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Great Eastern Highway Bypass Interchanges Native Vegetation Clearing Permit – Supporting Document

Document Details	
Client	Main Roads Western Australia
Document Owner	Environment
Client Contract No.	C197.19
Document Number	GEHBI-GCA-RPT-A000-EN-00004
Revision	2

Revision	Date	Details	Originator	Reviewed	Approved
A	25/06/2021	Issued for Review	M. Sejournee	J. Shaw	J. Nielsen
B	28/07/2021	Issued for Review	M. Sejournee	A. Chinnery	
C	13/09/2021	Issued for Review	M. Sejournee	A. Chinnery	J Shaw
D	21/09/2021	Issued for Review	M. Sejournee	J. Shaw	J Shaw
0	5/10/2021	Issued for Delivery	M. Sejournee	A. Chinnery	J Shaw
1	10/02/2022	Issued for Review	M. Sejournee A. Chinnery	J Shaw	J Shaw
2	08/03/2022	Issued for Delivery	M. Sejournee	A. Chinnery	J Shaw

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1. Purpose

The purpose of this document is to provide supporting information for a native vegetation clearing Area Permit application under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (Clearing Regulations) for the proposed Roe Highway / Great Eastern Highway Bypass (GEHB) Interchange works (CPS 9448/1). The document describes the native vegetation proposed for clearing within the Development Envelope (DE), outlines key activities associated with the Proposal, and defines the areal extent of clearing to be undertaken. It also summarises the Proposal's potential impacts in relation to the ten native vegetation Clearing Principles and strategies to be employed to minimise impacts to native vegetation.

2. Scope

2.1 Proposal Scope

Proposal Name: Great Eastern Highway Bypass Interchanges Project (the Proposal)

Proposal Purpose / Components: Main Roads Western Australia (Main Roads) is undertaking road construction works that include:

- Grade separation at the intersection of Roe Highway and GEHB
- Upgrade of Roe Highway (between Kalamunda Road and Clayton Street) including a duplication of the bridge over the Helena River
- Principal Shared Path (PSP) connection south to Kalamunda Road and north to 300m north of Clayton Street
- Stirling Crescent to be changed to terminate in a cul-de-sac.

Roe Highway is a strategic road that stretches from Kwinana Freeway to Great Northern Highway and forms the outer ring road network for the Perth metropolitan area. The Great Eastern Highway Bypass (GEHB) provides a critical connection between Roe Highway and Tonkin Highway.

GEHB is a limited-access two lane dual carriageway that links Great Eastern Highway and Roe Highway. Together with a section of Roe Highway, it bypasses the town centres of Guildford and Midland.

GEHB starts at the bifurcation intersection with Great Eastern Highway, travelling east and intersects with Kalamunda Road, Abernethy Road and Stirling Crescent and ends at a traffic light controlled T-Intersection with Roe Highway. This network provides connection to the Perth Airport, the industrial areas of High Wycombe, Forrestfield and Kewdale to the south and the industrial suburb of Hazelmere to the north.

The Roe / GEHB intersection is ranked as the 22nd most congested intersection in the ARRB (2016) report Network Performance Analysis for Perth Congestion Response 2016. With the recent grade-separation of the Roe / Kalamunda intersection, the Roe Highway / GEHB intersection is the last remaining at grade intersection on Roe Highway between Great Eastern Highway and Kwinana Freeway.

A project definition study was carried out in 2017, which indicated the preferred upgrade option for the Roe and GEHB is a trumpet interchange. In order to facilitate the necessary lane movements in the approach to the interchange along GEHB, Stirling Crescent will become a cul-de-sac.

Main Roads submitted a Native Vegetation Clearing Permit application (CPS 9448/1) on 6 October 2021. Subsequent to this, Greater Connect Alliance undertook a detailed review of the design to identify opportunities to reduce the project's impact on the State listed *Banksia attenuata* woodlands over species rich dense shrublands TEC (FCT 20a). These amendments to proposed clearing impacts are outlined in Section 2.4.2.

The proposed clearing is: Up to 23.31 ha.

The proposed temporary clearing is: None

Project Location(s): Roe Highway between 300m north of Clayton Street and Kalamunda Road, including a grade separation at the intersection SLK 37.54.

The proposed works occur within the City of Swan, City of Kalamunda and Shire of Mundaring, approximately 14 km east of the Perth CBD.

Start:

Latitude: -31.899006

Longitude: 116.009369

End:

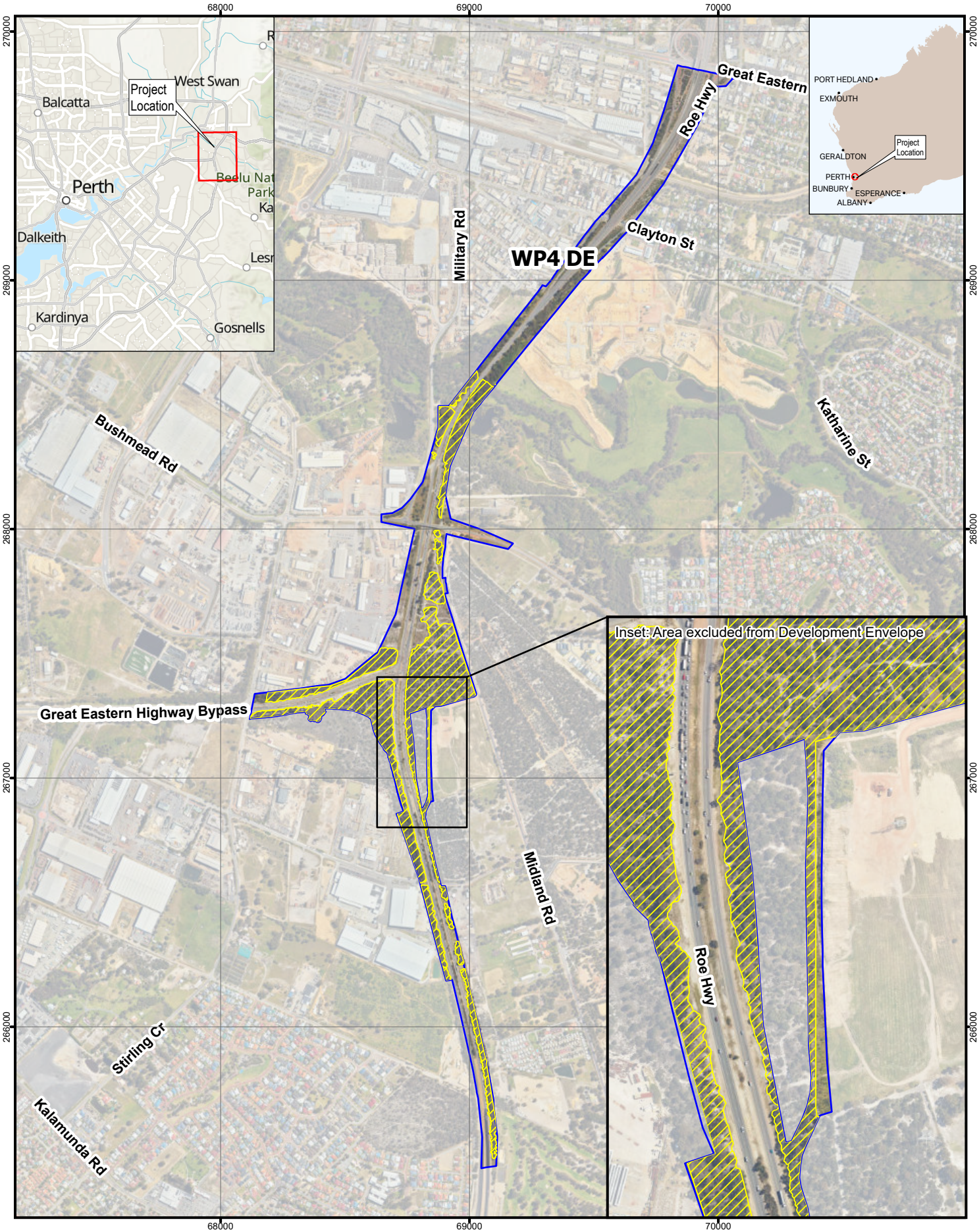
Latitude: -31.903576

Longitude: 116.007813

The location of the proposed works is illustrated in Figure 1.

2.2 Assessment Report Scope

The assessment area is shown in Figure 2.



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Datum: GDA 1994 Perth Coastal Grid 1994

0 100 200 300 400 500
metres

Data sources: Main Roads WA

LEGEND

WP4 Development Envelope – Assessed (8 Feb 22)

NVCP extents (January 2022)

Development Envelope Area

MAIN ROADS WA

GREAT EASTERN HIGHWAY BYPASS INTERCHANGES PROJECT

WP4 ROE HIGHWAY NVCP

Figure 1

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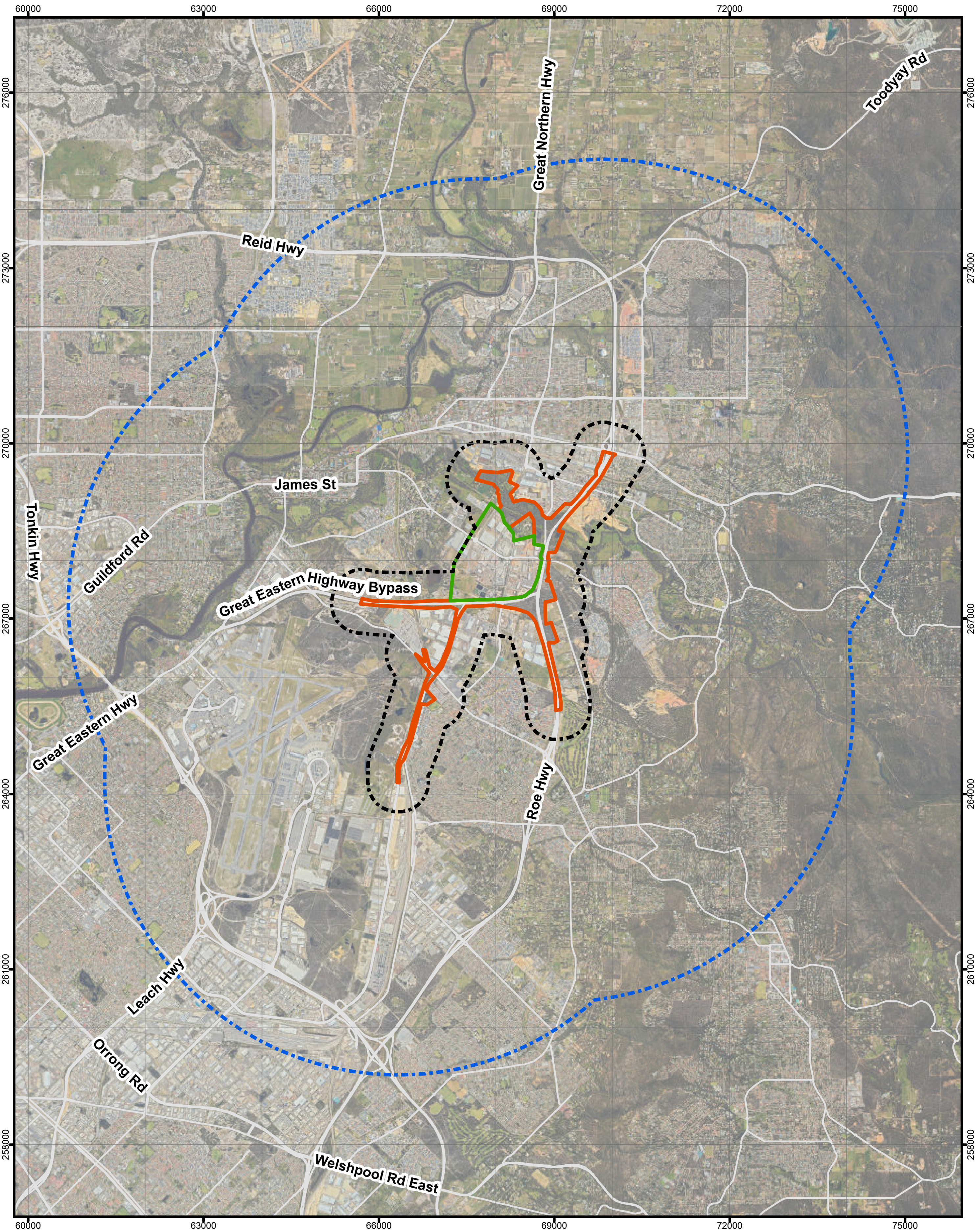

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metres

Data sources: Main Roads WA

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

LEGEND

- Contextual Area (500m Buffer)
- Great Eastern Highway Bypass Interchanges Biological Level 1 Survey Area
- Great Eastern Highway Bypass Interchanges Biological Level 2 Survey Area
- Study Area (5km Buffer)

Assessment Area (Biota 2021)

MAIN ROADS WA

GREAT EASTERN HIGHWAY BYPASS INTERCHANGES PROJECT

WP4 ROE HIGHWAY NVCP

Figure 2

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2.3 Alternatives to clearing

Historical land use planning constrains Main Roads to undertaking works within the existing road reserve, with the land surrounding the proposed interchange location being in private tenure and generally developed for urban, industrial, and rural purposes. As a result, to achieve the objective of providing free flowing traffic movement between Roe Highway and GEHB, Main Roads has limited alternatives to the current option.

Although the designed footprint of the Proposal is significantly smaller than the DE, the area of native vegetation to be cleared has been quantified in terms of the entire DE to allow for flexibility in refining the design. In practice, the Proposal will be designed to achieve Main Roads' project objectives with the minimum impact to native vegetation practicable.

Main Roads will not undertake temporary clearing of native vegetation for access tracks, construction laydown or stockpiling. Site access will be from within the construction alignment, while construction laydown and stockpile areas will be within previously cleared areas.

Main Roads has made significant efforts to avoid, minimise and mitigate clearing impacts associated with the proposal, as outlined in Section 2.4.

2.4 Measures to Avoid, Minimise, Reduce and Manage Project Clearing Impacts

2.4.1 Avoidance of Shrublands and Woodlands of the Eastern Swan Coastal Plain (SCP 20c)

The original concept alignment resulted in direct impacts on the Shrublands and Woodlands of the Eastern Swan Coastal Plain Threatened Ecological Community (TEC) (SCP20c), which is listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as Endangered and under the State *Biodiversity Conservation Act 2016* (BC Act) as Critically Endangered. The Shrublands and Woodlands of the Eastern Swan Coastal Plain TEC is known from only two occurrences, totalling 130ha. The predicted area of impact was 3.8ha. Prior to submission of the NVCP application in October 2021, Main Roads carried out a significant design review and development during the planning phase of the Proposal to balance the needs of improving safety performance with avoiding significant environmental values.

