale) / Future number WITH offset		21.00	No rehabilitation / planting proposed. Land will be managed for conservation of existing values.
Time until ecological benefit (years)		2.00	Land will be acquired within 24 months (2 years) of approval and immediately transferred to DBCA management.
Confidence in offset result (%)		15%	Low confidence (risk) of loss without offset as land is rural zoned and unlikely to be developed in the near future. High confidence in protection with offset, as land will be surveyed to confirm flora population and then purchased for transfer to DBCA management.
Duration of offset implementation (maximum 20 years)		N/A	N/A
Time until offset site secured (years)		N/A	N/A
Risk of future loss WITHOUT offset (%)		N/A	N/A
Risk of future loss WITH offset (%)		N/A	N/A
Offset ratio (Conservation area only)		N/A	N/A

Conospermum undulatum

WA Environmental Offsets calculator

PLEASE ENABLE MACROS FOR THIS SPREADSHEET

Produced by:

The Department of Water and Environmental Regulation (DWER) in consultation with stakeholder working groups

Purpose:

Use the WA Envirionmental Offsets calculator in conjunction with the *Environmental offsets metric: Quantifying environmental offsets in Western Australia* guideline. Together, they form a supplement to section 4 of the *WA Environmental Offsets Guidelines* and provide information to help decision-makers, government officers, industry and the community to quantify environmental offsets.

Data currency:

The correct application of the WA Environmental Offsets Calculator relies on access to current datasets (such as vegetation extent and land tenure).

Process for using the WA Environmental Offsets Calculator		
Step	**Worksheet**	**Component**
Step 1: Determining conservation significance	**Step1_ConservationSignificance**	**Conservation significance determination**
		Combined *area* /*feature*
Step 2: Calculating significant residual impact	**Step2_SignificantResidualImpact**	**Part A: Significant impact calculation**
		Separate *area* or *feature* calculations
		Part B: Rehabilitation credit calculation
		Separate *area* or *feature* calculations
		Part C: Significant residual impact calculation
		Separate a*rea* or *feature* calculations
Step 3: Calculating offsets	**Step3_Offsets**	**Offsets calculation**
		Separate a*rea* or *feature* calculations
Rationale for scores used in the Offsets Calculator	**Rationale**	**All**

Step 1: Determining conservation significance

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

(Or, if appropriate, manual data entry permitted)

Area / feature **(Impact site)**

Conservation significance		
Conservation significance determination for the environmental value impacted		
	Description	Individuals of Conospermum undulatum.
	Type of environmental value	Species (flora/fauna)
	Conservation significance of environmental value	Rare/threatened Species - vulnerable
	Conservation significance score	**0.2%**

Please select *area* or *feature* for the calculations	**Feature**

WA Environmental Offsets Calculator

Step 2: Calculating significant residual impact

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

Environmental value (step 1)	Individuals of Conospermum undulatum.

(SCROLL DOWN FOR FEATURE CALCULATION)

Feature **(impact site)**

Part A: Significant impact calculation ***Feature***			
Significant impact	**Description**	**Quantum of impact**	
	Clearing of Conospermum undulatum individuals.	**Type of feature**	**Number**
			62.00
		Total quantum of impact	**62.00**

Part B: Rehabilitation credit calculation ***Feature*** **(onsite)**					
Rehabilitation credit	**Description**	**Start number (of type of feature)**		**Time until ecological benefit (years)**	
	None proposed.	**Future number WITHOUT rehabilitation**		**Confidence in rehabilitation result (%)**	
		Future number WITH rehabilitation		**Rehabilitation credit**	**0.00**

Part C: Significant residual impact calculation ***Feature***		
Significant residual impact	**Total quantum of impact**	**62.00**
	Rehabilitation credit	**0.00**
	Significant residual impact	**62.00**

WA Environmental Offsets Calculator

Step 3: Calculating offsets

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

Environmental value (step 1)	Individuals of Conospermum undulatum.	Significant impact (step 2, part A)	62.00
		Rehabilitation credit (step 2, part B)	0.00
		Significant residual impact (step 2, part C)	62.00

(SCROLL DOWN FOR FEATURE CALCULATION)

Feature **(offset site)**

Offset calculation *Feature*							
Offsets calculation	**Description**	**Start number (of type of feature)**	240.00	**Time until ecological benefit (years)**	20.00	**Offset value** (applied to step 2, part C)	**62.26**
	Rehabilitation of Clifford St Bushland	**Future number WITHOUT offset**	240.00	**Confidence in offset result (%)**	90.0%		**100.4%**
		Future number WITH offset	312.00				
						OFFSET ADEQUATE?	**YES**

WA Environmental Offsets Calculator

Rationale for scores used in the offsets calculator

Environmental value to be offset			
Calculation		***Score (Feature)***	***Rationale***
Conservation significance			
Description		Individuals of Conospermum undulatum.	The proposed clearing will impact on 62 individuals of Conospermum undulatum.
Type of environmental value		Species (flora/fauna)	Conospermum undulatum is listed as Vulnerable by state ranking.
Conservation significance of environmental value		Rare/threatened Species - vulnerable	Conospermum undulatum is listed as Vulnerable by state ranking.
Landscape-level value impacted		yes/no	N/A
Significant impact			
Description		Clearing of Conospermum undulatum individuals.	Individuals of Conospermum undulatum are proposed to be cleared for the purpose of the Tonkin Highway upgrade.
Significant impact (hectares) / Type of feature		0	Individuals of Conospermum undulatum.
Quality (scale) / Number		62.00	Sixty-two individuals of Conospermum undulatum are proposed to be cleared for the purpose of the Tonkin Highway upgrade.
Rehabilitation credit			
Description		None proposed.	None proposed.
Proposed rehabilitation (area in hectares)		N/A	
Current quality of rehabilitation site / Start number (of type of feature)		0.00	
Future quality WITHOUT rehabilitation (scale) / Future number WITHOUT rehabilitation		0.00	
Future quality WITH rehabilitation (scale) / Future number WITH rehabilitation		0.00	
Time until ecological benefit (years)		0.00	
Confidence in rehabilitation result (%)		0	
Offset			
Description		Rehabilitation of Clifford St Bushland	An offset involving the rehabilitation of areas within Clifford St Bushland to achieve the presence of Conospermum undulatum individuals.
Proposed offset (area in hectares)		N/A	N/A
Current quality of offset site / Start number (of type of feature)		240.00	Start number derived from the Woodman (2019) survey within the Clifford St Bushland.
Future quality WITHOUT offset (scale) / Future number WITHOUT offset		240.00	Without rehabilitation and management, the number of Conospermum undulatum individuals within the Clifford St Bushland will not increase.
Future quality WITH offset (scale) / Future number WITH offset		312.00	A Revegetation Management Plan will be prepared in consultation with DBCA including agreed upon completion criteria.
Time until ecological benefit (years)		20.00	It is assumed that it will take approximately 20 years to achieve the desired number of Conospermum undulatum indivduals. For the purposes of the calculation, it is assumed that ecological benefit will be achieved at 20 years.
Confidence in offset result (%)		90%	High degree of confidence. DBCA is an experienced land manager and will provide expertise regarding the required completion criteria.
Duration of offset implementation (maximum 20 years)		N/A	N/A
Time until offset site secured (years)		N/A	N/A
Risk of future loss WITHOUT offset (%)		N/A	N/A
Risk of future loss WITH offset (%)		N/A	N/A
Offset ratio (Conservation area only)		N/A	N/A

