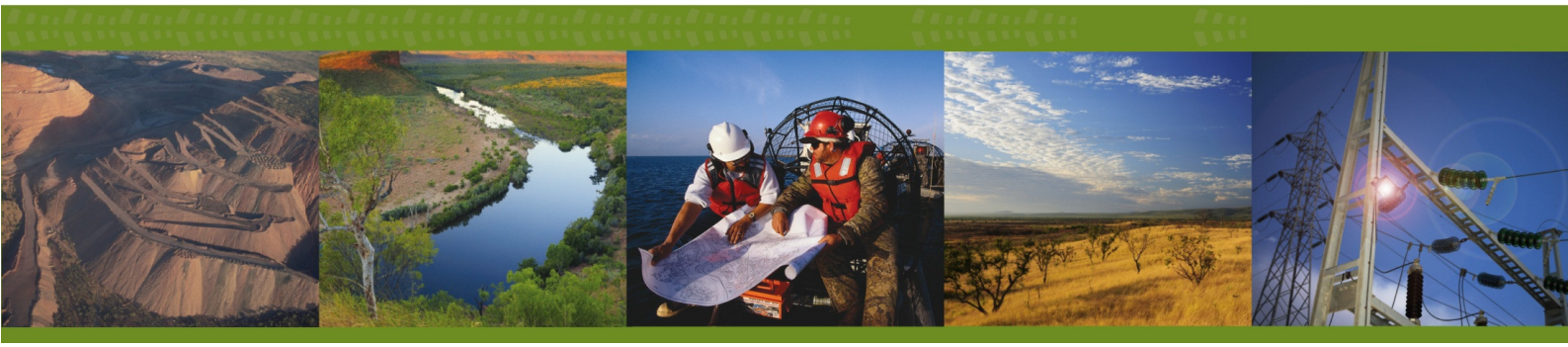

Mundijong Road Extension

Environmental Offsets Management Plan

Prepared for

City of Rockingham

by Strategen

September 2013

STRATEGEN
environmental consultants

Mundijong Road Extension

Environmental Offsets Management Plan

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Client: City of Rockingham

Report Version	Revision No.	Purpose	Strategen author/reviewer	Submitted to Client	
				Form	Date
Preliminary Draft Report	A	Client review	R Chesney / T Bowra	Electronic	13 September 2013
Final Report	0	Submission to DSEWPaC	R Chesney/City of Rockingham	Electronic/ hard copy	20 September 2013

Filename: COR13168_01 R001 Rev 0 - 20 September 2013

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1. Introduction

1.1 Project background

The City of Rockingham is proposing to extend and upgrade the Mundijong Road carriageway between Kwinana Freeway in the east and Dixon Road in the west. This proposal is referred to as the Mundijong Road Extension herein. The Mundijong Road Extension is in the City of Rockingham and the City of Kwinana local government areas.

Mundijong Road Extension comprises a new section of road to be constructed running east-west from the existing Mundijong Road terminus at Baldivis Road, through to Mandurah Road. It will intersect Mandurah Road north of Lake Cooloongup, adjacent to the existing freight rail line. The route is shown in Figure 1 and is referred to in this document as the Development Site. Approval to clear vegetation for the Development Site has been granted under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*, subject to several conditions. These conditions include a requirement to offset the residual environmental impact to Bush Forever site 356 and Lake Cooloongup.

1.2 Purpose and scope of Environmental Offsets Management Plan

The purpose of this Environmental Offsets Management Plan (EOMP) is to provide a framework to enable the City of Rockingham to meet the conditions of State approval (Clearing Permit 2493/3) as listed in Section 1.4.1, and those of the Commonwealth approval, as listed in Section 1.4.2. The EOMP also provides management and monitoring actions to satisfy the requirements of Condition 3 of the Commonwealth approval that requires the implementation of a Black-cockatoo Habitat Revegetation and Rehabilitation Program.

This EOMP focuses on the key environmental issues of relevance to the offset sites. An evaluation of the existing environment at the offset sites, defined management objectives and identification of environmental values requiring protection is provided. The basis for ongoing management of the offset sites, provisions for monitoring and evaluation of environmental condition, and remedial actions to be implemented, if required, are also detailed within the EOMP.