Key re-design initiatives included:

- Tightening the radius of the ramp that carries movements from Roe Highway northbound to GEHB westbound to entirely avoid any clearing of SCP20c. In addition, this realignment avoids an area of native vegetation that was identified by Department of Biodiversity, Conservation and Attractions (DBCA) officers as potentially representing SCP02 (state listed Southern Wet Shrublands of the Swan Coastal Plain TEC), as well as avoiding several mapped Priority flora species. As a result of this realignment, Main Roads has had to reduce the design speed of this movement from 90 km/hr to 80 km/hr.
- Shifting the interchange northwards to reduce the amount of overall clearing of the commonwealth listed Banksia Woodlands of the Swan Coastal Plain TEC (state listed Priority Ecological Community, PEC).
- Tightening the radius of the ramp that carries movements from Roe Highway southbound to GEHB westwards and movements from GEHB eastbound to Roe Highway southbound. This change has achieved a reduction in clearing of SCP 21c (Low lying *Banksia attenuata* Woodlands or Shrublands, state listed PEC, Commonwealth TEC).
- Modifying the DE boundary (Figure 1) to ensure there is no design creep into the Shrublands and Woodlands of the Eastern Swan Coastal Plain TEC.

As a result of these design changes, Main Roads has reduced the area of native vegetation to be cleared and, significantly, has completely avoided any clearing of the Shrublands and Woodlands of the Eastern Swan Coastal Plain TEC.

2.4.2 Reduction of clearing in State listed TEC Floristic Community Type (FCT) 20a

In late 2021, the project design was reviewed to reduce clearing impacts on the State listed *Banksia attenuata* woodlands over species rich dense shrublands TEC (FCT 20a). The resulting changes to the design reduced native vegetation clearing requirements by 25%, this represented a decrease of 7.72 ha from 31.03 ha to 23.31 ha.

The PSP was realigned to follow the boundary of an existing rural property, connecting back to the highway further south from the intersection. This change increased the area of uncleared vegetation between the PSP and the highway. Due to tightening of design widths south of the PSP connection, a larger 3.01 ha area of FCT 20a south of the intersection was also avoided. The disturbance width for the PSP is estimated at a maximum of 10 m,

which is far less than the 30 m minimum distance for a gap between patches of *Banksia attenuata* woodlands over species rich dense shrublands TEC (TSSC 2016).

The retained vegetation within the two areas either side of the PSP will therefore continue to represent one single patch of TEC, approximately 4.78 ha in size. Although the PSP bisects the vegetation, resulting in unavoidable fragmentation, the alternative is for additional clearing of FCT20a and the retention of small areas of TEC which do not meet the criteria for minimum patch size. Areas of FCT 20a avoided by the amended design can be seen on Figure 6.

The design changes also reduced impacts to the following environmental values:

- Commonwealth listed Banksia Woodlands of the Swan Coastal Plain TEC (state listed Priority Ecological Community, PEC)
- Black cockatoo foraging habitat
- Trees with suitable DBH (> 500 mm) to form Black Cockatoo breeding hollows
- Bush Forever Sites 481 and 122
- Threatened Flora *Conospermum undulatum*
- Priority Flora *Isopogon autumnalis*
- Multiple Use Wetland UFI 15266

Changes to the clearing permit area are illustrated on Figure 3. Table 1 summarises the reduction in clearing impacts as a result of the February 2022 design change. These areas can be seen on the constraints maps presented in Section 7.

Table 1 – Reduction in predicted clearing impacts February 2022

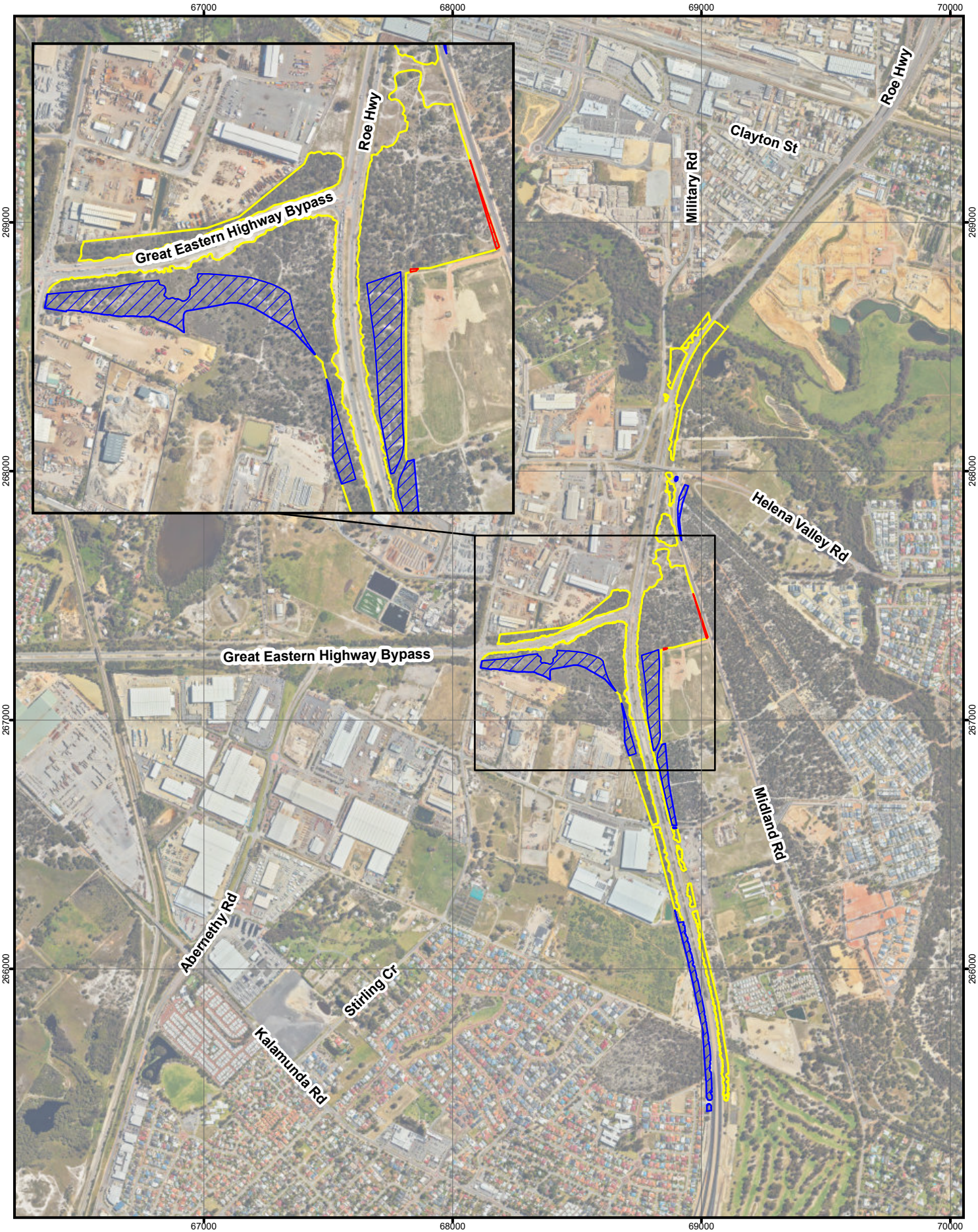
Environmental value with reduced impacts following redesign	Potential impact NVCP application October 2021	Potential impact revised NVCP application February 2022
Native vegetation	31.03 ha	23.31 ha
State listed *Banksia attenuata* woodlands over species rich dense shrublands TEC (FCT 20a)	9.49 ha	5.78 ha
Commonwealth listed Banksia Woodlands of the Swan Coastal Plain TEC (state listed Priority Ecological Community, PEC)	21.77 ha	14.94 ha
Black cockatoo foraging habitat	31.02 ha	23.24 ha
Trees with suitable DBH (> 500 mm) to form Black Cockatoo breeding hollows	211	119
Bush Forever Site 481	15.94 ha	12.75 ha
Bush Forever Site 122	0.01 ha	0 ha
Threatened Flora *Conospermum undulatum*	3	1
Priority Flora *Isopogon autumnalis*	112	27
Multiple Use Wetland UFI 15266	1.98 ha	0.91 ha

2.4.3 Further avoidance during design and construction

During detailed design and construction, Main Roads will consider the following measures to avoid and mitigate clearing:

- Use of retaining walls and steeper batter slopes
- Locating noise barriers adjacent to the road infrastructure rather than setback to the edge of road reserve
- Installing drainage basins within loop ramps, which are likely to be more heavily impacted by clearing and edge effects than outside the loops
- Implementing dieback management protocols that ensure dieback is not introduced or spread within the DE
- Demarcating the clearing area prior to commencing ground disturbing activities

- Retaining large trees where practicable and safe to do so, to provide ongoing fauna habitat and refuge
- Including environmental and heritage sensitivities and management controls in the site induction and daily pre-start meetings
- Highlighting clearing limits and sensitivities at daily pre-start meetings
- Retaining topsoil for rehabilitation, with dieback infested and non-infested soil stored separately.



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Datum: GDA 1994 Perth Coastal Grid 1994

0 100 200 300 400 500
metres

Data sources: Main Roads WA

LEGEND

- Area added since previous NVCP
- Area removed from previous NVCP
- NVCP extents (January 2022)

Changes to Development Envelope to avoid and minimise impacts

MAIN ROADS WA

GREAT EASTERN HIGHWAY BYPASS INTERCHANGES PROJECT

WP4 ROE HIGHWAY NVCP

Figure 3

Map Document: \\AUPER1pfiln001.na.aecomnet.com\local\Perth\Legacy\Projects\606X\60657311\900_CAD_GIS\920_GIS\APPS\FIGURES_APRX\ENVIRONMENT\APRXs\09_ENV_WPP4_NVCP_Figure_Calcs\G60657311_ENV_WP4_NVCP_Pro\G60657311_ENV_WP4_NVCP_Pro_V5.aprx (leiJ)

2.5 Approved Policies and Planning Instruments

The clearing of native vegetation in Western Australia is regulated under the EP Act and the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (Clearing Regulations).

In addition to the matters considered in accordance with section 51O of the EP Act (see Section 1.3), Main Roads has also had regard to the below instruments.

Other Legislation of relevance for assessment of clearing and planning/other matters

- *Aboriginal Heritage Act 1972* (WA)
- *Biodiversity Conservation Act 2016* (WA) (BC Act)
- *Conservation and Land Management Act 1984* (WA) (CALM Act)
- *Country Areas Water Supply Act 1947* (WA) (CAWS Act)
- *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act)
- *Planning and Development Act 2005* (WA) (P&D Act)
- *Soil and Land Conservation Act 1945* (WA)
- *Rights in Water and Irrigation Act 1914* (WA)
- *Town Planning and Development Act 1928* (WA).

Other Relevant policies and guidance documents:

- Environmental Offsets Policy (Government of Western Australia, 2011)
- A guide to the assessment of applications to clear native vegetation (DEC, 2014)
- Procedure: Native vegetation clearing permits (DWER, 2019)
- Environmental Offsets Guidelines (Government of Western Australia, 2014)
- Technical guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016)
- Technical guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA, 2020)
- Approved Conservation Advice for *Calyptorhynchus banksii naso* (Forest Red-tailed Black Cockatoo) (DoE 2009)
- Approved Conservation Advice for *Calyptorhynchus baudinii* (Baudin's Cockatoo) (TSSC 2018a)
- Approved Conservation Advice for *Westralunio carteri* (Carter's Freshwater Mussel) (TSSC 2018b)
- Approved Conservation Advice for *Banksia Woodlands of the Swan Coastal Plain ecological community* (TSSC 2016)
- Carnaby's Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan (DPaW 2013)
- Forest Black Cockatoo (Baudin's Cockatoo *Calyptorhynchus baudinii* and Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*) Recovery Plan (DEC 2008)
- EPBC Act Referral guidelines for three black cockatoo species: Carnaby's cockatoo, Baudin's cockatoo and Forest red-tailed black cockatoo (DSEWPaC 2012)
- Perth and Peel @ 3.5 Million: Environmental impacts, risks and remedies (EPA 2015).

3. Summary of Surveys

3.1 Biological Survey

Biota (2021) conducted a biological survey of the Great Eastern Highway Bypass Interchanges (Roe Highway and Abernethy Road) Project Area between October 2019 and May 2020. Additional sampling and resampling of selected quadrats was conducted over a four-day field survey in November 2020 (Biota 2021).

The biological survey included two survey areas (Level 1 and Level 2) with different scopes of works (Figure 2). Level 1 survey area (169.9 ha) was subject to a desktop study, a reconnaissance flora and vegetation survey and targeted significant flora survey (Figure 2). For the purposes of the desktop study, a 5km buffer zone was applied for conducting database searches. The Level 2 survey area (190.6 ha) was subject to a desktop study, detailed vegetation survey, targeted significant flora and weed searches and TEC/PEC assessment (Figure 2). The biological survey also included fauna habitat mapping, installation of motion cameras within the Level 2 survey area, and targeted surveys for Black Cockatoos and Carter's Freshwater Mussel (*Westralunio carteri*).

3.1.1 Vegetation

The DE contains pre-European Vegetation Associations (VA) 1001, described as 'medium very sparse woodland; Jarrah, with low woodland; Banksia and Casuarina', and 1009, described as 'medium woodland; Marri and River Gum' (GoWA 2019a). Table 2 provides a summary of the VAs occurring within the DE and an overview of their condition (Biota 2021).

Table 2 - Summary of Development Envelope Mapped Pre-European Vegetation Associations

Pre-European Vegetation Association(s)	Extent within the DE	Vegetation Condition	Comments
Vegetation Association 1001 described as a medium very sparse woodland; Jarrah, with low woodland; Banksia & Casuarina (GoWA, 2019a)	22.22 ha	The vegetation condition is completely degraded to very good.	Vegetation description and condition determined from biological survey (Biota 2021).
Vegetation Association 1009 described as Medium woodland; Marri and River Gum (GoWA, 2019a)	1.08 ha	The vegetation condition is completely degraded to very good.	Vegetation description and condition determined from biological survey (Biota 2021).

The regional and local extent of each VA remaining is presented in Table 3, along with the amount remaining that is protected within DBCA managed lands.

Table 3 - Pre-European Vegetation Representation (GoWA, 2019a)

Vegetation Association	Scale	Pre-European Extent (ha)	Current Extent (ha)	Remaining (%)	Current extent within DBCA Managed Lands (%)	Extent within DE (ha)	% of current extent within the DE	Current extent after implementation of Proposal (ha)	Current extent remaining after implementation of Proposal (%)
1001	State: WA	57,410.23	12,660.76	22.05	3.13	22.22	0.18	12,638.54	22.01
	IBRA Bioregion Swan Coastal Plain	57,410.23	12,660.76	22.05	3.13	22.22	0.18	12,638.54	22.01
	LGA City of Kalamunda	1,473.91	111.08	7.54	0	0.49	0.72	110.59	7.46
	LGA Shire of Mundaring	51.25	6.54	12.76	0	1.87	28.60	4.67	9.11
	LGA City of Swan	8,868.19	2,321.48	26.18	1.04	19.86	0.86	2,302.02	26.96
1009	State: WA	18,255.88	3,004.07	16.48	0.59	1.08	0.04	3,002.99	16.45
	IBRA Bioregion Swan Coastal Plain	18,184.82	2,983.06	16.40	0.59	1.08	0.04	2,981.98	16.40
	LGA Shire of Mundaring	317.24	15.81	4.98	0	1.08	6.81	14.73	4.64
	LGA City of Swan	8,519.91	378.76	4.45	0.48	0.00	0.00	378.76	4.45

Heddle et. al. (1980) defines two Vegetation Complexes occurring within the DE (Table 4) based on vegetation in association with landforms and underlying geology including:

- Forrestfield Complex (12.19 ha of native vegetation in the DE)
- Southern River Complex (11.12 ha of native vegetation in the DE)

Whilst the pre-European extent of the Guildford vegetation complex intersects the DE, no remnant native vegetation representative of this complex was present.