Johnsonia pubescens subsp. cygnorum

WA Environmental Offsets calculator

PLEASE ENABLE MACROS FOR THIS SPREADSHEET

Produced by:

The Department of Water and Environmental Regulation (DWER) in consultation with stakeholder working groups

Purpose:

Use the WA Envirionmental Offsets calculator in conjunction with the *Environmental offsets metric: Quantifying environmental offsets in Western Australia* guideline. Together, they form a supplement to section 4 of the *WA Environmental Offsets Guidelines* and provide information to help decision-makers, government officers, industry and the community to quantify environmental offsets.

Data currency:

The correct application of the WA Environmental Offsets Calculator relies on access to current datasets (such as vegetation extent and land tenure).

Process for using the WA Environmental Offsets Calculator		
Step	**Worksheet**	**Component**
Step 1: Determining conservation significance	**Step1_ConservationSignificance**	**Conservation significance determination**
		Combined *area* /*feature*
Step 2: Calculating significant residual impact	**Step2_SignificantResidualImpact**	**Part A: Significant impact calculation**
		Separate *area* or *feature* calculations
		Part B: Rehabilitation credit calculation
		Separate *area* or *feature* calculations
		Part C: Significant residual impact calculation
		Separate a*rea* or *feature* calculations
Step 3: Calculating offsets	**Step3_Offsets**	**Offsets calculation**
		Separate a*rea* or *feature* calculations
Rationale for scores used in the Offsets Calculator	**Rationale**	**All**

WA Environmental Offsets Calculator

Step 1: Determining conservation significance

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

(Or, if appropriate, manual data entry permitted)

Area / feature **(Impact site)**

Conservation significance determination for the environmental value impacted		
Conservation significance	**Description**	Individuals of Johnsonia pubescens subsp. cygnorum
	Type of environmental value	Species (flora/fauna)
	Conservation significance of environmental value	Priority species
	Conservation significance score	**0.1%**

Please select *area* or *feature* for the calculations	**Feature**

WA Environmental Offsets Calculator

Step 2: Calculating significant residual impact

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

Environmental value (step 1)	Individuals of Johnsonia pubescens subsp. cygnorum

(SCROLL DOWN FOR FEATURE CALCULATION)

Feature **(impact site)**

Part A: Significant impact calculation *Feature*			
Significant impact	**Description**	**Quantum of impact**	
	Clearing of Johnsonia pubescens subsp. cygnorum individuals.	**Type of feature**	**Number**
			119.00
		Total quantum of impact	**119.00**

Part B: Rehabilitation credit calculation *Feature* (onsite)					
Rehabilitation credit	**Description**	**Start number (of type of feature)**		**Time until ecological benefit (years)**	
	None proposed.	**Future number WITHOUT rehabilitation**		**Confidence in rehabilitation result (%)**	
		Future number WITH rehabilitation		**Rehabilitation credit**	**0.00**

Part C: Significant residual impact calculation *Feature*		
Significant residual impact	**Total quantum of impact**	**119.00**
	Rehabilitation credit	**0.00**
	Significant residual impact	**119.00**

WA Environmental Offsets Calculator

Step 3: Calculating offsets

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

Environmental value (step 1)	Individuals of Johnsonia pubescens subsp. cygnorum	Significant impact (step 2, part A)	119.00
		Rehabilitation credit (step 2, part B)	0.00
		Significant residual impact (step 2, part C)	119.00

(SCROLL DOWN FOR FEATURE CALCULATION)

Feature **(offset site)**

Offset calculation *Feature*							
Offsets calculation	**Description**	**Start number (of type of feature)**	127.00	**Time until ecological benefit (years)**	20.00	**Offset value** (applied to step 2, part C)	**119.10**
	Rehabilitation of Hartfield Park and Clifford St Bushland	**Future number WITHOUT offset**	127.00	**Confidence in offset result (%)**	90.0%		**100.1%**
		Future number WITH offset	262.00				
						OFFSET ADEQUATE?	**YES**