1.3 Location and description of offset areas

The agreed environmental offsets for clearing associated with the Mundijong Road Extension are protection and improvement of a total of 63.5 ha of land at the following sites:

- Site 1: Trenant Park Wetland in Golden Bay
- Site 2: Dixon Road Precinct in Hillman.

Details for each site are outlined in Table 1 and site locations are illustrated in Figure 1.

Table 1 Offset site details

Item	Site 1	Site 2
Site location	• Trenant Park Wetland, Dampier Drive, Golden Bay (Lot 4060, R 42604) • 16.5 km south of Development Site	• Dixon Road, Hillman • Within 1 km of Development Site
Site ownership details	City of Rockingham, Lot 4060, R 42604.	Crown Land under the care of the Department of Planning and Infrastructure; zoned parks and recreation
Site area	Approximately 7.5 ha	Approximately 56 ha

1.4 Approvals history

1.4.1 State government approvals

Mundijong Road extension

Clearing permit number 2493/3, authorising clearing at the Development Site, was issued in October 2011. The following conditions of the permit are relevant to offsets:

- Condition 10: Offsets

  The Permit Holder must implement and adhere to the offset proposal 'Mundijong Road Extension Environmental Offsets Strategy 15 April 2009' [Worley Parsons 2009a] and to 'Attachment A: Proposed Rehabilitation Methods and Measurement, 5 May 2009.'

- Condition 11: Records must be kept

  The permit holder must maintain the following records for activities done pursuant to this Permit, as relevant:

  (c) In relation to the offsets of areas pursuant to condition 10:

  (i) The location of any area of offsets recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994 (GDA94), expressing the geographical coordinates in eastings and northings
  (ii) A description of the offset activities undertaken; and
  (iii) *The size of the offset area (in hectares).*

- Condition 12: Reporting

  (a) The Permit Holder must provide to the CEO, on or before 30 June of each year, a written report of records required under condition 11 and activities done by the permit holder under this permit between 1 January and 31 December of the preceding year.

  (b) Prior to 18 October 2012, the permit holder must provide to the CEO a written report of records required under condition 11 where these records have not already been provided under condition 12(a).

Other relevant State approvals

The City of Rockingham sought approval from the EPA for the duplication of Dixon Road in 2003. The proposal was not formally assessed; however, the EPA provided conditions in order to mitigate environmental impacts associated with clearing. The condition relevant to this document is as follows:

> *The City develop and implement a Rehabilitation, Restoration and Weed Management Plan, in consultation with relevant stakeholders, to minimise the potential for impact on the Regional Park and Bush Forever site adjacent to Dixon Road. Council is to commit at least $250 000 in funds and resources to these works.*

Section 2.2.4 of this report provides detail as to works that have been undertaken in relation to this condition.

1.4.2 Commonwealth approvals

EPBC referral and DSEWPaC decision

The City of Rockingham referred the proposal to the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) in May 2011. DSEWPaC responded on 21 June 2011, indicating that the proposal was considered to be a 'Controlled Action' to be assessed at the level of Assessment of Preliminary Documentation. DSEWPaC requested further information on potential impacts to listed Threatened species and Ecological Communities, specifically, impacts to foraging and potential breeding habitat for the EPBC listed threatened species including:

- Carnaby's black-cockatoo
- Baudin's black-cockatoo
- forest red-tailed black-cockatoo.

The referral response also requested the City of Rockingham to provide information on:

- offset site suitability
- offset site protection measures
- rehabilitation management for onsite rehabilitation
- measures to ensure minimal impacts to nearby Lake Cooloongup.

The Preliminary Documentation was provided to DSEWPaC on 20 September 2011.

Approval conditions

In response to the Preliminary Documentation, DSEWPaC provided advice on 30 March 2012 and set the following conditions in relation to the offset sites:

- **Condition 2 (b):** Prepare and submit an EOMP for the offset areas for the Minister's approval. The EOMP must detail the following:
    (i) the revegetation and rehabilitation methods to be undertaken (as required by condition 3)
    (ii) measures to ensure that seedlings being planted are free of dieback (*Phythophthora cinnamomi*)
    (iii) feral animal and weed controls to be implemented within the offset areas
    (iv) fencing to be undertaken
    (v) the monitoring and survey measures to be utilised, including timing schedules and reporting requirements
    (vi) outcomes to be achieved and targets indicating successful achievement of these outcomes
    (vii) appropriate corrective or contingency measures if strategy or indicator is not achieved
    (viii) roles and responsibilities of contractors, staff and the person taking the action, prior to, during and following any rehabilitation and revegetation works undertaken on the offset areas
    (ix) how the WA DEC, or other conservation organisation(s), have been consulted in the preparation of the EOMP.