Table 4 - Summary of Development Envelope Mapped Pre-European Vegetation Associations (Government of Western Australia. (2019))

Heddle/Mattiske Veg Complex	Pre-European Extent (ha)	2018 Vegetation Extent	% Remaining
Forrestfield Complex	22,812.92	2,803.36	12.33
Southern River Complex	58,781.48	10,832.18	18.43
Swan Complex	15,194.13	2,062.03	13.57

Biota (2021) identified nine native vegetation communities within the DE, totalling an area of 23.31 ha. The remaining 44.76 ha of the 77.19 ha DE is comprised of planted and revegetated areas and cleared or developed land. The vegetation types identified within the DE are described in Table 5 and shown in Figure 4.

None of the native vegetation was assessed to be in Pristine condition. Vegetation condition within the DE ranged between Excellent to Degraded (Figure 5). These calculations do not include vegetation described as cleared or completely degraded.

Table 5 - Vegetation types and condition identified within the DE

Vegetation Code (Biota, 2021)	Vegetation description	Vegetation Condition	Area (ha)	%
L3 – Marri over Melaleuca Low Open Woodland on Clay Pits	*Corymbia calophylla* open woodland over *Melaleuca rhaphiophylla* low open forest over **Bromus diandrus*, **Briza maxima*, *Briza minor, **Ehrharta calycina*, *Avena fatua very open tussock grassland over *Schoenus clandestinus*, *Juncus articulates*, *Juncus capitatus*, *Isolepis cernua* var. *setiformis* sedgeland over *Cycnogeton huegelii* scattered herbs.	Degraded	0.15	0.22
L5 - Jacksonia over Xanthorrhoea with Sedges	*Jacksonia floribunda* scattered tall shrubs over *Xanthorrhoea preissii*, *Melaleuca seriata* open shrubland over **Ehrharta calycina*, **Pentameris pallida* scattered grasses over *Lyginia barbata,* (*Lyginia imberbis*) open sedgeland over *Alexgeorgea nitens*, (*Dasypogon bromeliifolius*, **Ursinia anthemoides*) herbland	Good	0.08	0.12
P1 - Allocasuarina and Banksia over Xanthorrhoea with Sedges	*Allocasuarina fraseriana* open woodland over *Eucalyptus todtiana*, *Banksia menziesii* (*Banksia attenuata*) low woodland over *Jacksonia floribunda* scattered tall shrubs over *Xanthorrhoea preissii* open shrubland over *Hibbertia hypericoides* subsp. *hypericoides*, *Bossiaea eriocarpa*, *Stirlingia latifolia*, *Scaevola* repens var. repens low open shrubland over *Mesomelaena pseudostygia*, *Lyginia barbata* very open sedgeland over *Alexgeorgea nitens* very open herbland.	Excellent to Degraded	15.27	22.43
P2 - Marri over Kingia australis with Sedges	*Corymbia calophylla* low open woodland over *Kingia australis* tall open shrubland over *Xanthorrhoea preissii* open shrubland over *Verticordia densiflora*, *Banksia dallanneyi* var. *dallanneyi*, *Stirlingia latifolia* low shrubland over *Caustis dioica*, *Mesomelaena pseudostygia*, M. *tetragona*, *Lyginia imberbis*, *Patersonia occidentalis* var. *occidentalis* open sedgeland over *Alexgeorgea nitens*, *Desmocladus fasciculatus* very open herbland.	Excellent to Very Good	0.35	0.51
P3 - Flooded Gum over Weedy Grasses on Floodplain	*Eucalyptus rudis* subsp. *rudis* open forest over **Bromus diandrus*, **Avena fatua*, **Ehrharta longiflora* grassland over **Fumaria capreolata* herbland.	Excellent to Degraded	2.35	3.45

Vegetation Code (Biota, 2021)	Vegetation description	Vegetation Condition	Area (ha)	%
P4 - Eremaea Open Heath	*Jacksonia floribunda* tall shrubs over *Eremaea pauciflora* open heath over *Astroloma xerophyllum* low open shrubs over *Lyginia imberbis* open sedgeland.	Excellent to Very Good	0.37	0.54
P5 - Jarrah over Xanthorrhoea with Mixed Shrubs and Herbs	*Eucalyptus marginata* subsp. *marginata* open forest over *Adenanthos cygnorum*, *Xanthorrhoea preissii* tall open shrubland over *Hibbertia hypericoides*, *Gompholobium tomentosum* scattered low shrubs over **Eragrostis curvula*, **Briza maxima* very open grassland over *Lyginia barbata*, *Lomandra preissii* scattered sedges over *Alexgeorgea nitens* open herbland.	Very Good to Degraded	1.99	2.92
P6 - Flooded Gum over Weedy Understorey on Riverbank	*Eucalyptus rudis* subsp. *rudis* open forest over *Melaleuca rhaphiophylla* low open woodland over **Ehrharta longiflora*, **Bromus diandrus* open grassland over **Fumaria capreolata*, *Cycnogeton huegelii* open herbland.	Good to Degraded	0.12	0.18
P7 - Jarrah and Banksia over Xanthorrhoea with Sedges	*Eucalyptus marginata* subsp. *marginata*, *Banksia attenuata, Allocasuarina fraseriana* and *Banksia menziesii* low open woodland over *Xanthorrhoea preissii*, *Allocasuarina humilis* open shrubland over *Dasypogon bromeliifolius*, *Hibbertia hypericoides*, *Bossiaea eriocarpa*, *Banksia dallanneyi* var. *dallanneyi* low open shrubland over *Mesomelaena pseudostygia*, *Schoenus efoliatus* very open sedgeland over *Alexgeorgea nitens* scattered herbs.	Excellent to Good	2.62	3.85

3.1.2 Significant Ecological Communities

Biota (2021) undertook a floristic analysis of quadrat data to assist with determining the Floristic Community Types (FCT) within their Level 2 survey area. The floristic analysis confirmed that two state-level TECs occurred within the Level 2 survey area i.e. *'Banksia attenuata* woodlands over species rich dense shrublands' (FCT 20a); and 'Shrublands and woodlands of the eastern side of the Swan Coastal Plain' (FCT 20c). In addition, several FCTs were identified within or adjacent to the DE that are associated with the EPBC Act listed Banksia Woodlands of the Swan Coastal Plain TEC that is also a state listed PEC (Table 6).

Both the State '*Banksia attenuata* woodlands over species rich dense shrublands' (FCT 20a) and 'Shrublands and Woodlands of the eastern swan coastal plain' (FCT20c) TECs are components of the Commonwealth 'Banksia Woodlands of the Swan Coastal Plain' TEC. The 'Shrublands and Woodlands of the eastern swan coastal plain' (FCT20c) TEC is also listed separately under the EPBC Act.

As outlined in Section 2.4, the Proposal has been re-designed to avoid the Critically Endangered FCT 20c and reduce disturbance of the Endangered FCT 20a (Figure 6).

Table 6 - FCTs associated with Banksia Woodlands of the Swan Coastal Plain

Floristic Community Type Name	Floristic Community Type (Gibson et al. 1994)	State Listing	Area within DE (ha)
Banksia attenuata woodlands over species rich dense shrublands	FCT 20a	Threatened (Endangered)	5.78
Eastern shrublands and woodlands	FCT 20c	Threatened (Critically Endangered)	0.00
Low lying *Banksia ilicifolia* woodlands	FCT 21c	Priority 3	2.53
Central *Banksia attenuata* – *Banksia menziesii* woodlands	FCT 23a	Priority 3 (as part of Banksia woodlands of the Swan Coastal Plain PEC)	6.17
Spearwood *Banksia attenuata* or *Banksia attenuata* – Eucalyptus woodlands	FCT 28	Priority 3 (as part of Banksia woodlands of the Swan Coastal Plain PEC)	0.46

3.1.3 Flora

A desktop review by Biota (2021) indicated that a total of 24 Threatened flora species and 43 Priority flora species potentially occur within a five-kilometre radius of the DE. In the Level 2 survey area, Biota (2021) recorded a total of 287 native vascular flora taxa, representing 145 genera and 53 families, and an additional 96 species of introduced flora. A targeted Threatened and Priority flora search confirmed the presence of four significant flora species with the DE (Table 7) (Figure 7). A fifth species, *Verticordia lindleyi subs. lindleyi* has been entirely avoided by the DE (Figure 6). Of the 96 introduced species recorded, one (**Asparagus asparagoides*) is classified as a Weed of National Significance (WoNS) and a Declared Pest and one (**Zantedeschia aethiopica*) as Declared Pest.

Table 7 - Significant flora species within the DE

Species Name	Cons.Code	Number of occurrences within DE (Biota 2021)
Conospermum undulatum	Vulnerable (EPBC Act) Threatened (BC Act)	One individual
Johnsonia pubescens subsp. cygnorum	Priority 2	Two individuals
Isopogon autumnalis	Priority 3	Approximately 27 individuals
Hypolaena robusta	Priority 4	Two individuals

3.1.4 Fauna

Biota (2021) identified four fauna habitats within the DE (Table 8, Figure 8).

Table 8 - Fauna habitats mapped within the Development Envelope

Habitat Description	Conservation significant species potentially utilising habitat	Mapped within DE (ha)	Extent within DE (%)
Banksia woodland with scattered Eucalyptus / Marri	Black Cockatoos, Quenda	20.18	29.65%
Fabaceous heathland	Black Cockatoos, Quenda	0.44	0.65%
Flooded Gum over grasslands	Black Cockatoos, Quenda	2.35	3.45%
Wetlands / River	Black Cockatoo	0.27	0.40%
Total		23.24	34.14%

Biota (2021) recorded a total of 62 species of fauna within the survey area, comprising seven mammal species, 49 birds, five reptiles and one amphibian. Three significant fauna species were recorded. Biota (2021) made direct observations of the Endangered Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), the Vulnerable Forest Red Tailed Black Cockatoo (*Calyptorhynchus banksii naso*), and the Priority 4 mammal species Quenda (*Isoodon fusciventer*). Potential Black Cockatoo habitat was subject to a subsequent targeted survey (Section 3.1.5). Suitable Quenda habitat in the DE comprised Banksia Woodland with scattered Eucalyptus/Marri, Flooded gum over grassland and Fabaceous heathland. None of the remaining fauna species were considered to be conservation significant.

3.1.5 Targeted Black Cockatoo Assessment

Biota (2021) undertook a targeted survey for Black Cockatoo habitat. Biota (2021) recorded five direct observations of Carnaby's Black Cockatoos within the DE, specifically within the interchange area. The survey recorded 1,641 trees within the survey area with suitable DBH (>500mm) to form black cockatoo breeding hollows in the future, with 119 trees occurring within the DE. Four trees with existing hollows potentially suitable for use for breeding by Black Cockatoos were identified within the survey area, however none of these were located within the DE.

Two mapped fauna habitats inside the DE were considered suitable for black cockatoo foraging, including Banksia woodlands with scattered Eucalyptus/Marri and Fabaceous heathland. Biota (2021) mapped a total of 23.24 ha of black cockatoo foraging habitat within the DE. Of this, 20.62 ha is of high quality and the remaining 2.62 ha is habitat that may occasionally be used for foraging, despite no evidence being recorded during the survey (Biota 2021).

3.1.6 Targeted Carter's Mussel Assessment

Biota (2021) undertook a targeted survey of the section Helena River intersecting the survey area to determine the presence of the Carter's Freshwater Mussel (*Westralunio carteri*), listed as Vulnerable under the EPBC Act and the BC Act. The survey included dip netting and in-situ visual observations of habitat suitability based on known habitat characteristics at 12 sites within and downstream of the DE. An additional two sites located 2.5 km west and 5 km west of the Lloyd Street bridge, where populations have been previously recorded, were inspected as reference sites.

Biota (2021) concluded that the degraded and turbid nature of this section of the Helena River was unlikely to represent optimal habitat for the Carter's Freshwater Mussel. No Carter's Freshwater Mussels were observed in the DE and are considered unlikely to occur based on the degraded nature of the habitat and the searches undertaken.

3.2 Wetland assessment

A wetland management category is assigned to a wetland based on the evaluation of it attributes, functions and values. A Conservation Category Wetland (CCW) supports a high level of attributes and functions and is the highest priority wetland. A Multiple Use Category Wetland (MUW) contains few remaining important attributes and functions. The DE overlaps 0.91 ha of native vegetation within MUW and 2.47 ha within CCW (Figure 9). The vegetation condition of each wetland is described in Table 9.

Table 9 – Wetland vegetation

Wetlands Classification	Identification code	Wetland description	Extent within DE (ha)	% of DE	Vegetation types	Vegetation condition (Biota 2021)
Conservation Category	UFI 15440	Where Roe Highway bridge crosses Helena River north of the Roe Highway and Bushmead Road intersection.	2.47 ha	3.20%	L3, P3, P6	• Degraded (1.30 ha) • Good (0.65 ha) • Excellent to Very Good (0.52 ha)
Multiple Use	UFI 15266	Southwest of the Roe Highway and Great Eastern Highway Bypass intersection. The portion of the wetland that intersects the DE is largely within Bush Forever Site 481. The wetland is associated with the FCT20a *Banksia attenuata* woodlands over species rich dense shrublands TEC	0.91 ha	2.57%	P4, L5, P1, P2	• Very Good (0.26 ha) • Very Good to Good (0.23 ha) • Excellent to Very Good (0.96 ha)

3.3 Bush Forever Sites

Bush Forever protects regionally significant bushland within the Swan Coastal Plain portion of the Perth metropolitan area and aims to protect a comprehensive representation of all ecological communities originally occurring in the region (GoWA, 2000).

Bush Forever Site 481 (Stirling Court Bushland) occurs within the DE, comprising 12.75 ha of native vegetation). There is no impact to Bush Forever Site 213 (Bushmead Bushland) or Bush Forever Site 122 (Hawkevale Bushland) which are located immediately adjacent to the DE.

Table 10 below shows the current extent and the percentage reduction in area of Bush Forever Sites 481 as a result of implementation of the Proposal.