WA Environmental Offsets Calculator

Rationale for scores used in the offsets calculator

Environmental value to be offset			
Calculation		***Score (Feature)***	***Rationale***
Conservation significance			
Description		Individuals of Johnsonia pubescens subsp. cygnorum	The proposed clearing will impact on 119 individuals of Johnsonia pubescens subsp. cygnorum.
Type of environmental value		Species (flora/fauna)	Johnsonia pubescens subsp. cygnorum is listed as Priority 2 by the DBCA.
Conservation significance of environmental value		Priority species	Johnsonia pubescens subsp. cygnorum is listed as Priority 2 by the DBCA.
Landscape-level value impacted		yes/no	N/A
Significant impact			
Description		Clearing of Johnsonia pubescens subsp. cygnorum individuals.	Individuals of Johnsonia pubescens subsp. cygnorum are proposed to be cleared for the purpose of the Tonkin Highway upgrade.
Significant impact (hectares) / Type of feature		0	Individuals of Johnsonia pubescens subsp. cygnorum.
Quality (scale) / Number		119.00	119 individuals of Johnsonia pubescens subsp. cygnorum are proposed to be cleared for the purpose of the Tonkin Highway upgrade.
Rehabilitation credit			
Description		None proposed.	None proposed.
Proposed rehabilitation (area in hectares)		N/A	
Current quality of rehabilitation site / Start number (of type of feature)		0.00	
Future quality WITHOUT rehabilitation (scale) / Future number WITHOUT rehabilitation		0.00	
Future quality WITH rehabilitation (scale) / Future number WITH rehabilitation		0.00	
Time until ecological benefit (years)		0.00	
Confidence in rehabilitation result (%)		0	
Offset			
Description		Rehabilitation of Hartfield Park and Clifford St Bushland	An offset involving the rehabilitation of areas within Hartfield Park and Clifford St Bushland to achieve the presence of Johnsonia pubescens subsp. cygnorum individuals.
Proposed offset (area in hectares)		N/A	N/A
Current quality of offset site / Start number (of type of feature)		127.00	Start number derived from the Woodman (2019) survey within Hartfield Park and the Clifford St Bushland.
Future quality WITHOUT offset (scale) / Future number WITHOUT offset		127.00	Without rehabilitation and management, the number of Johnsonia pubescens subsp. cygnorum individuals within the Clifford St Bushland will not increase.
Future quality WITH offset (scale) / Future number WITH offset		262.00	A Revegetation Management Plan will be prepared in consultation with DBCA including agreed upon completion criteria.
Time until ecological benefit (years)		20.00	It is assumed that it will take approximately 20 years to achieve the desired number of Johnsonia pubescens subsp. cygnorum indivduals. For the purposes of the calculation, it is assumed that ecological benefit will be achieved at 20 years.
Confidence in offset result (%)		90%	High degree of confidence. DBCA is an experienced land manager and will provide expertise regarding the required completion criteria.
Duration of offset implementation (maximum 20 years)		N/A	N/A
Time until offset site secured (years)		N/A	N/A
Risk of future loss WITHOUT offset (%)		N/A	N/A
Risk of future loss WITH offset (%)		N/A	N/A
Offset ratio (Conservation area only)		N/A	N/A

Carnaby's Cockatoo

WA Environmental Offsets calculator

PLEASE ENABLE MACROS FOR THIS SPREADSHEET

Produced by:

The Department of Water and Environmental Regulation (DWER) in consultation with stakeholder working groups

Purpose:

Use the WA Envirionmental Offsets calculator in conjunction with the *Environmental offsets metric: Quantifying environmental offsets in Western Australia* guideline. Together, they form a supplement to section 4 of the *WA Environmental Offsets Guidelines* and provide information to help decision-makers, government officers, industry and the community to quantify environmental offsets.

Data currency:

The correct application of the WA Environmental Offsets Calculator relies on access to current datasets (such as vegetation extent and land tenure).

Process for using the WA Environmental Offsets Calculator		
Step	**Worksheet**	**Component**
Step 1: Determining conservation significance	**Step1_ConservationSignificance**	**Conservation significance determination**
		Combined *area* /*feature*
Step 2: Calculating significant residual impact	**Step2_SignificantResidualImpact**	**Part A: Significant impact calculation**
		Separate *area* or *feature* calculations
		Part B: Rehabilitation credit calculation
		Separate *area* or *feature* calculations
		Part C: Significant residual impact calculation
		Separate a*rea* or *feature* calculations
Step 3: Calculating offsets	**Step3_Offsets**	**Offsets calculation**
		Separate a*rea* or *feature* calculations
Rationale for scores used in the Offsets Calculator	**Rationale**	**All**

WA Environmental Offsets Calculator

Step 1: Determining conservation significance

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

(Or, if appropriate, manual data entry permitted)

Area / feature **(Impact site)**

Conservation significance determination for the environmental value impacted		
Conservation significance	**Description**	Carnaby's cockatoo foraging habitat.
	Type of environmental value	Species (flora/fauna)
	Conservation significance of environmental value	Rare/threatened species - endangered
	Conservation significance score	**1.2%**

Please select *area* or *feature* for the calculations	**Area**

WA Environmental Offsets Calculator

Step 2: Calculating significant residual impact

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

Environmental value (step 1)	Carnaby's cockatoo foraging habitat.

Area **(impact site)**

Part A: Significant impact calculation *Area*			
Significant impact	**Description**	**Quantum of impact**	
	Clearing of vegetation that comprises significant foraging habitat for Carnaby's cockatoo.	**Significant impact (hectares)**	18.54
		Quality (scale)	6.00
		Total quantum of impact	**11.12**

Part B: Rehabilitation credit calculation *Area* (onsite)					
Rehabilitation Credit	**Description**	**Proposed rehabilitation (area in hectares)**		**Time until ecological benefit (years)**	
	None proposed.	**Current quality of rehabilitation site (scale)**		**Confidence in rehabilitation result (%)**	
		Future quality WITHOUT rehabilitation (scale)		**Rehabilitation credit**	**0.00**
		Future quality WITH rehabilitation (scale)			

Part C: Significant residual impact calculation *Area*		
Significant residual impact	**Total quantum of impact**	**11.12**
	Rehabilitation credit	**0.00**
	Significant residual impact	**11.12**

WA Environmental Offsets Calculator

Step 3: Calculating offsets

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

Environmental value (step 1)	Carnaby's cockatoo foraging habitat.	Significant impact (step 2, part A)	18.54
		Rehabilitation credit (step 2, part B)	0.00
		Significant residual impact (step 2, part C)	11.12

Area **(offset site)**

Offset calculation
Area

Offsets calculation

Description	**Proposed offset (area in hectares)**	83.50	**Duration of offset implementation (maximum 20 years)**	20.00	**Offset value** (applied to step 2, part C)	**11.13**
Land acquisition.	**Current quality of offset site (scale)**	6.00	**Time until offset site secured (years)**	2.00		**100.0%**
	Future quality WITHOUT offset (scale)	5.00	**Risk of future loss WITHOUT offset (%)**	15.0%		
	Future quality WITH offset (scale)	6.00	**Risk of future loss WITH offset (%)**	5.0%		
	Time until ecological benefit (years)	2.00				
	Confidence in offset result (%)	90.0%			**OFFSET ADEQUATE?**	**YES**