  The approved EOMP must be implemented.
- **Condition 3:** To offset the loss of black-cockatoo habitat, the person taking the action must implement a black-cockatoo habitat Revegetation and Rehabilitation Program for the three offset areas as described below:
    (i) Topsoil, native vegetation seed and habitat logs must be collected from the development zone, prior to and/or during construction, to be used in rehabilitation works

(ii) The offset areas must be fully revegetated using at least 75% known habitat plants for black-cockatoos

(iii) If after 5 years of planting, a survival rate of at least 80% is not achieved, all planted trees that have not survived must be replanted within 12 months and monitored for a further 2 years

(iv) The person taking the action must fund and manage the black-cockatoo habitat Revegetation and Rehabilitation Program for at least 8 years after the commencement of construction or until management responsibility has been transferred to a conservation organisation approved by WA DEC and the Department.

- **Condition 4:** Within two (2) years of the commencement of construction, the person taking the action must provide the Department with written evidence that the offset areas have been placed under an irrevocable conservation covenant for protection in perpetuity.
- **Condition 5:** Within two (2) years of the date of this approval, the person taking the action must provide to the Department a description and map clearly defining the location and boundaries of the Offset Area, which must be accompanied with the offset attributes and a shapefile.
- **Condition 6:** Unless otherwise agreed to in writing by the Minister, the person taking the action must publish all management plans referred to in these conditions of approval on their website. Each management plan must be published on the website for the length of the approval within 1 month of the management plan being approved.
- **Condition 8:** The person taking the action must maintain accurate records substantiating all activities associated with or relevant to the conditions of approval, including measures taken to implement the plan(s) required by this approval, and make them available upon request to the Department. Such records may be subject to audit by the Department or an independent auditor in accordance with section 458 of the EPBC Act, or used to verify compliance with the conditions of approval. Summaries of audits will be posted on the Department's website. The results of audits may also be publicised through the general media.
- **Condition 9:** Within three months of every 12 month anniversary of the commencement of the action, the person taking the action must publish a report on their website addressing compliance with each of the conditions of this approval, including implementation of any plan(s) as specified in the conditions. The report must stay on the website for at least five (5) years. Documentary evidence providing proof of the date of publication and non-compliance with any of the conditions of this approval must be provided to the Department at the same time as the compliance report is published.
- **Condition 10:** If the person taking the action wishes to carry out any activity otherwise than in accordance with the plan(s) as specified in the Conditions, the person taking the action must submit to the Department for the Minister's written approval a revised version of that plan. The varied activity shall not commence until the Minister has approved the varied plan(s) in writing. The Minister will not approve a varied plan(s) unless the revised plan would result in an equivalent or improved environmental outcome over time. If the Minister approves the revised plan(s), that plan(s) must be implemented in place of the plan(s) originally approved.
- **Condition 11:** If the Minister believes that it is necessary or convenient for the better protection of listed threatened species and communities to do so, the Minister may request that the person taking the action make specified revisions to the plan(s) specified in the Conditions and submit the revised plan(s) for the Minister's written approval. The person taking the action must comply with any such request. The revised approved plan(s) must be implemented. Unless the Minister has approved the revised plan(s), then the person taking the action must continue to implement the plan(s) originally approved, as specified in the conditions.
- **Condition 12:** If, at any time after five years from the date of this approval, the person taking the action has not substantially commenced the action, then the person taking the action must not substantially commence the action without the written agreement of the Minister.