Table 10 – Bush Forever sites mapped within DE

Bush Forever Sites	Current Extent (ha)	Area within DE (ha)	% Reduction
Bush Forever Site 481	51.17	12.75	24.92%

Bush Forever Sites	Current Extent (ha)	Area within DE (ha)	% Reduction

Vegetation within Bush Forever Site 481 is comprised of the following FCT's within the DE

- Total of 3.78 ha of FCT20a in the following condition:
  - 2.46 ha of 'Excellent to Very Good' condition vegetation.
  - 0.40 ha of 'Very Good' condition vegetation.
  - 0.89 ha of 'Good' condition vegetation.
  - 0.03 ha of 'Degraded' condition vegetation.
- Total of 2.43 ha of FCT21c of 'Good' condition vegetation
- Total of 4.03 ha of FCT23a in the following condition:
  - 0.08 ha of 'Excellent to Very Good' condition vegetation
  - 3.91 ha of 'Very Good' condition vegetation.
  - 0.03 ha of 'Good' condition vegetation.
- Total of 0.24 ha of FCT28 of 'Excellent to Very Good' condition

Bush Forever Site 481 is already fragmented by the existing Roe Highway alignment, the Proposal will reduce the size of the both east and west patches.

3.4 Dieback survey

Glevan Consulting (2020) conducted a dieback survey in August 2020. As the design has progressed since the survey was completed, a small portion (1.43 ha) of the DE located adjacent to Military Road was not surveyed, however given adjacent mapping, would be expected to be classified as Excluded. Approximately 6.50 ha of the DE was mapped as 'Infested' with *Phytophthora* dieback (Table 11). Areas adjacent to Roe Highway south of Adelaide Street and in the southwest quadrant of the interchange were mapped as infested, along with the fringes of bushland between Roe Highway and Midland Road (Figure 11).

A further 4.86 ha was mapped as 'Uninfested Protectable' (Table 11 and Figure 10). An additional 2.25 ha was mapped as 'Uninfested Unprotectable' (Table 11). A further 0.58 ha was mapped as temporarily uninterpretable (TUI) due a fire disturbance (Glevan Consulting 2020).

Table 11 – Dieback Status

Dieback Status	Extent within survey area (ha)	Extent within DE (ha)
Infested	13.08	6.50
Uninfested Protectable	5.72	4.86
Uninfested Unprotectable	4.15	2.25
Excluded	97.33	52.44
TUI	0.58	0.58
Total Mapped	120.86	68.07

* 1.43 ha of the DE was not surveyed by the dieback survey, but is considered to be Excluded

Dieback indicator species correspond with those occurring within the Banksia Woodlands of the Swan Coastal Plain TEC and its associated Floristic Community Types (FCT). Within the DE, a total of 4.12 ha of the EPBC listed Banksia Woodlands of the Swan Coastal Plain TEC was mapped as 'Infested' (Table 12). This includes 1.13 ha of FCT21c and 2.46 ha of FCT23a. The dieback status of each FCT occurring within the DE is provided in Table 12.

Table 12 – Floristic Community Type Dieback Status within DE

FCT	Infested	Uninfested Protectable	Uninfested Unprotectable	Excluded	TUI
FCT 20a	0.10	2.35	1.24	2.06	0.00
FCT 20c	0.00	0.00	0.00	0.00	0.00
FCT 21c	1.13	1.35	0.00	0.00	0.00
FCT 23a	2.46	1.05	0.92	1.15	0.58
FCT 28	0.43	0.00	0.00	0.04	0.00

4. Assessment against the ten clearing principles

In assessing whether the Proposal's proposed clearing is likely to have a significant impact on the environment, the Proposal was assessed against the ten clearing principles (EP Act 1986, Schedule 5).

Each principle was assessed in accordance with DWER's 'A Guide to the Assessment of Applications to Clear Native Vegetation' (DER 2014).

The proposed clearing is considered to be at variance with five principles (a, b, c, d, f), is not likely to be at variance to three principles (g, i and j) and is not at variance with the clearing principles e and h.

(a) Native vegetation should not be cleared if it comprises a high level of biological diversity

Comments	Proposed clearing is at variance to this Principle

The Proposal involves the clearing of up to 23.31 ha of native vegetation (Figure 4) comprising 9 vegetation types (Table 5). The condition of native vegetation within the DE ranged from Excellent to Degraded (Table 5).

Approximately 14.94 ha of the DE comprised the EPBC Act listed '*Banksia Woodlands of the Swan Coastal Plain*' TEC (Endangered), which is also a Priority 3 PEC in WA. As a result of design changes and review, this was reduced in February 2022 down by 25%, from 21.78 ha originally predicted in the October 2021 NVCP application.

The 14.94 ha of *Banksia* Woodlands includes 5.78 ha of the State BC Act listed '*Banksia attenuata woodlands over species rich dense shrublands*' TEC (FCT20a) (Endangered) and 2.53 ha of P3 PEC Low lying *Banksia attenuata* woodlands or shrublands (FCT21c). The area of impact to FCT20a was reduced by 39%, down from 9.49 ha of FCT20a as a result of design changes to minimise clearing.

Biota 2021 mapped 105.94 ha of FCT20a within the broader survey boundary, including areas inferred to be the TEC based on aerial extrapolation. The Proposal will reduce the known extent of FCT20a within the survey area by 5.46%.

Biota (2021) mapped 2.55 ha of FCT21c within the survey area, 99% of which will be cleared.

Conservation significant flora in the DE with potential to be cleared are summarised in the table below. For most of the species the proposed clearing represents a small proportion of the number of individuals recorded on Florabase and is therefore not likely to result in a significant impact to these species. The exception is *Johnsonia pubescens* subsp. *cygnorum* (Priority 2), which according to FloraBase is known from 18 records representing approximately 14 populations. The estimated total population size of *J. pubescens* subsp. *cygnorum* is 2,488 individuals, including approximately 1,919 individuals located at Perth Airport (pers comm. DBCA, 2021), 283 individuals in other populations and 286 individuals recorded as part of surveys along Tonkin Highway.

Species	No. of individuals in DE	Known abundance (WAH, 1998-)	Proportion in DE (%)
Conospermum undulatum (Threatened)	1	10,938	<0.01%
Hypolaena robusta (Priority 4)	2	17,369	0.01%
Isopogon autumnalis (Priority 3)	27	3,558	0.76%
Johnsonia pubescens subsp. *cygnorum* (Priority 2)	2	2,488	0.08%

The following significant fauna were recorded in the DE (Biota 2021):

- Carnaby's Black Cockatoo (*Calyptorhynchus latirostris* – EN)
- Forest Red-tailed Black Cockatoos (*Calyptorhynchus banksii naso* – VU)
- Quenda (*Isoodon fusciventer* – P4).

Approximately 23.24 ha of native vegetation potentially suitable for Black Cockatoo foraging was recorded within the DE (Biota 2021), comprising:

- Banksia woodland with scattered Eucalyptus / Marri
- Fabaceous heathland.
- Flooded Gum over grasslands (may occasionally be used for foraging by Black Cockatoos)
- Wetlands / River (may occasionally be used for foraging by Black Cockatoos).

Comments	Proposed clearing is at variance to this Principle
	There are 119 trees with suitable DBH (> 500 mm) to form Black Cockatoo breeding hollows at some time in the future occurring in the DE. No trees containing existing hollows of suitable size for Black Cockatoo nesting were recorded within the DE. Given the extent of TECs and PECs occurring in the DE, which range in condition from Excellent to Degraded, the presence of significant flora and fauna, and extent of potentially suitable Black Cockatoo foraging habitat, the area to be cleared is considered to comprise a high level of biological diversity. Consequently, clearing is considered to be at variance with this principle. Assessed outcome: The proposed clearing is at variance to this principle.
.Methodology	Biota (2021) DBCA shapefiles EPA (2016) Government of WA (2013) NatureMap (Accessed October 2020)

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

Comments	Proposed clearing is at variance to this Principle

The proposal involves clearing of up to 23.24 ha of native vegetation comprising four fauna habitat types (Biota 2021):

- Banksia woodland with scattered Eucalyptus / Marri
- Fabaceous heathland
- Flooded Gum over grasslands
- Wetlands / River.

Biota (2021) identified nine significant fauna species as potentially occurring within the survey area, based on a desktop review. This included one mammal, seven bird and one reptile taxa. Of these, three taxa were recorded within the survey area and DE.

- *Calyptorhynchus latirostris* (Carnaby's Black Cockatoo) – Endangered
- *Calyptorhynchus banksii naso* (Forest Red-Tailed Black Cockatoo) – Vulnerable
- *Isoodon fusciventer* (Quenda) – Priority 4.

The Carter's Freshwater Mussel was not recorded and is considered unlikely to occur in the DE due to the degraded condition of the river and high water turbidity (Biota 2021).

Black Cockatoos

The DE is located within the mapped distribution for the Carnaby's Cockatoo (*Calyptorhynchus latirostris*), Baudin's Cockatoo (*Calyptorhynchus baudinii*) and Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii subsp. naso*) (DSEWPaC 2012). Biota (2021) confirmed that Carnaby's Black Cockatoos and Forest Red-tailed black Cockatoos utilise habitat within the DE. GPS and satellite tracking data from Murdoch (2015) indicated that Baudin's Black Cockatoos are also likely to use habitat within the DE for foraging to support nearby roost sites. Baudin's Black Cockatoos were recorded within 200 metres of the Survey Area (Murdoch, 2015).

A total of 23.24 ha of potential Black Cockatoo foraging habitat is present within the DE. Of this habitat, a total of 20.62 ha was identified by Biota (2021) as being higher quality habitat, within which Black Cockatoos were observed. These habitat types include 'Banksia woodland with scattered Eucalyptus/Marri' and 'Fabaceous heathland'. The remaining 2.62 ha was noted to be suitable for occasional foraging by Black Cockatoos, and include 'Flooded gum over grasslands', and 'Wetlands/River'.

Dominant foraging species within the DE primarily include Marri (*Corymbia calophylla*), Jarrah (*Eucalyptus marginata*), *Banksia attenuata, Banksia menziesii* and *Xanthorrhoea preissii*. Flooded Gum (*Eucalyptus rudis*) was also recorded within the DE but is considered to provide only low foraging value to Black Cockatoos.

Within the Peel-Perth region, foraging and water resources within 6 km, as well as overlapping foraging within 12 km, is required to support roosting and breeding sites and maintain habitat connectivity so that movement can be facilitated through the landscape (EPA 2019).

A high proportion of potential Black Cockatoo foraging habitat in the local area is protected within DBCA managed reserves. Approximately 40 per cent of foraging habitat is located within DBCA managed reserves within 12 km (40.3 %) and 6 km (39.9 %) of the Proposal Area. Key DBCA managed land within 6 km of the DE containing potential foraging habitat include:

- Beelu National Park (154 ha)
- Greenmount National Park (174 ha)
- John Forrest National Park (135 ha)
- Gooseberry Hill National Park (32 ha)
- Talbot Road Nature Reserve (68 ha).

Breeding habitat for Black Cockatoos is defined as trees of a suitable species known to support breeding with a suitable nest hollow, or with a suitable diameter at breast height (DBH) so as to develop a nest hollow (DSEWPaC 2012). The DE contains a total of 119 trees with suitable DBH (> 500 mm) to form Black Cockatoo breeding hollows at some point in the future. This included 38 Marri, one Tuart, 49 Jarrah and 31 Flooded Gum. Of those, six trees contained at least one hollow; however none of these hollows were considered currently suitable for Black Cockatoo breeding due to being of insufficient size, location or the presence of

Comments	Proposed clearing is at variance to this Principle
	bees. Biota (2021) recorded an additional 1,432 trees outside and in close proximity to the DE, comprising 79 Marri, 51 Jarrah, 1,345 Flooded Gum, and six dead stag trees. The DE is within the known breeding range of Carnaby's Black Cockatoo with two confirmed breeding sites approximately 10 km east and 10 km southeast of the DE based on DBCA (2018) mapping. For Forest Red-tailed Black Cockatoos, the DE is outside the known breeding range, however there are recent records of the species breeding on the Swan Coastal Pain, approximately 30 km south of the DE (Kirkby 2019). The Proposal area is located in the mapped range of where Baudin's Cockatoo may breed (DSEWPaC 2012). There are a number of roosting sites located within the vicinity of the DE, however the DE itself is not considered to contain significant roosting habitat for any Black Cockatoo species. Biota (2021) did not record any evidence of roosting for any Black Cockatoo species within the survey area; however, GPS tracking data recorded by Murdoch (2015) indicated three key roosting areas for Baudin's Black Cockatoo within 6 km of the DE, with the closest being located approximately 600 m to the southeast. Data obtained through The Great Cocky Count (Peck, et al. 2019) indicated 14 roosting sites for white-tailed Black Cockatoos (including Carnaby's and Baudin's Black Cockatoos) existed within 12 km of the DE, along with 19 used by Forest Red-tailed Black Cockatoos. A further 12 joint roosting sites were confirmed within 12 km of the DE (Peck et. al. 2019). Forest Red-tailed Black Cockatoos have been shown to roost in Jarrah-Marri forest along the Darling Scarp, and forage on the Swan Coastal Plain during the day (Johnstone et al. 2010). The Proposal is therefore not considered to comprise suitable roosting habitat for the Forest Red-tailed Black Cockatoo. **Quenda** Quenda (*Isoodon fusciventer*) is listed as Priority 4 by the DBCA. Biota (2021) recorded evidence of Quendas throughout the DE via diggings, direct observations and recordings on motion activated cameras. Diggings were recorded within the 'Banksia Woodland with scattered Eucalyptus/Marri' habitat type within the DE. Suitable Quenda habitat in the DE comprised Banksia Woodland with scattered Eucalyptus/Marri, Flooded gum over grassland and Fabaceous heathland. A total of 29.73 ha of potentially suitable Quenda habitat exists within the DE. The majority of this habitat available exists within existing road verges, which are not expected to comprise preferred habitat in the wider context. Assessed outcome: The proposed clearing is at variance to this principle
Methodology	Biota (2021) DBCA Shapefiles DBCA website EPA (2016, 2020) Peck et al 2019 DSEWPaC (2012)

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

Comments	Proposal is at variance to this Principle
	The Biota 2021 desktop assessment found a total of 24 Threatened flora species and 43 Priority species occurring or potentially occurring within five kilometres of the DE. A Targeted Threatened and Priority flora (TPFL) search confirmed the presence of three individuals of one Threatened flora species (*Conospermum undulatum*) within the DE (Figure 6). Three *Conospermum undulatum* individuals were recorded within vegetation type P7, of which one is located within the DE. This vegetation type is not restricted to the DE. The removal of one individual of *Conospermum undulatum* represents a 0.01% impact of the currently known total number of individuals of the taxon, impacting one known population of the species. This one individual is likely to form part of TPFL Population 23 (three individuals). Due to design changes there is no impact to TPFL Population 2, with the majority of the population occurring within Bush Forever site 122 to the west of the DE. Assessed outcome: The proposed clearing is at variance to this principle
Methodology	Biota (2021) DBCA shapefiles EPA (2016) Strategen (2020)

(d) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community.