WA Environmental Offsets Calculator

Rationale for scores used in the offsets calculator

Environmental value to be offset			
Calculation	***Score (Area)***		***Rationale***
Conservation significance			
Description	Carnaby's cockatoo foraging habitat.		The proposed clearing will impact on 18.54 hectares of significant foraging habitat for Carnaby's cockatoo.
Type of environmental value	Species (flora/fauna)		Carnaby's cockatoo is listed as a threatened fauna species under the Commonwealth EPBC Act and state BC Act.
Conservation significance of environmental value	Rare/threatened species - endangered		Carnaby's cockatoo is listed as Endangered under both the EPBC Act and BC Act.
Landscape-level value impacted	yes/no		N/A
Significant impact			
Description	Clearing of vegetation that comprises significant foraging habitat for Carnaby's cockatoo.		Vegetation that comprises significant foraging habitat for Carnaby's cockatoo is proposed to be cleared for the purpose of the Tonkin Highway upgrade.
Significant impact (hectares) / Type of feature	18.54		18.54 ha of species habitat mapped within Development Envelope during ecological survey (Woodman 2021). This excludes areas mapped as nil to negligible habitat value (score 0-1, see Section 3.2).
Quality (scale) / Number	6.00		Moderate score based on an area-weighted scoring of habitat quality across the Development Envelope ranging from score 4 to 6 out of 10 as a summation of foraging condition (score 2-4 out of 6), site context (score 1 out of 3) and species density (score 1 out of 1) (Woodman 2021), as follows: •Score 6 x 80% of habitat area •Score 5 x 10% of habitat area •Score 4 x 9% of habitat area. The area-weighted score is 5.7. Foraging score ranged from 2 to 4 (low to medium value, see Section 3.2), excluding areas mapped as nil to negligible value. Site context was scored 1 out of 3 as the Development Envelope provided limited habitat for breeding birds (Woodman 2021). Species density was scored 1 out of 1 due evidence of occupation and foraging within the Development Envelope (Woodman 2021). The Development Envelope contains 141 potential breeding trees, none of which contain hollows suitable for nesting by Carnaby's Cockatoos. The Development Envelope does not contain any known nesting or roosting trees for Carnaby's Cockatoos. The Development Envelope is subject to threatening processes including Phytophthora dieback and weeds. The Development Envelope contains Carnaby's Cockatoo habitat that has been previously fragmented upon development of Tonkin Highway.
Rehabilitation credit			
Description	None proposed.		None proposed.
Proposed rehabilitation (area in hectares)	0.00		
Current quality of rehabilitation site / Start number (of type of feature)	0.00		
Future quality WITHOUT rehabilitation (scale) / Future number WITHOUT rehabilitation	0.00		
Future quality WITH rehabilitation (scale) / Future number WITH rehabilitation	0.00		
Time until ecological benefit (years)	0.00		
Confidence in rehabilitation result (%)	0		
Offset			
Description	Land acquisition.		A single offset involving the purchase and transfer to DBCA management of an offset site that includes vegetation that comprises significant foraging habitat for Carnaby's cockatoo.
Proposed offset (area in hectares)	83.50		An approximate 83.50 ha portion of the Cowalla property may be allocated to the offset, primarily to counterbalance impacts to Carnaby's Cockatoo.
Current quality of offset site / Start number (of type of feature)	6.00		The site is expected to contain areas of foraging habitat and potential breeding habitat for Carnaby's Cockatoo. Expect habitat quality will be equivalent or better than the habitat within the Development Envelope.
Future quality WITHOUT offset (scale) / Future number WITHOUT offset	5.00		Rural freehold land. Vegetation may deteriorate without management and site will benefit from transfer to DBCA management.
Future quality WITH offset (scale) / Future number WITH offset	6.00		No rehabilitation proposed. Land will be managed for conservation of existing values.
Time until ecological benefit (years)	2.00		Land will be acquired within 24 months (2 years) of approval and immediately transferred to DBCA management.
Confidence in offset result (%)	90%		High degree of confidence, land will be surveyed to confirm habitat values and then purchased for transfer to DBCA management.

Duration of offset implementation (maximum 20 years)	20.00		Land will be transferred to DBCA management so long term protection is afforded (the land will be protected in perpetuity). Main Roads is liaising with DBCA regarding acquisition of suitable land in order to meet offset requirements and intends to have all required offsets in place within 24 months (2 years) of approval.
Time until offset site secured (years)	2.00		Land will be acquired within 24 months (2 years) of approval and immediately transferred to DBCA management.
Risk of future loss WITHOUT offset (%)	15.0%		Low risk as land is rural zoned and unlikely to be developed in the near future.
Risk of future loss WITH offset (%)	5.0%		The future conservation (in perpetuity) of the offset site would result in a substantial increased security and substantially reduce the risk of loss.
Offset ratio (Conservation area only)	N/A		N/A

FRTBC

WA Environmental Offsets calculator

PLEASE ENABLE MACROS FOR THIS SPREADSHEET

Produced by:

The Department of Water and Environmental Regulation (DWER) in consultation with stakeholder working groups

Purpose:

Use the WA Envirionmental Offsets calculator in conjunction with the *Environmental offsets metric: Quantifying environmental offsets in Western Australia* guideline. Together, they form a supplement to section 4 of the *WA Environmental Offsets Guidelines* and provide information to help decision-makers, government officers, industry and the community to quantify environmental offsets.

Data currency:

The correct application of the WA Environmental Offsets Calculator relies on access to current datasets (such as vegetation extent and land tenure).

Process for using the WA Environmental Offsets Calculator		
Step	**Worksheet**	**Component**
Step 1: Determining conservation significance	**Step1_ConservationSignificance**	**Conservation significance determination**
		Combined *area* /*feature*
Step 2: Calculating significant residual impact	**Step2_SignificantResidualImpact**	**Part A: Significant impact calculation**
		Separate *area* or *feature* calculations
		Part B: Rehabilitation credit calculation
		Separate *area* or *feature* calculations
		Part C: Significant residual impact calculation
		Separate a*rea* or *feature* calculations
Step 3: Calculating offsets	**Step3_Offsets**	**Offsets calculation**
		Separate a*rea* or *feature* calculations
Rationale for scores used in the Offsets Calculator	**Rationale**	**All**

WA Environmental Offsets Calculator

Step 1: Determining conservation significance

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

(Or, if appropriate, manual data entry permitted)

Area / feature **(Impact site)**

	Conservation significance determination for the environmental value impacted	
Conservation significance	**Description**	Forest Red-tailed Black Cockatoo foraging habitat.
	Type of environmental value	Species (flora/fauna)
	Conservation significance of environmental value	Rare/threatened Species - vulnerable
	Conservation significance score	**0.2%**

Please select *area* or *feature* for the calculations	**Area**

WA Environmental Offsets Calculator

Step 2: Calculating significant residual impact

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

Environmental value (step 1)	Forest Red-tailed Black Cockatoo foraging habitat.