1.5 Consultation

Consultation took place between the City of Rockingham and the former Department of Environment and Conservation (DEC) with regard to placing covenants on the offset sites. As part of this process, the DEC provided a set of proposed methods for rehabilitation and monitoring of the offset sites (DEC 2009). The Department of Environmental Regulation (DER) has assumed responsibility for regulatory processes, and management of conservation estate is now undertaken by the Department of Parks and Wildlife (Daw), subsequent to the breakup of the DEC in July 2013. It should be noted that the acronym DEC remains in this report where it appears within direct quotes, and in relation to documents and databases that were consulted prior to July 2013.

1.6 Related documents

The following reports document the investigations that have been conducted in relation to clearing of the Development Site:

- *Report for Mundijong Road Extension, Flora and Fauna Assessment* (GHD 2008)
- *Mundijong Road Extension, Construction Environmental Management Plan* (Worley Parsons 2009b)
- *Report for Mundijong Road Extension, Threatened Ecological Community Assessment* (GHD 2009)
- *Graceful Sun Moth Survey, Mundijong Road Extension* (Greg Harewood 2011)
- *Mundijong Road Extension Construction Environmental Management Plan* (Strategen 2012).

The following reports have been prepared in relation to the offset strategy and management of the sites:

- *Mundijong Road Extension, Environmental Offsets Strategy* (Worley Parsons 2009a)
- *Attachment A: Proposed Rehabilitation Methods and Measurement* (DEC 2009)
- *Fire Management Plan* (report prepared for residential area adjacent to Trenant Park wetland) (BSC 2011)
- *Trenant Park Wetland Management Plan* (CoR undated [b]).

The following reports, pertaining to the area covered by Site 2 and an area directly to the west of Site 3, were prepared in relation to the EPA condition regarding the duplication of Dixon Road:

- *Dixon Road Precinct Management Plan, Rockingham Lakes Regional Park* (Draft) (VisionEnvironment 2005)
- *Weed Management Plan, Dixon Road Precinct* (Cardno BSD Pty Ltd 2006a)
- *Dixon Road Wetland Assessment* (Cardno BSD Pty Ltd 2006b)
- *Dixon Road Conservation Precinct Vegetation Monitoring Report 2009 Results* (Coffey 2009)
- *Dixon Road Conservation Precinct Vegetation Monitoring Report 2010 Results* (Coffey 2010)
- *Dixon Road Duplication – Flora and Vegetation Assessment* (BSD 2003)
- *Dixon Road Conservation Precinct* (informal report on works undertaken within Dixon Road Precinct) (CoR undated[c]).

Flora and fauna studies have been undertaken within Site 1, including:

- *Environmental Management and Implementation Plan, Trenant Park Wetland, July 2013* (Coterra 2013)
- *Botanical Assessment of Trenant Park Wetland, City of Rockingham* (BEC 2012).