Comments	Proposal is at variance to this Principle
	One threatened ecological community listed under the BC Act (also listed under Commonwealth EPBC Act) has been recorded in the DE (Biota 2021): • *Banksia attenuata* woodlands over species rich dense shrublands (FCT20a) (Endangered) (5.78 ha) Based on the associations between the TEC and vegetation mapping by Biota (2021) FCT20a tends to be associated with mapped vegetation types L5, P1, P2 and P7. In the southern portion of the DE to the east of Roe Highway, clearing of this TEC will be limited to smaller patches along the road reserve. Two larger portions of the TEC located to the east of the intersection of Roe Highway and Great Eastern Highway Bypass have been excised from the DE, as a result of realigning the PSP. These areas of the State listed TEC are 1.77 ha (area excised from the DE) and 3.0 ha (area adjacent to the DE to the south of the intersection). The disturbance width for the PSP will be less than 30 m, which is the minimum distance for a gap between patches (TSSC 2016). As such, following the clearing the retained vegetation will continue to represent one single patch of TEC, approximately 4.78 ha in size. Banksia woodland, which is classified under the EPBC Act as Endangered TEC, has been recorded within the DE. However noting that this is not a state listed TEC, impacts to this community have been described under Principle (a). Assessed outcome: The proposed clearing is at variance to this principle
Methodology	Biota (2021) DBCA shapefiles EPA (2016)

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

Comments	Proposal is not at variance to this Principle
	The National Objectives and Targets for Biodiversity Conservation 2001-2005 (Commonwealth of Australia, 2001) recognises that the retention of 30% or more of the pre-clearing extent of each ecological community is necessary if Australia's biodiversity is to be protected. Given that the DE is within the constrained Swan Coastal Plain area, retention objectives of 10 % apply (EPA, 2016). Summary of the DE's Mapped Pre-European Vegetation Associations is presented in Table 2 and Pre-European Vegetation Representation in Table 3. The DE is mapped as containing Vegetation Associations (VA) 1001 and 1009. These are described as 'medium very sparse woodlands; Jarrah, with low woodland; Banksia and Casuarina' and 'Medium woodland; Marri and River Gum'. The Proposal will reduce VA 1009 and VA 1001 by up to 0.04% and 0.18%, respectively, within the SCP IBRA region. The SCP IBRA region scale extent for both VA 1001 and VA1009 is over the EPA (2015) 10% retention specification, with VA1001 remaining at 22.01% and VA 1009 at 16.40%. Three Heddle/Matiske complexes occur within the DE, the Forrestfield Complex, Southern River Complex and Swan Complex. Clearing associated with the Proposal will not cause a significant reduction to any of these (Table 3). The extent of all complexes will remain above the 10% retention objective. Assessed outcome The proposed is not at variance principle
Methodology	Biota (2021) DBCA shapefiles EPA (2016)

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

Comments	Proposal is at variance to this Principle
	Two geomorphic wetlands intersect the DE, CCW Helena River (UFI 15440) and MUW Helena River Floodplain (UFI 15266) (Figure 9). The portion of the MUW wetland that intersects the DE is largely within Bush Forever site 481. The wetland is associated with the FCT23a *Central Banksia attenuata – Banksia menziesii woodlands* The Proposal is located within the Development Control Area designated under the Swan and Canning Rivers Management Act 2006 and subject to State Planning Policy 2.10 Swan-Canning River System. A CCW is considered a significant wetland (DER 2014). There is 6.58 ha of mapped geomorphic wetland within the DE, of which 3.38 ha currently supports native vegetation. Clearing of up to 2.47 ha of native vegetation is associated with CCW UFI 15540 and up to 0.91 ha associated with MUW UFI15266. The vegetation types and condition present are shown in Table 8. It is noted that the existing Roe Highway already crosses the CCW Helena River and that native vegetation within the DE was previously impacted by the Roe Highway and Great Eastern Bypass alignment. In total, 1.30 ha (19.76%) of wetland associated native vegetation is considered to be in 'Degraded' condition. A total of 1.17 ha and 0.91 ha of native vegetation in Good or better condition is proposed to be cleared at the CCW and MUW respectively. The EPA considers CCWs to be of high conservation significance requiring a high level of protection, for which clearing of native vegetation is considered a significant impact (EPA 2008). Clearing of vegetation associated with a wetland will be avoided as far as possible. Measures to limit the impacts on the Helena River have been incorporated in the Project EMP and road and bridge design. Drainage design will ensure that surface runoff is infiltrated at source, wherever possible. Any road runoff that is captured by kerbs will be contained within retention basins that are designed to treat first flush and then overtop and allow natural flows to be maintained into CCW. Sites surveyed for Carter's Freshwater Mussel (Biota 2021) indicated that the section of Helena River within the survey area including parts of the CCW was degraded and weed-choked, with high water turbidity. The Proposal has been designed to maintain and improve the drainage environment associated within the existing alignment of Roe Highway and retain flow into the Helena River. It is therefore unlikely that the Proposal will have a significant impact on the Helena River. Assessed outcome The proposed clearing is at variance to this principle
Methodology	Biota (2021) DBCA shapefiles EPA (2016)

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

Comments	Proposal is not likely to be at variance to this Principle
	The DE is located within the Pinjarra and Bassendean soil systems with a small portion of Roe Highway classified as Forrestfield. The soil systems are described as below: • Pinjarra soil system: poorly drained coastal plain with variable alluvial and aeolian soils, with variable vegetation including Jarrah, Marri, Wandoo, Paperbark sheoaks and Rudis. • Bassendean soil: sand dunes and sandplains with pale deep sand, semi-wet and wet soil, and vegetation including Banksia-paperbark woodlands and mixed heaths. • Forrestfield soil system: duplex sandy gravels, pale deep sands and grey deep sandy duplexes. Vegetation includes Woodlands of *E. marginata, Corymbia calophylla* and *E. wandoo* and sometimes *B. grandis* Most of the DE is mapped as having a moderate to low risk of acid sulfate soils (ASS) occurring within three kilometres of natural soil surface. The northern portion of the DE has no known risk of ASS. The table below summaries the soil degradation risk with the DE.

Aspect	Degradation risk
Wind erosion	High to extreme risk
Waterlogging	Moderate to very high risk
Water Erosion	High to extreme risk
Salinity	Moderate to high risk
Flood risk	Moderate to high risk

Comments	Proposal is not likely to be at variance to this Principle
	Erosion risks are manageable through the implementation of controls in construction, including hydro mulching and management of drainage through cleared areas. This will be covered in the Project EMP. Assessed outcome The proposed clearing is not likely to be at variance to this principle
Methodology	Natural Resource Management SLIP Soil Systems (Accessed May 2021)

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

Comments	Proposal is not at variance to this Principle
	A number of conservation areas exist within 6 km of the DE, including: • Beelu National Park • Gooseberry Hill National Park • Greenmount National Park • John Forrest National Park • Talbot Road Bushland • Talbot Road Nature Reserve (Bush Forever Site 306) • Nature Reserve R 49079 (Hawkesvale Bushland Nature Reserve) • Swan and Canning Rivers Management Area • Numerous DBCA-managed reserves on Crown land. The closest conservation area to the DE is the Hawkesvale Bushland Nature reserve, located on the corner of Adelaide Street and Roe Highway. This nature reserve is located adjacent to the DE. The DE is located within a mapped Regional Ecological Linkage that connects vegetation associated with the Helena River and nearby formal and informal reserves that include Beelu National Park and Gooseberry Hill National Park (Figure 12). As the DE is along an existing road, the retention of vegetation surrounding the DE will act to maintain that ecological linkage. Assessed outcome The proposed clearing is not at variance to this principle
Methodology	DBCA shapefiles EPA (2016)

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

Comments	Proposal is not likely to be at variance to this Principle
	Part of the DE is located within a MUW and CCW and is intersected by the Helena River (Figure 8). The Proposal will not significantly alter the hydrology of the area. During clearing and construction works, sediment management measures will be in place to prevent erosion and sedimentation of the Helena River. These measures are likely to include: sediment fences, hay bales and silt curtains. The risk of clearing of native vegetation causing surface water quality deterioration is considered minimal due to the largely linear nature of the clearing and the erosion control measures being implemented. Surface water flows will be maintained through construction of appropriate drainage infrastructure. The proposed native vegetation clearing is not expected to have an impact upon surface water and groundwater quality. Assessed outcome The proposed clearing is not likely at variance to this principle
Methodology	DWER and DBCA shapefiles EPA (2016)

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

Comments	Proposal is not likely to be at variance to this Principle
	The NRM SLIP identifies a moderate to high risk of flooding around the Roe Highway bridge, the Great Eastern Highway interchange and the southern extent of the Roe Highway upgrade. Only high intensity, prolonged rainfall events are considered as being likely to cause temporary and localised major surface flows and flood events. As the proposed clearing will largely occur as a linear strip and surface water flows will be maintained through construction of appropriate drainage infrastructure, the removal of vegetation is unlikely to cause or exacerbate flooding. Assessed outcome The proposed clearing is not likely at variance to this principle
Methodology	Natural Resource Management SLIP Soil Systems (Accessed May 2021)

5. Stakeholder Consultation

5.1 Stakeholder engagement

Main Roads has commenced consultation with key government stakeholders such as the DAWE (C'wth), DWER EPA Services Unit (WA) and DBCA (WA). Main Roads has also consulted the City of Swan, City of Kalamunda and Shire of Mundaring. Stakeholder and community engagement is continuing with landowners and local residents, communities of interest, local government authorities and State Government agencies. As other approvals from DBCA are required for Main Roads to undertake work within DBCA managed area, this consultation will be ongoing.

Main Roads will continue to work with DWER to identify a suitable offset package required to counterbalance significant residual impacts to State listed Threatened Ecological Communities and Black Cockatoo habitat.

A Community and Stakeholder Engagement Plan (CSEP) will be developed for this project which will determine the risks, expected issues and mitigation, communication activities and tools. This includes pre-construction communication and engagement to ensure directly impacted stakeholders have an understanding of the project prior to construction starting.

5.2 Consultation with Traditional Owners

In July 2020, Main Roads commissioned Brad Goode & Associates Pty Ltd (BGA) to conduct a Site ID Archaeological and Ethnographic Aboriginal Heritage Survey of the Roe Highway / GEHB Interchanges Project. BGA Archaeologists along with Whadjuk Noongar representatives undertook an archaeological survey of the area between 21st and 23rd July 2020. No archaeological material had been found. BGA advised that no archaeological material had been identified not because it was not there, but that it was likely that it could now not be seen due to extensive modification to the landscape, poor visibility, and natural processes that cover materials over time.

BGA undertook an ethnographic survey of the area with seven nominated representatives of the Whadjuk Working Party on 28th July 2020. This was followed by another ethnographic consultation with Whadjuk representatives undertaken by BGA on 26th August 2020.

During the consultations, the Whadjuk representatives reported that it was their belief that the Helena River (Site ID 3758) in its entirety was a sacred site associated with the Waugal, and that this deity was believed to be both responsible for the rivers' creation and the maintenance of its water and its flows. As such it was advised that, to protect this significance, it was the jural responsibility of the Whadjuk People to provide comments and advice to proponents to ensure that any activity that would impact this significance was done in a culturally appropriate manner.

During the consultations, the Whadjuk representatives advised that the plans to duplicate the bridge on Roe Highway would in their view directly and negatively impact upon the religious values held for the site. In relation to these effects, the Whadjuk representatives consulted were concerned that the bridge designs were not culturally appropriate and could block the flow of the waters of the Helena River with too many pylons in the rivers channel and floodplain, and that the abutment design could restrict the natural flood events along the river margins denying the riparian vegetation the waters that are required to sustain life.

In relation to the bridge, Main Roads advised that while they could make some adjustments to the pylon structures shape, they could not change the design greatly as the bridge design was constrained to fit in with what is already there so it would not be possible to remove the piers at this location.

BGA consultants advised that this issue could be managed by way of drafting a Cultural Heritage Management Plan in consultation with the Whadjuk working party at SWALSC, that could also include processes for the management of cultural material that is believed to be likely unearthed because of construction activities for the whole of the project. Here it was advised that it was the belief that the entire project area would need careful archaeological monitoring by Whadjuk People to properly identify archaeological material.

In terms of the balance of the project, the Whadjuk group advised that they supported the work as long as all Aboriginal sites and materials are properly managed and that Main Roads continue to consult with and work with the Whadjuk People working party administered by SWALSC.

BGA advised that any impact to the Registered Aboriginal Sites Helena River (Site ID 3758), Holding Paddock 1 – 4 (Site ID 3966), Helena River A – C (Site ID 3967), and lodged place Midland/Helena Valley Roads (ID 4337) will require consent under Section 18 of the *Aboriginal Heritage Act 1972* (WA) (AH Act). It was advised that Main Roads had no further obligations under the AH Act in relation to Great Eastern Highway/Stirling Crescent Scatter

(Site ID 16110), however there may be sub-surface material in the area and is thus included in this application. Consent under Section 18 of the AH Act was granted on the 25th May 2021.

6. Vegetation Management

Main Roads will avoid clearing native vegetation where possible. Where clearing cannot be avoided, clearing will be kept to a minimum. A project specific Environmental Management Plan (EMP) will be developed for the project, which includes measures to manage vegetation clearing and indirect impacts to vegetation during construction. Table 13 below summarises the impacts in this assessment and key management measures to be implemented.