Area **(impact site)**

Part A: Significant impact calculation
Area

	Description		
Significant impact	Clearing of vegetation that comprises significant foraging habitat for FRTBC.	**Significant impact (hectares)**	18.94
		Quality (scale)	6.00
		Total quantum of impact	**11.36**

Part B: Rehabilitation credit calculation
Area **(onsite)**

	Description				
Rehabilitation Credit	None proposed.	**Proposed rehabilitation (area in hectares)**		**Time until ecological benefit (years)**	
		Current quality of rehabilitation site (scale)		**Confidence in rehabilitation result (%)**	
		Future quality WITHOUT rehabilitation (scale)		**Rehabilitation credit**	**0.00**
		Future quality WITH rehabilitation (scale)			

Part C: Significant residual impact calculation ***Area***

Significant residual impact	**Total quantum of impact**	**11.36**
	Rehabilitation credit	**0.00**
	Significant residual impact	**11.36**

WA Environmental Offsets Calculator

Step 3: Calculating offsets

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

Environmental value (step 1)	Forest Red-tailed Black Cockatoo foraging habitat.	Significant impact (step 2, part A)	18.94
		Rehabilitation credit (step 2, part B)	0.00
		Significant residual impact (step 2, part C)	11.36

Area **(offset site)**

Offset calculation
Area

Offsets calculation

Description	**Proposed offset (area in hectares)**	83.60	**Duration of offset implementation (maximum 20 years)**	20.00	**Offset value** (applied to step 2, part C)	**11.37**
Land acquisition.	**Current quality of offset site (scale)**	6.00	**Time until offset site secured (years)**	2.00		**100.0%**
	Future quality WITHOUT offset (scale)	5.00	**Risk of future loss WITHOUT offset (%)**	15.0%		
	Future quality WITH offset (scale)	6.00	**Risk of future loss WITH offset (%)**	5.0%		
	Time until ecological benefit (years)	2.00				
	Confidence in offset result (%)	90.0%			**OFFSET ADEQUATE?**	**YES**

WA Environmental Offsets Calculator

Rationale for scores used in the offsets calculator

Environmental value to be offset			
Calculation	***Score (Area)***		***Rationale***
Conservation significance			
Description	Forest Red-tailed Black Cockatoo foraging habitat.		The proposed clearing will impact on 18.94 hectares of significant foraging habitat for FRTBC.
Type of environmental value	Species (flora/fauna)		FRTBC is listed as a threatened fauna species under the Commonwealth EPBC Act and state BC Act.
Conservation significance of environmental value	Rare/threatened Species - vulnerable		FRTBC is listed as Vulnerable under both the EPBC Act and BC Act.
Landscape-level value impacted	yes/no		N/A
Significant impact			
Description	Clearing of vegetation that comprises significant foraging habitat for FRTBC.		Vegetation that comprises significant foraging habitat for FRTBC is proposed to be cleared for the purpose of the Tonkin Highway upgrade.
Significant impact (hectares) / Type of feature	18.94		18.94 ha of species habitat mapped within Development Envelope during ecological survey (Woodman 2021). This excludes areas mapped as nil to negligible habitat value (score 0-1, see Section 3.2).
Quality (scale) / Number	6.00		Moderate score based on an area-weighted scoring of habitat quality across the Development Envelope ranging from score 4 to 7 out of 10 as a summation of foraging condition (score 2-5 out of 6), site context (score 1 out of 3) and species density (score 1 out of 1) (Woodman 2021), as follows: •Score 7 x 41% of habitat area •Score 6 x 34% of habitat area •Score 5 x 14% of habitat area •Score 4 x 11% of habitat area. The area-weighted score is 6.0. Foraging score ranged from 2 to 5 (low to high value, see Section 3.2), excluding areas mapped as nil to negligible value. Site context was scored 1 out of 3 as the Development Envelope provided limited habitat for breeding birds (Woodman 2021). Species density was scored 1 out of 1 due evidence of occupation and foraging within the Development Envelope (Woodman 2021). The Development Envelope contains 141 potential breeding trees, none of which contain hollows suitable for nesting by FRTBC. The Development Envelope does not contain any known nesting or roosting trees for FRTBC. The Development Envelope is subject to threatening processes including Phytophthora dieback and weeds. The Development Envelope contains FRTBC habitat that has been previously fragmented upon development of Tonkin Highway.
Rehabilitation credit			
Description	None proposed.		None proposed.
Proposed rehabilitation (area in hectares)	0.00		
Current quality of rehabilitation site / Start number (of type of feature)	0.00		
Future quality WITHOUT rehabilitation (scale) / Future number WITHOUT rehabilitation	0.00		
Future quality WITH rehabilitation (scale) / Future number WITH rehabilitation	0.00		
Time until ecological benefit (years)	0.00		
Confidence in rehabilitation result (%)	0		
Offset			
Description	Land acquisition.		A single offset involving the purchase and transfer to DBCA management of an offset site that includes vegetation that comprises significant foraging habitat for FRTBC.
Proposed offset (area in hectares)	83.60		An approximate 83.60 ha portion of the Lot 579 property may be allocated to the offset, primarily to counterbalance impacts to FRTBC.
Current quality of offset site / Start number (of type of feature)	6.00		The site is expected to contain areas of foraging habitat and potential breeding habitat for FRTBC. Expect habitat quality will be equivalent or better than the habitat within the Development Envelope.
Future quality WITHOUT offset (scale) / Future number WITHOUT offset	5.00		Rural freehold land. Vegetation may deteriorate without management and site will benefit from transfer to DBCA management.
Future quality WITH offset (scale) / Future number WITH offset	6.00		No rehabilitation proposed. Land will be managed for conservation of existing values.
Time until ecological benefit (years)	2.00		Land will be acquired within 24 months (2 years) of approval and immediately transferred to DBCA management.
Confidence in offset result (%)	90%		High degree of confidence, land will be surveyed to confirm habitat values and then purchased for transfer to DBCA management.

Duration of offset implementation (maximum 20 years)	20.00		Land will be transferred to DBCA management so long term protection is afforded (the land will be protected in perpetuity). Main Roads is liaising with DBCA regarding acquisition of suitable land in order to meet offset requirements and intends to have all required offsets in place within 24 months (2 years) of approval.
Time until offset site secured (years)	2.00		Land will be acquired within 24 months (2 years) of approval and immediately transferred to DBCA management.
Risk of future loss WITHOUT offset (%)	15.0%		Low risk as land is rural zoned and unlikely to be developed in the near future.
Risk of future loss WITH offset (%)	5.0%		The future conservation (in perpetuity) of the offset site would result in a substantial increased security and substantially reduce the risk of loss.
Offset ratio (Conservation area only)	N/A		N/A

Baudin's Cockatoo

WA Environmental Offsets calculator

PLEASE ENABLE MACROS FOR THIS SPREADSHEET

Produced by:

The Department of Water and Environmental Regulation (DWER) in consultation with stakeholder working groups

Purpose:

Use the WA Envirionmental Offsets calculator in conjunction with the *Environmental offsets metric: Quantifying environmental offsets in Western Australia* guideline. Together, they form a supplement to section 4 of the *WA Environmental Offsets Guidelines* and provide information to help decision-makers, government officers, industry and the community to quantify environmental offsets.

Data currency:

The correct application of the WA Environmental Offsets Calculator relies on access to current datasets (such as vegetation extent and land tenure).

Process for using the WA Environmental Offsets Calculator		
Step	**Worksheet**	**Component**
Step 1: Determining conservation significance	**Step1_ConservationSignificance**	**Conservation significance determination**
		Combined *area* /*feature*
Step 2: Calculating significant residual impact	**Step2_SignificantResidualImpact**	**Part A: Significant impact calculation**
		Separate *area* or *feature* calculations
		Part B: Rehabilitation credit calculation
		Separate *area* or *feature* calculations
		Part C: Significant residual impact calculation
		Separate a*rea* or *feature* calculations
Step 3: Calculating offsets	**Step3_Offsets**	**Offsets calculation**
		Separate a*rea* or *feature* calculations
Rationale for scores used in the Offsets Calculator	**Rationale**	**All**

WA Environmental Offsets Calculator

Step 1: Determining conservation significance

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

(Or, if appropriate, manual data entry permitted)

Area / feature **(Impact site)**

Conservation significance determination for the environmental value impacted		
Conservation significance	**Description**	Baudin's Cockatoo foraging habitat.
	Type of environmental value	Species (flora/fauna)
	Conservation significance of environmental value	Rare/threatened species - endangered
	Conservation significance score	**1.2%**

Please select *area* or *feature* for the calculations	**Area**

WA Environmental Offsets Calculator

Step 2: Calculating significant residual impact

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

Environmental value (step 1)	Baudin's Cockatoo foraging habitat.

Area **(impact site)**

Part A: Significant impact calculation
Area

Significant impact	Description	Quantum of impact	
	Clearing of vegetation that comprises significant foraging habitat for Baudin's Cockatoo.	**Significant impact (hectares)**	18.94
		Quality (scale)	6.00
		Total quantum of impact	**11.36**

Part B: Rehabilitation credit calculation
Area **(onsite)**

Rehabilitation Credit	Description				
	None proposed.	**Proposed rehabilitation (area in hectares)**		**Time until ecological benefit (years)**	
		Current quality of rehabilitation site (scale)		**Confidence in rehabilitation result (%)**	
		Future quality WITHOUT rehabilitation (scale)		**Rehabilitation credit**	**0.00**
		Future quality WITH rehabilitation (scale)			

Part C: Significant residual impact calculation ***Area***

Significant residual impact		
	Total quantum of impact	**11.36**
	Rehabilitation credit	**0.00**
	Significant residual impact	**11.36**

WA Environmental Offsets Calculator

Step 3: Calculating offsets

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

Environmental value (step 1)	Baudin's Cockatoo foraging habitat.	Significant impact (step 2, part A)	18.94
		Rehabilitation credit (step 2, part B)	0.00
		Significant residual impact (step 2, part C)	11.36

Area **(offset site)**

Offset calculation
Area

Offsets calculation

Description	**Proposed offset (area in hectares)**	85.30	**Duration of offset implementation (maximum 20 years)**	20.00	**Offset value** (applied to step 2, part C)	**11.37**
Land acquisition.	**Current quality of offset site (scale)**	6.00	**Time until offset site secured (years)**	2.00		**100.0%**
	Future quality WITHOUT offset (scale)	5.00	**Risk of future loss WITHOUT offset (%)**	15.0%		
	Future quality WITH offset (scale)	6.00	**Risk of future loss WITH offset (%)**	5.0%		
	Time until ecological benefit (years)	2.00				
	Confidence in offset result (%)	90.0%			**OFFSET ADEQUATE?**	**YES**