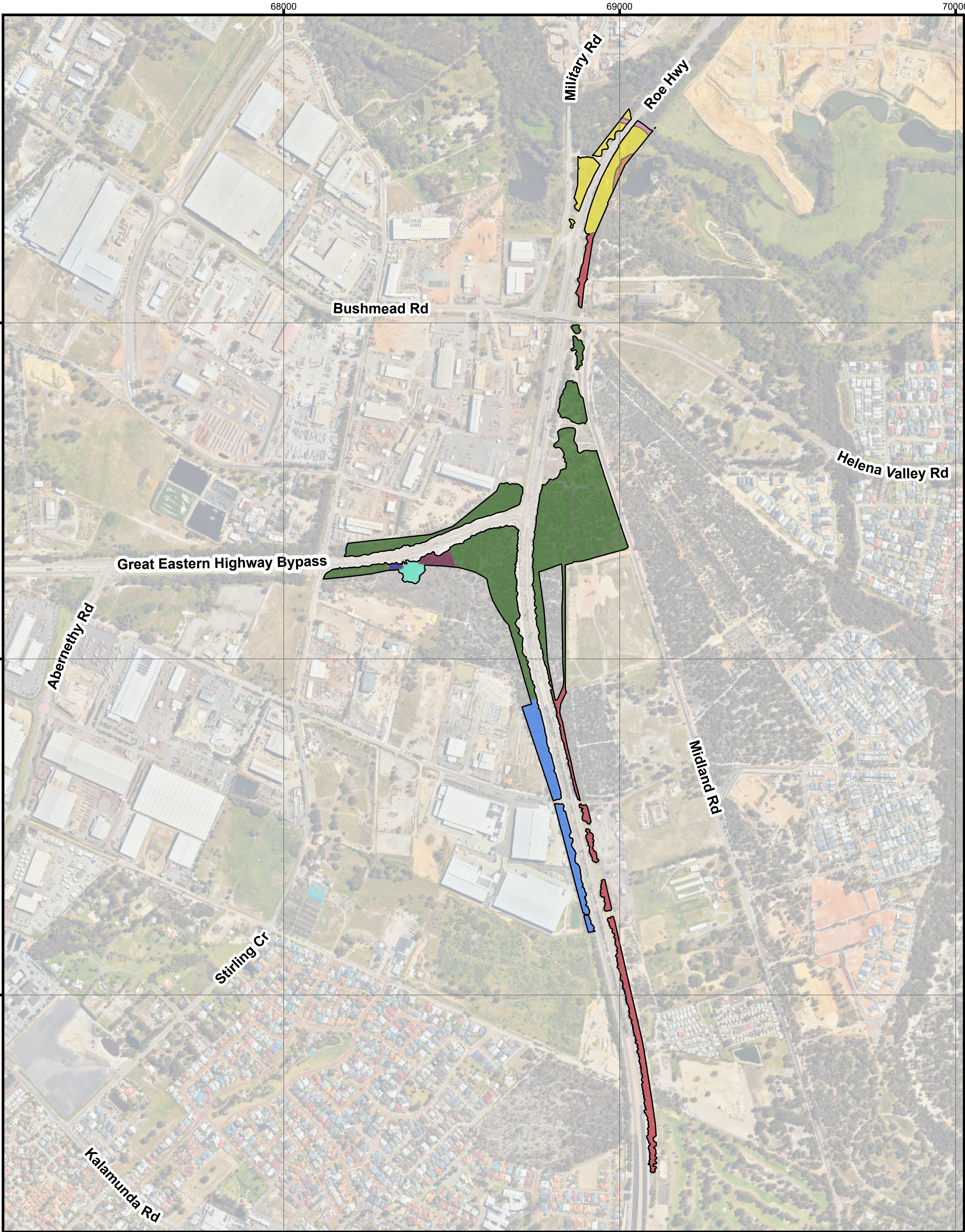
Table 13 – Key management measures to be implemented

Impact	Preparation	Response	Responsibility	Reporting
Unapproved clearing or damage to protected vegetation, threatened or endangered flora	• Clearly demarcate site boundaries prior to clearing and earthworks • Clearly demarcate clearing areas and brief site personnel • Identify/mark vegetation to be retained or that is protected • Identify species and vegetation that may be impacted or protected within the Project induction • Include requirements within construction planning documentation	• Immediately cease activities' • Report to Main Roads • Assess damage and implications to vegetation and the presence of any endangered or threatened communities, with Main Roads • Undertake an investigation to identify the root causes.	• Construction Supervisor • Site Environmental Officer • Project HSE Leader	• Site Environmental Officer to immediately inform Statutory Approvals and Environment Manager • Statutory Approvals and Environment Manager report incident to Main Roads • Main Roads to immediately inform EPA / DWER and follow statutory reporting requirements as per Section 12 of the EMP.
Injury or death to protected, endangered, or threatened fauna	• Identify potentially impacted species prior to commencement of construction and if required, build into an EMP • Identify species that may be impacted and include material within the Project induction • Review and inspect vegetation to be cleared prior to clearing; use an ecologist or spotter where there is the potential for endangered or threatened species • Conduct fauna trapping to remove ground dwelling fauna and include conditions to not disturb nesting bird species such as Black Cockatoos (if applicable) • Engage with local vet and/or native wildlife rehabilitation representative on the appropriate contact and procedure • Implement a site procedure for the short-term management of injured fauna.	• Immediately cease activities upon discovery of injured fauna and ensure safety • Implement procedure for short-term stabilisation and transport to vet or a native wildlife rehabilitation centre • Undertake additional vegetation inspection to identify any remaining fauna prior to restarting work and assess the need for additional traps.	• Construction Supervisor • Site Environmental Officer • Project HSE Leader	• Site Environmental Officer to immediately inform Statutory Approvals and Environment Manager • Statutory Approvals and Environment Manager report incident to Main Roads
Damage to temporary erosion and sediment	• Plan controls to be suitable for expected conditions	• A review of the site to be undertaken by the Project HSE Team	• Construction Supervisor	• Site Environmental Officer to immediately inform Statutory

Impact	Preparation	Response	Responsibility	Reporting
controls during rainfall	• Ensure sufficient materials, labour and plant are available for additional controls	• Consultants to repair or replace damaged controls within 24 hours of detection or immediately if inclement weather current.	• Project HSE Team • Consultants	Approvals and Environment Manager • Statutory Approvals and Environment Manager report incident to Main Roads •
Damage to sediment basin	• Check basins for suitability to Project requirements – such as size and treatment type • Design basin outlet to remain functional in a 1 in 20 ARI event • Ensure basin construction is in accordance with quality assurance requirements, including relevant inspection and test plans (ITPs).	• Pump water in damaged basin to another secure basin or discharge if the water meets the site criteria • Repair damage as soon as practical • Monitor the repairs when the basin is brought back online.	• Construction Supervisor • Project HSE Team	• Site Environmental Officer to immediately inform Statutory Approvals and Environment Manager • Statutory Approvals and Environment Manager report incident to Main Roads •
Stormwater	• Ensure material such as gravel, crushed rock and excavated material is stockpiled away from drainage paths and covered to prevent erosion. • Minimise exposed soil working surfaces and protect them from storm water erosion with suitable stabilisation methods. • Disturbed areas shall be stabilised soon after construction activities are completed.	• Take appropriate measures to contain turbidity and prevent sediment plumes from moving outside the immediate area of work. In the event that plumes or adverse turbidity occur beyond the work area, works shall cease until the issue has been resolved to the satisfaction of DBCA.	• Construction Supervisor • Site Environmental Officer	• Site Environmental Officer to immediately inform Statutory Approvals and Environment Manager • Statutory Approvals and Environment Manager report incident to Main Roads and DBCA
Weed Management	• Clearing and topsoil operations must be planned and integrated so as to prevent the spread or proliferation of weeds or diseases • Develop and implement a system of controls to prevent the introduction and spread of dieback and/or weeds within or adjacent to the Site • Development of a hygiene management plan to manage the potential introduction and spread of weeds and disease. This plan must	• Confirm dieback (*Phytopthora cinnamomi*) and weed status of the Project area • All machinery entering the Site must be cleaned of soil and plant debris	• Construction Supervisor • Site Environmental Officer • Project HSE Leader	• Site Environmental Officer to immediately inform Statutory Approvals and Environment Manager • Statutory Approvals and Environment Manager report incident to Main Roads

Impact	Preparation	Response	Responsibility	Reporting
	include precautions to be taken for the re-use of topsoil			

7. Constraints Mapping



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LEGEND

NVCP extents (January 2022)

Vegetation Communities

- L3
- L5
- P1
- P2
- P3
- P4
- P5
- P6
- P7

Vegetation Communities (Biota 2021)

MAIN ROADS WA

GREAT EASTERN HIGHWAY BYPASS INTERCHANGES PROJECT

WP4 ROE HIGHWAY NVCP

Figure

4

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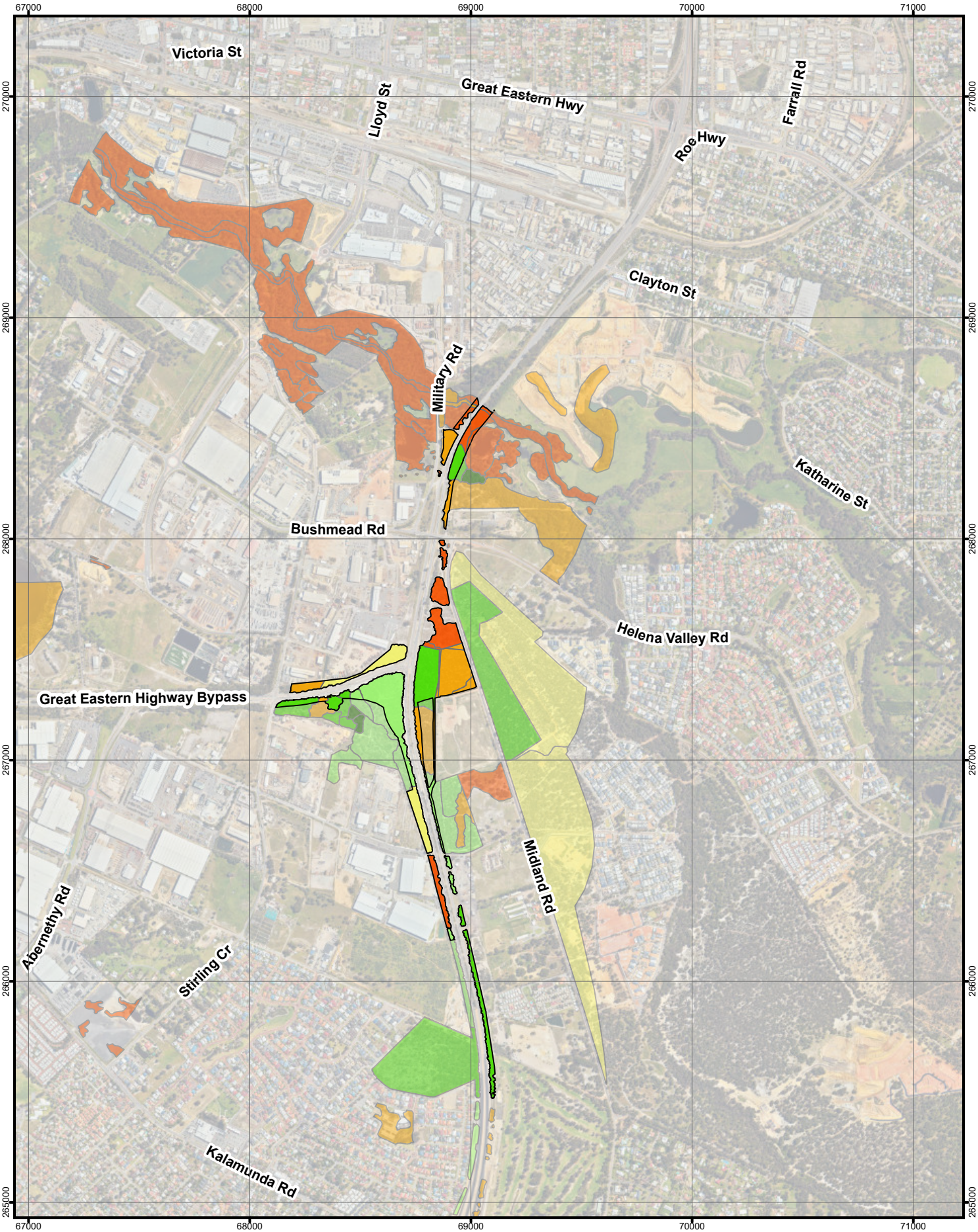

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Data sources: Main Roads WA

LEGEND

NVCP extents (January 2022)

Vegetation Condition

- Excellent to Very Good
- Very Good
- Very Good to Good
- Good
- Degraded

Vegetation Condition (Biota 2021)

MAIN ROADS WA

GREAT EASTERN HIGHWAY BYPASS INTERCHANGES PROJECT

WP4 ROE HIGHWAY NVCP

Figure 5

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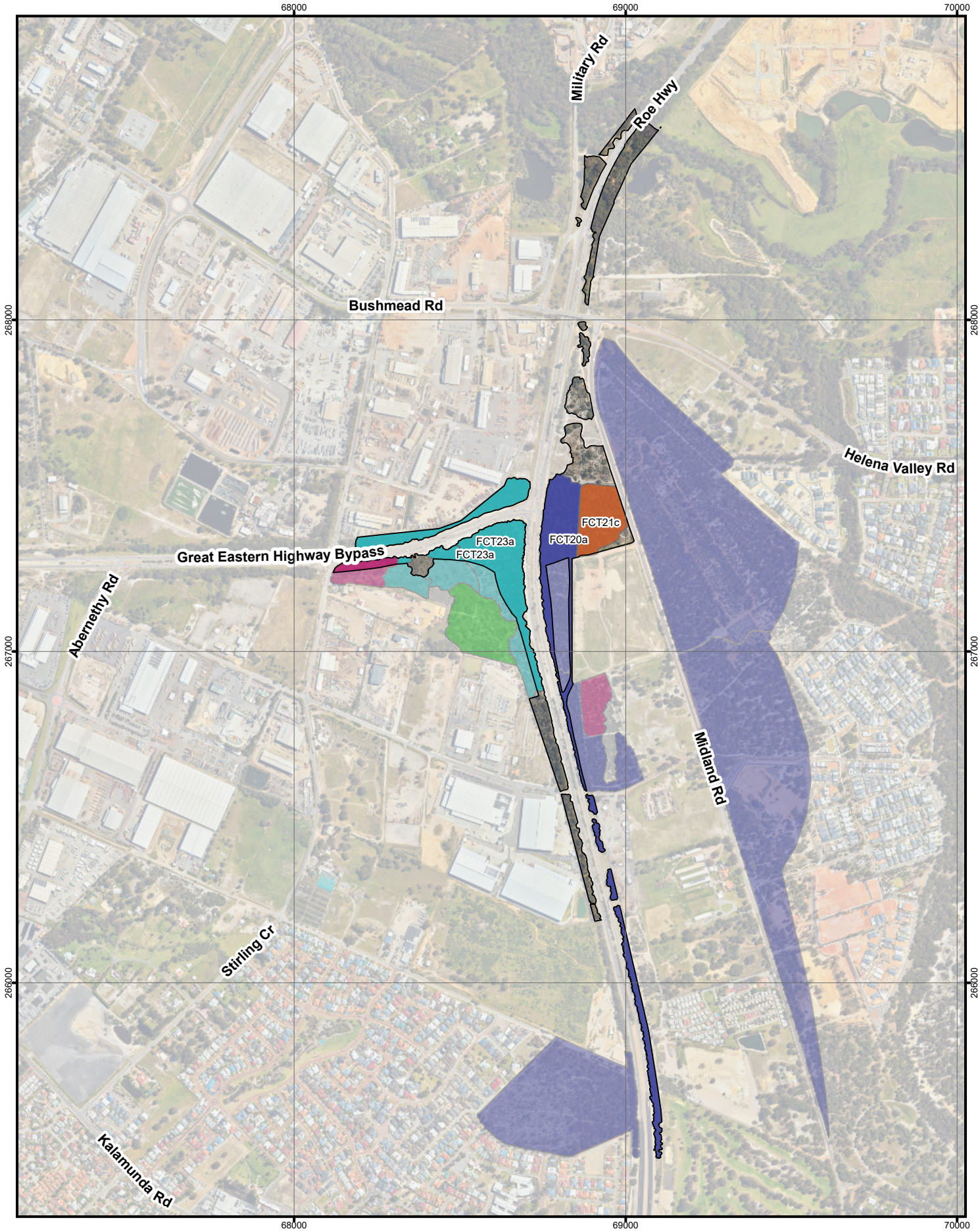