WA Environmental Offsets Calculator

Rationale for scores used in the offsets calculator

Environmental value to be offset			
Calculation	***Score (Area)***		***Rationale***
Conservation significance			
Description	Baudin's Cockatoo foraging habitat.		The proposed clearing will impact on 18.94 hectares of significant foraging habitat for Baudin's Cockatoo.
Type of environmental value	Species (flora/fauna)		Baudin's Cockatoo is listed as a threatened fauna species under the Commonwealth EPBC Act and state BC Act.
Conservation significance of environmental value	Rare/threatened species - endangered		Baudin's Cockatoo is listed as Endangered under both the EPBC Act and BC Act.
Landscape-level value impacted	yes/no		N/A
Significant impact			
Description	Clearing of vegetation that comprises significant foraging habitat for Baudin's Cockatoo.		Vegetation that comprises significant foraging habitat for Baudin's Cockatoo is proposed to be cleared for the purpose of the Tonkin Highway upgrade.
Significant impact (hectares) / Type of feature	18.94		18.94 ha of species habitat mapped within Development Envelope during ecological survey (Woodman 2021). This excludes areas mapped as nil to negligible habitat value (score 0-1, see Section 3.2).
Quality (scale) / Number	6.00		Moderate score based on an area-weighted scoring of habitat quality across the Development Envelope ranging from score 4 to 7 out of 10 as a summation of foraging condition (score 2-5 out of 6), site context (score 1 out of 3) and species density (score 1 out of 1) (Woodman 2021), as follows: •Score 7 x 41% of habitat area •Score 6 x 34% of habitat area •Score 5 x 14% of habitat area •Score 4 x 11% of habitat area. The area-weighted score is 6.0. Foraging score ranged from 2 to 5 (low to high value, see Section 3.2), excluding areas mapped as nil to negligible value. Site context was scored 1 out of 3 as the Development Envelope provided limited habitat for breeding birds (Woodman 2021). Species density was scored 1 out of 1 due evidence of occupation and foraging within the Development Envelope (Woodman 2021). The Development Envelope is unlikely to provide breeding habitat for Baudin's Cockatoo, and none of the 141 potential breeding trees contain hollows suitable for nesting. The Development Envelope does not contain any known roosting trees for Baudin's Cockatoos. The Development Envelope is subject to threatening processes including Phytophthora dieback and weeds. The Development Envelope contains Baudin's Cockatoo habitat that has been previously fragmented upon development of Tonkin Highway.
Rehabilitation credit			
Description	None proposed.		None proposed.
Proposed rehabilitation (area in hectares)	0.00		
Current quality of rehabilitation site / Start number (of type of feature)	0.00		
Future quality WITHOUT rehabilitation (scale) / Future number WITHOUT rehabilitation	0.00		
Future quality WITH rehabilitation (scale) / Future number WITH rehabilitation	0.00		
Time until ecological benefit (years)	0.00		
Confidence in rehabilitation result (%)	0		
Offset			
Description	Land acquisition.		A single offset involving the purchase and transfer to DBCA management of an offset site that includes vegetation that comprises significant foraging habitat for Baudin's Cockatoo.
Proposed offset (area in hectares)	85.30		An approximate 85.3 ha portion of the Lot 579 property may be allocated to the offset, primarily to counterbalance impacts to Baudin's Cockatoo.
Current quality of offset site / Start number (of type of feature)	6.00		The site is expected to contain areas of foraging habitat and potential breeding habitat for Baudin's Cockatoo. Expect habitat quality will be equivalent or better than the habitat within the Development Envelope.
Future quality WITHOUT offset (scale) / Future number WITHOUT offset	5.00		Rural freehold land. Vegetation may deteriorate without management and site will benefit from transfer to DBCA management.
Future quality WITH offset (scale) / Future number WITH offset	6.00		No rehabilitation proposed. Land will be managed for conservation of existing values.
Time until ecological benefit (years)	2.00		Land will be acquired within 24 months (2 years) of approval and immediately transferred to DBCA management.
Confidence in offset result (%)	90%		High degree of confidence, land will be surveyed to confirm habitat values and then purchased for transfer to DBCA management.

Duration of offset implementation (maximum 20 years)	20.00		Land will be transferred to DBCA management so long term protection is afforded (the land will be protected in perpetuity). Main Roads is liaising with DBCA regarding acquisition of suitable land in order to meet offset requirements and intends to have all required offsets in place within 24 months (2 years) of of approval.
Time until offset site secured (years)	2.00		Land will be acquired within 24 months (2 years) of approval and immediately transferred to DBCA management.
Risk of future loss WITHOUT offset (%)	15.0%		Low risk as land is rural zoned and unlikely to be developed in the near future.
Risk of future loss WITH offset (%)	5.0%		The future conservation (in perpetuity) of the offset site would result in a substantial increased security and substantially reduce the risk of loss.
Offset ratio (Conservation area only)	N/A		N/A

CCWs

WA Environmental Offsets calculator

PLEASE ENABLE MACROS FOR THIS SPREADSHEET

Produced by:

The Department of Water and Environmental Regulation (DWER) in consultation with stakeholder working groups

Purpose:

Use the WA Envirionmental Offsets calculator in conjunction with the *Environmental offsets metric: Quantifying environmental offsets in Western Australia* guideline. Together, they form a supplement to section 4 of the *WA Environmental Offsets Guidelines* and provide information to help decision-makers, government officers, industry and the community to quantify environmental offsets.

Data currency:

The correct application of the WA Environmental Offsets Calculator relies on access to current datasets (such as vegetation extent and land tenure).

Process for using the WA Environmental Offsets Calculator		
Step	**Worksheet**	**Component**
Step 1: Determining conservation significance	**Step1_ConservationSignificance**	**Conservation significance determination**
		Combined *area* /*feature*
Step 2: Calculating significant residual impact	**Step2_SignificantResidualImpact**	**Part A: Significant impact calculation**
		Separate *area* or *feature* calculations
		Part B: Rehabilitation credit calculation
		Separate *area* or *feature* calculations
		Part C: Significant residual impact calculation
		Separate a*rea* or *feature* calculations
Step 3: Calculating offsets	**Step3_Offsets**	**Offsets calculation**
		Separate a*rea* or *feature* calculations
Rationale for scores used in the Offsets Calculator	**Rationale**	**All**

WA Environmental Offsets Calculator

Step 1: Determining conservation significance

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

(Or, if appropriate, manual data entry permitted)

Area / feature **(Impact site)**

Conservation significance determination for the environmental value impacted		
Conservation significance	**Description**	Native vegetation within Conservation Category Wetlands.
	Type of environmental value	Wetland/watercourse
	Conservation significance of environmental value	A category or type of wetland or watercourse for which an offset is required
	Conservation significance score	**0.1%**

Please select *area* or *feature* for the calculations	**Area**

WA Environmental Offsets Calculator

Step 2: Calculating significant residual impact

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

Environmental value (step 1)	Native vegetation within Conservation Category Wetlands.