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LEGEND

- NVCP extents (January 2022)

Banksia Woodlands of the Swan Coastal Plain TEC

- FCT20a
- FCT20c
- FCT21c
- FCT23a
- FCT28

Threatened Ecological Communities (Biota 2021)

MAIN ROADS WA

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Figure 6

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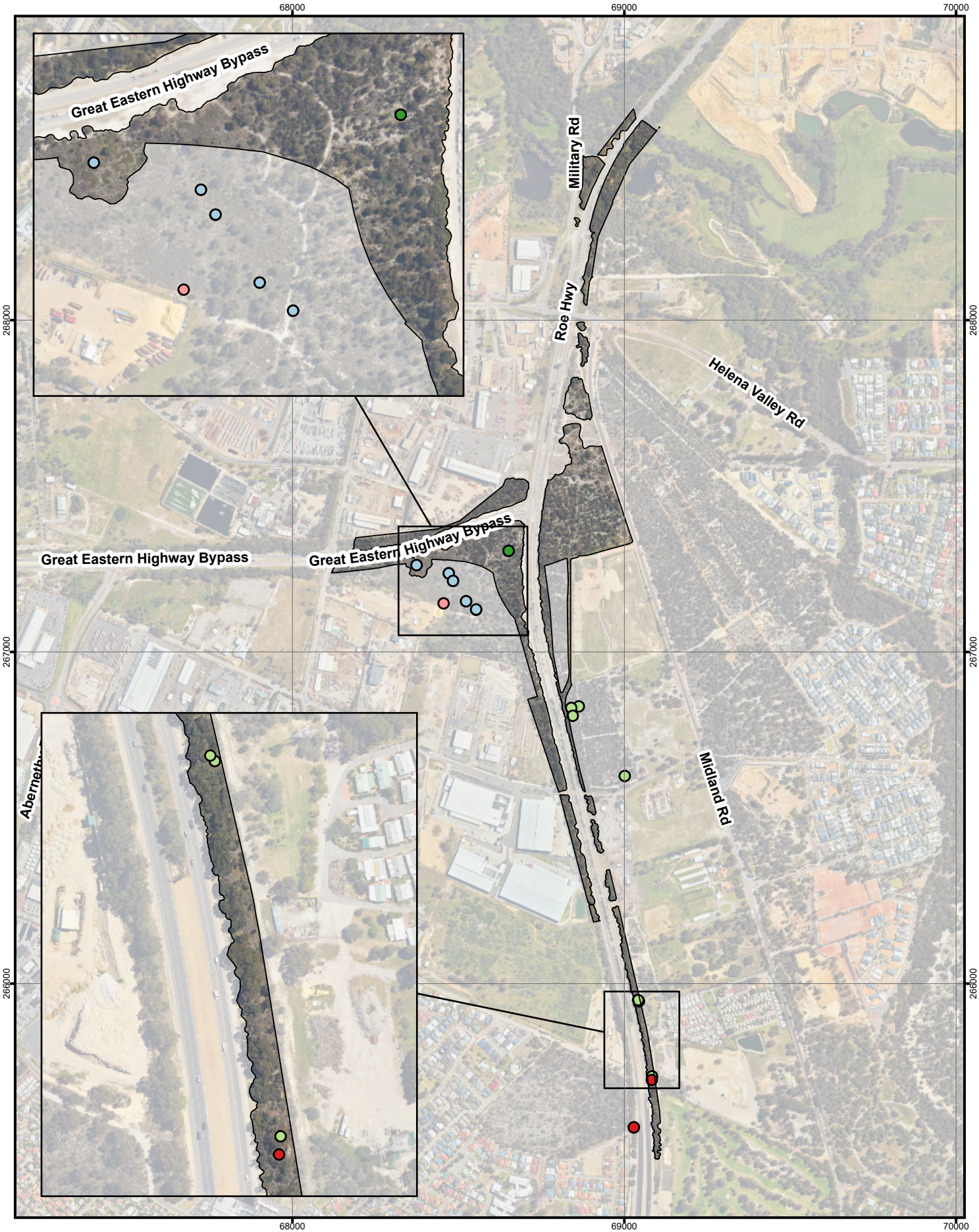

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metres

Data sources: Main Roads WA

LEGEND

NVCP extents (January 2022)

Conservation Significant Flora Status and Taxon

- *Johnsonia pubescens* subsp. *cygnorum* (P2)
- *Melaleuca viminalis* (P2)
- *Isopogon autumnalis* (P3)
- *Hypolaena robusta* (P4)
- *Verticordia lindleyi* subsp. *lindleyi* (P4)
- *Conospermum undulatum* (T)

Significant Flora

MAIN ROADS WA

GREAT EASTERN HIGHWAY BYPASS INTERCHANGES PROJECT

WP4 ROE HIGHWAY NVCP

Figure 7

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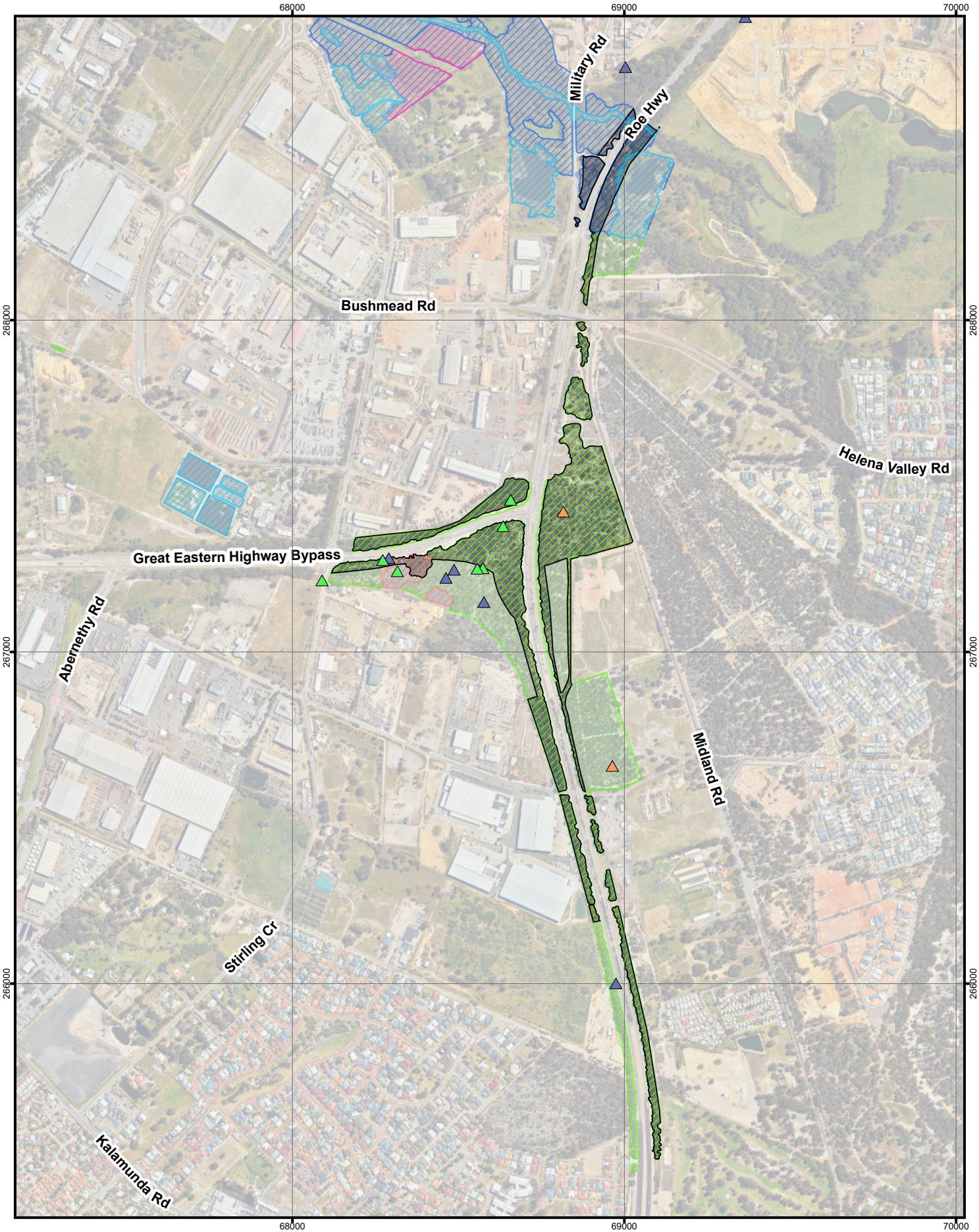

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Data sources: Main Roads WA

LEGEND

NVCP extents (January 2022)

Fauna observations

- *Calyptorhynchus banksii naso*
- *Calyptorhynchus latirostris*
- *Isoodon fusciventer*

Fauna Habitat

- Banksia woodland with scattered Eucalyptus/Marri
- Fabaceous healthland
- Flooded Gum over grasslands
- Wetlands/River

Quenda and potentially suitable Black Cockatoo Habitat (Biota 2021)

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Figure 8

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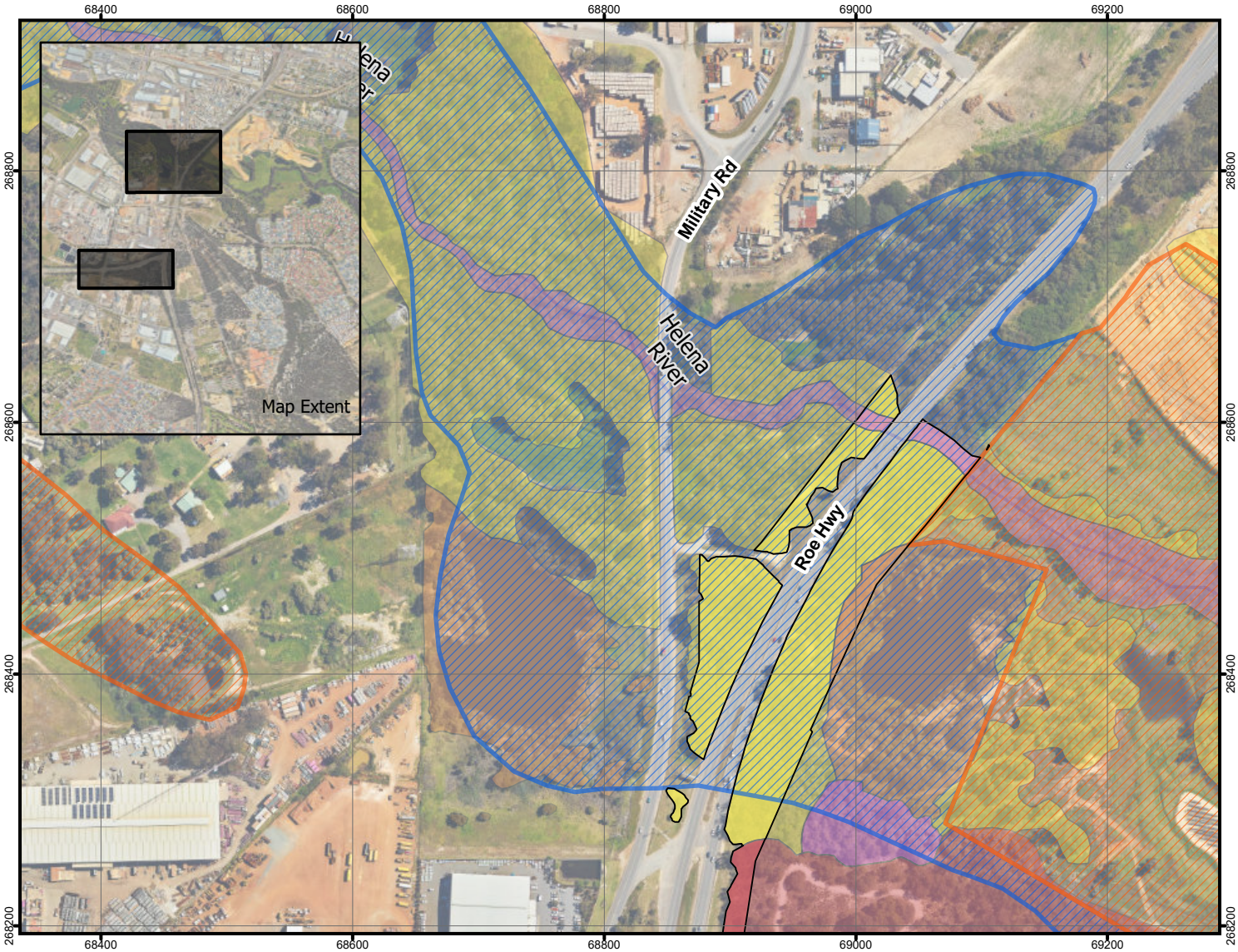

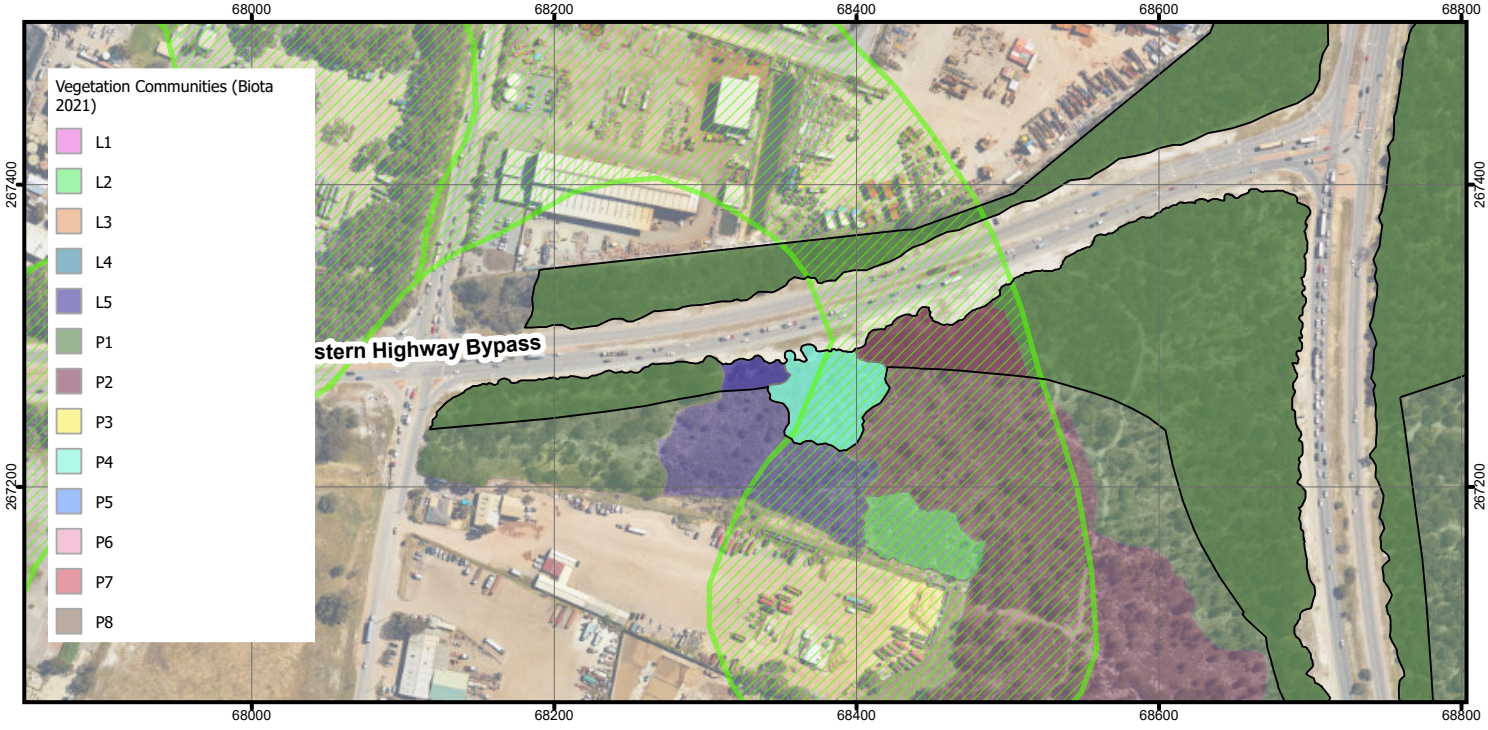

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Data sources: Main Roads WA

LEGEND

- NVCP extents (January 2022)

Geomorphic Wetlands of the Swan Coastal Plain (DBCA 019)

- Conservation
- Multiple Use
- Resource Enhancement

Wetlands and Watercourses

MAIN ROADS WA

GREAT EASTERN HIGHWAY BYPASS INTERCHANGES PROJECT

WP4 ROE HIGHWAY NVCP

Figure 9

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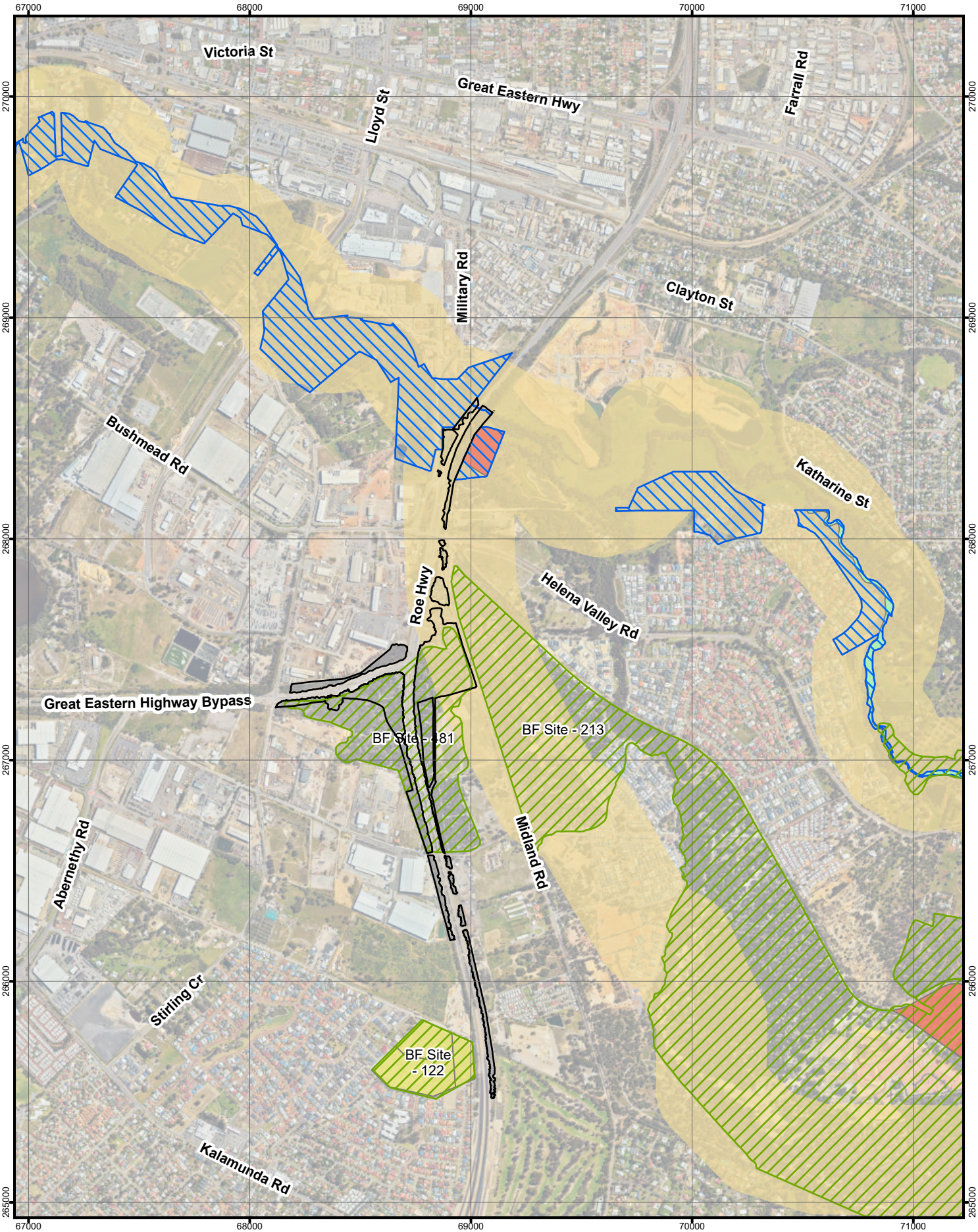

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Data sources: Main Roads WA

LEGEND

- NVCP extents (January 2022)
- Bush Forever Areas 2000 (DPLH)
- Swan Canning Riverpark (DBCA-035)
- Ecological Linkages (WALGA, 2004)

DBCA Legislated Lands and Waters

- Crown Freehold - Dept Managed
- Nature Reserve
- SCRM Act - River Reserve

DBCA Legislated Lands and Waters and Bush Forever

MAIN ROADS WA

GREAT EASTERN HIGHWAY BYPASS INTERCHANGES PROJECT

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Figure **10**

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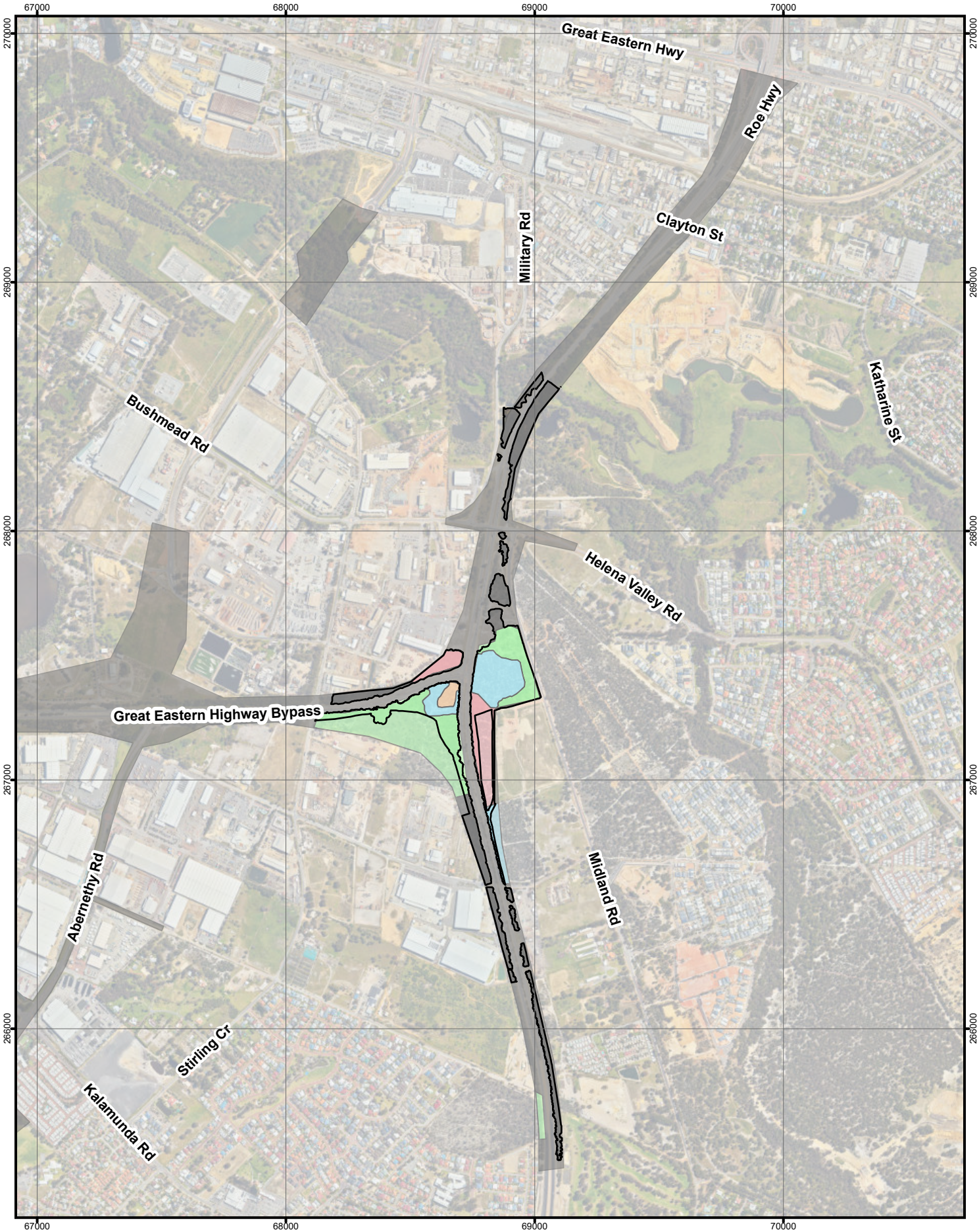

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metres

Data sources: Main Roads WA

LEGEND

NVCP extents (January 2022)

Dieback Occurrence

- Infested
- Uninfested Protectable
- Uninfested Unprotectable
- Temporarily Uninterpretable (due to fire)
- Excluded

Dieback Mapping (Glevan Consulting 2020)

MAIN ROADS WA

GREAT EASTERN HIGHWAY BYPASS INTERCHANGES PROJECT

WP4 ROE HIGHWAY NVCP

Figure 11

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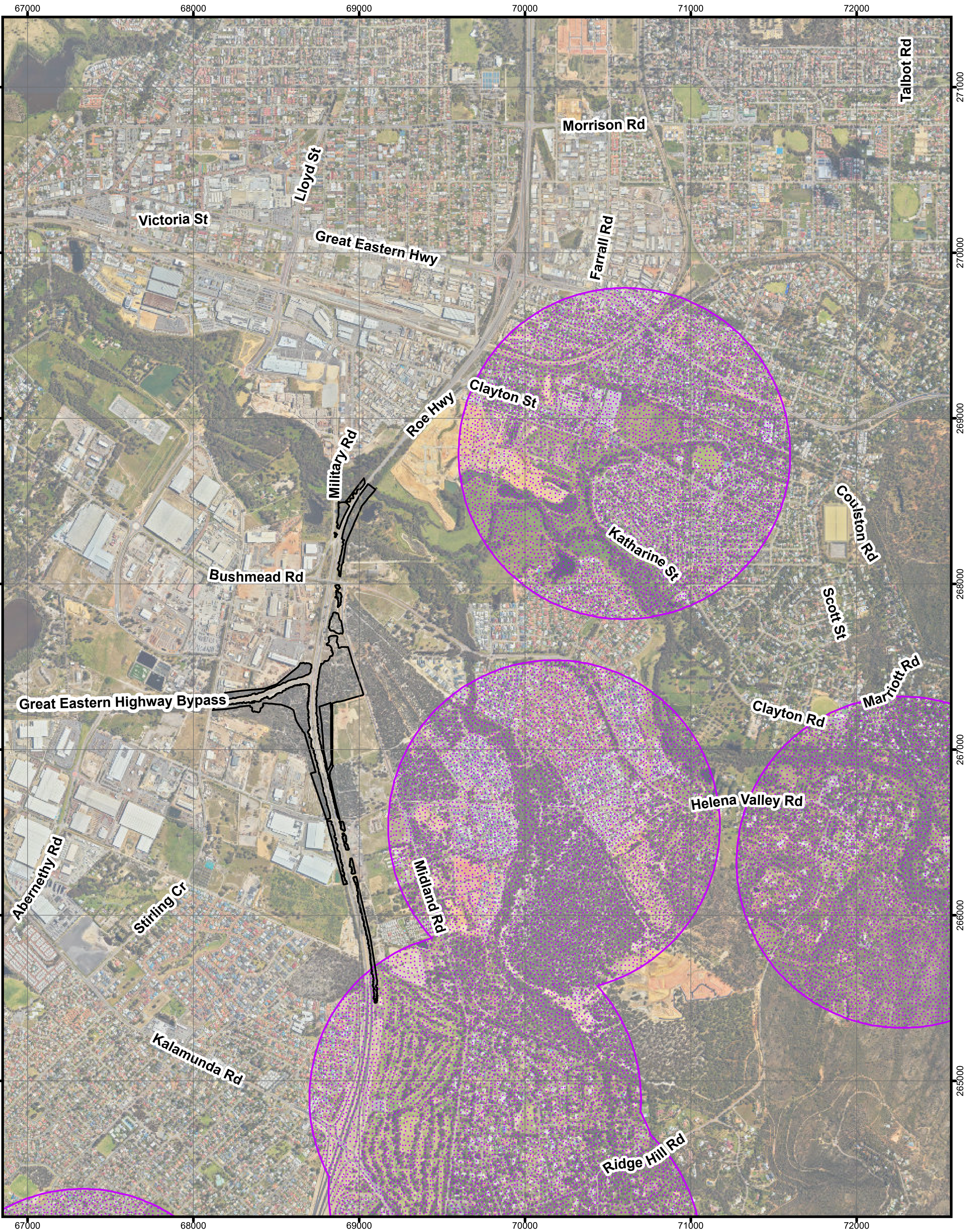

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metres

Data sources: Main Roads WA

LEGEND

NVCP extents (January 2022)

Black Cockatoo Roosting Sites (buffered) (DBCA-064)

Regional Black Cockatoo Habitat

MAIN ROADS WA

GREAT EASTERN HIGHWAY BYPASS INTERCHANGES PROJECT

WP4 ROE HIGHWAY NVCP

Figure 12

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