Area **(impact site)**

Part A: Significant impact calculation *Area*			
Significant impact	**Description**	**Quantum of impact**	
	Clearing of native vegetation within Conservation Category Wetlands.	**Significant impact (hectares)**	9.34
		Quality (scale)	6.00
		Total quantum of impact	**5.60**

Part B: Rehabilitation credit calculation *Area* **(onsite)**					
Rehabilitation Credit	**Description**	**Proposed rehabilitation (area in hectares)**		**Time until ecological benefit (years)**	
	None proposed.	**Current quality of rehabilitation site (scale)**		**Confidence in rehabilitation result (%)**	
		Future quality WITHOUT rehabilitation (scale)		**Rehabilitation credit**	**0.00**
		Future quality WITH rehabilitation (scale)			

Part C: Significant residual impact calculation *Area*		
Significant residual impact	**Total quantum of impact**	**5.60**
	Rehabilitation credit	**0.00**
	Significant residual impact	**5.60**

WA Environmental Offsets Calculator

Step 3: Calculating offsets

Key:

	Data to be entered
	Drop-down selection
	Automatically-generated scores

Environmental value (step 1)	Native vegetation within Conservation Category Wetlands.	Significant impact (step 2, part A)	9.34
		Rehabilitation credit (step 2, part B)	0.00
		Significant residual impact (step 2, part C)	5.60

Area **(offset site)**

Offset calculation
Area

Offsets calculation

Description	**Proposed offset (area in hectares)**	54.30	**Duration of offset implementation (maximum 20 years)**	20.00	**Offset value** (applied to step 2, part C)	**5.60**
Rehabilitation of the Greater Brixton Street Wetlands	**Current quality of offset site (scale)**	5.00	**Time until offset site secured (years)**	2.00		**100.0%**
	Future quality WITHOUT offset (scale)	5.00	**Risk of future loss WITHOUT offset (%)**	5.0%		
	Future quality WITH offset (scale)	6.00	**Risk of future loss WITH offset (%)**	2.0%		
	Time until ecological benefit (years)	3.00				
	Confidence in offset result (%)	90.0%			**OFFSET ADEQUATE?**	**YES**

WA Environmental Offsets Calculator

Rationale for scores used in the offsets calculator

Environmental value to be offset			
Calculation	***Score (Area)***		***Rationale***
Conservation significance			
Description	Native vegetation within Conservation Category Wetlands.		The proposed clearing will impact on 9.34 ha of native vegetation that is mapped as of the CCWs.
Type of environmental value	Wetland/watercourse		The proposed clearing will impact on native vegetation mapped as Conservation Category Wetlands.
Conservation significance of environmental value	A category or type of wetland or watercourse for which an offset is required		CCWs are defined as wetlands that support a high level of ecological attributes and functions (generally having intact vegetation and natural hydrological processes), or that have a reasonable level of functionality and are representative of wetland types that are rare or poorly protected.
Landscape-level value impacted	yes/no		N/A
Significant impact			
Description	Clearing of native vegetation within Conservation Category Wetlands.		Native vegetation that is mapped as CCWs is proposed to be cleared for the purpose of the Tonkin Highway upgrade.
Significant impact (hectares) / Type of feature	9.34		9.34 ha of native vegetation that is mapped as CCWs occurs within the Development Envelope according to mapping from the ecological survey (Woodman, 2021).
Quality (scale) / Number	6.00		Moderate score based on an area-weighted scoring of CCWs vegetation condition across the Development Envelope, as follows: •Pristine – score 10 x 0% of CCW area •Excellent – score 9 x 29% of CCW area •Very Good – score 7 x 17% of CCW area •Good – score 5 x 8% of CCW area •Degraded – score 3 x 45% of CCW area •Completely Degraded – score 1 x 0% of TEC area. The area-weighted score is 6. The Development Envelope is subject to threatening processes including Phytophthora dieback and weeds. The Development Envelope contains seven CCWs that have been previously fragmented upon development of Tonkin Highway.
Rehabilitation credit			
Description	None proposed.		None proposed.
Proposed rehabilitation (area in hectares)	0.00		
Current quality of rehabilitation site / Start number (of type of feature)	0.00		
Future quality WITHOUT rehabilitation (scale) / Future number WITHOUT rehabilitation	0.00		
Future quality WITH rehabilitation (scale) / Future number WITH rehabilitation	0.00		
Time until ecological benefit (years)	0.00		
Confidence in rehabilitation result (%)	0		
Offset			
Description	Rehabilitation of the Greater Brixton Street Wetlands		A offset involving the rehabilitation of areas of the Great Brixton Street Wetlands to achieve an improved and functional ecosystem at these locations.
Proposed offset (area in hectares)	54.30		An approximate 54.30 ha portion of the Greater Brixton Street Wetlands may be rehabilitated primarily to counterbalance impacts to native vegetation within the Conservation Category Wetlands.
Current quality of offset site / Start number (of type of feature)	5.00		Desktop review and consultation with DBCA indicates that the areas to be rehabilitated are in moderate condition.
Future quality WITHOUT offset (scale) / Future number WITHOUT offset	5.00		Without rehabilitation and management, these areas will not improve in condition.
Future quality WITH offset (scale) / Future number WITH offset	6.00		A Revegetation Management Plan will be prepared in consultation with DBCA including agreed upon completion criteria. It is assumed that vegetation will be condition 6 or higher upon meeting these completion criteria
Time until ecological benefit (years)	3.00		It is assumed that it will take approximately 3 years to achieve the desired species diversity, vegetation cover and weed density. For the purposes of the calculation, it is assumed that ecological benefit will be achieved at 3 years.
Confidence in offset result (%)	90%		High degree of confidence. DBCA is an experienced land manager and will provide expertise regarding the required completion criteria.
Duration of offset implementation (maximum 20 years)	20.00		Main Roads will implement rehabilitation for three years, or until compleition criteria identified in the Revegetation Management Plan have been met (if prior to 3 years).
Time until offset site secured (years)	2.00		Rehabilitation of suitable areas will begin within 24 months of approval.

Risk of future loss WITHOUT offset (%)	5.0%		Risk of loss without offset has been set at 5%, as the area to be cleared is within the Brixton Street Wetlands (Nationally Important Wetland) and subject to conservation protection.
Risk of future loss WITH offset (%)	2.0%		Risk of loss with offset has been set at 2%, as the area to be cleared is within the Brixton Street Wetlands (Nationally Important Wetland) and subject to conservation protection.
Offset ratio (Conservation area only)	N/A		N/A