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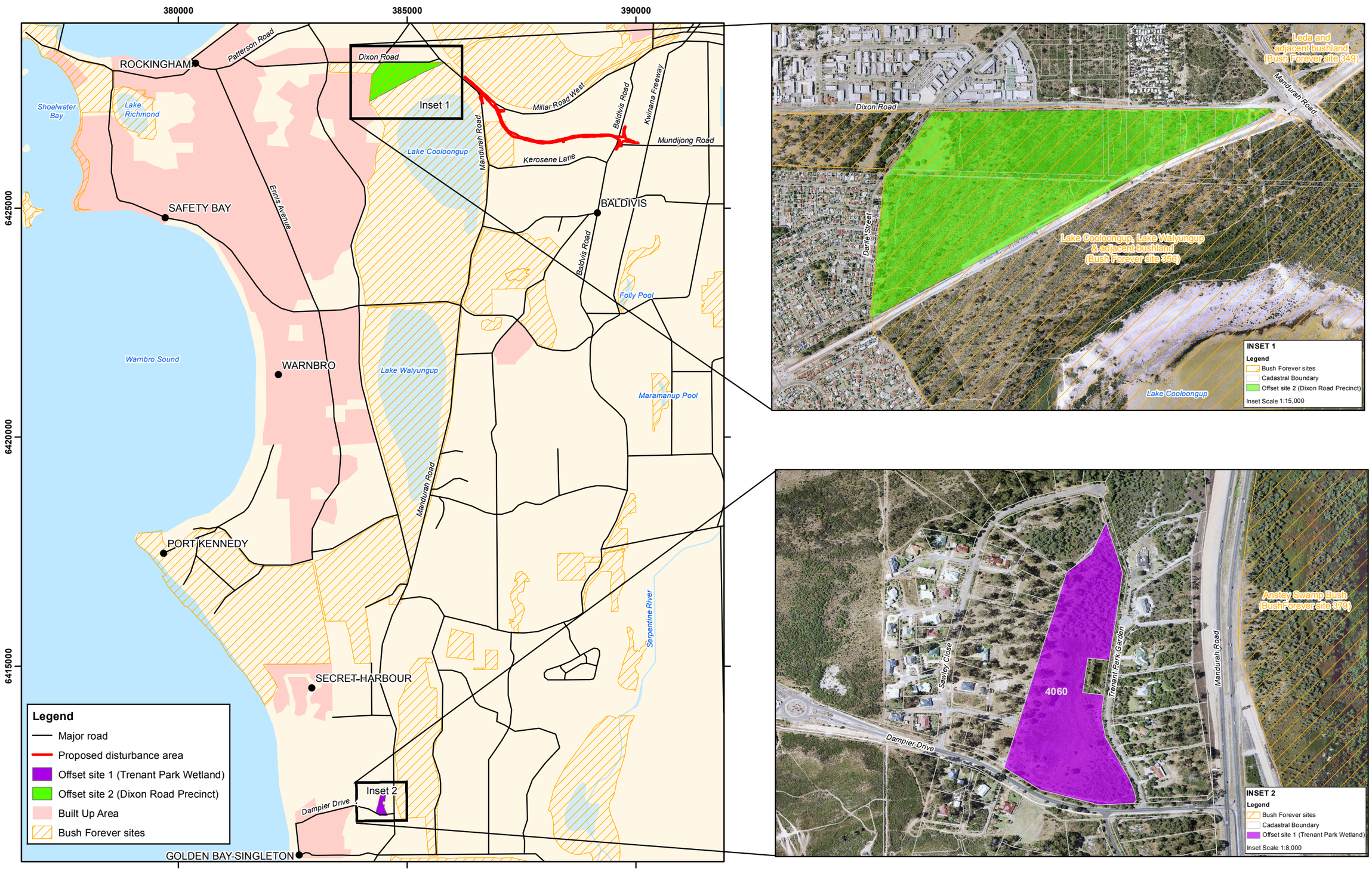

Figure 1 Proposed offset sites

Scale 1:15,000 at A3

0 100 200 300 400 500 m

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 18/09/2013
Author: JCrute
Source: Aerial image: SLIP, Landgate 2012. Topography: Geoscience Australia 2011.
Infrastructure layout: Worley Parsons 2012. Cadastre: Client 2012.

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2. Existing environment

2.1 Site 1 – Trenant Park Wetland

Site 1 is considered a "local natural area (medium level of protection)" in the City of Rockingham *Greenways Plan* (No.120, Reserve [Peelfold Glen]) (CoR undated[a]). Site 1 and surrounding lots are zoned for rural purposes.

2.1.1 Hydrogeology and wetlands

The wetland areas within Site 1 are considered part of Anstey Swamp, a 246 ha conservation category sumpland. The lake areas within Anstey Swamp are managed based on the *Environmental Protection Swan Coastal Plain Lakes Policy 1992* (known as EPP lakes). Lakes covered under this policy are protected from actions such as filling in, excavation and mining, discharge of effluent or drainage of water into or out of the lake that may cause degradation or destruction of the lake. Anstey Swamp lies within the Spearwood Dunes geomorphic setting and the Stakehill consanguineous wetland suite (S.4) (Hill *et al.* 1996). Vegetation along the westernmost boundary of Site 1 is not classed as wetland, and forms part of a vegetated buffer for the wetland from neighbouring rural properties.

2.1.2 Flora and vegetation

Vegetation complexes

Vegetation complexes are regional, broad scale, overarching vegetation descriptions based on the general vegetation types associated with the landforms of the Swan Coastal Plain.

Vegetation complex mapping of the Swan Coastal Plain by Heddle *et al.* (1980) indicates Site 1 occurs largely in the Cottesloe Central and South complex. Vegetation of this complex is described as a mosaic consisting of woodland of *Eucalyptus gomphocephala*; open forest of *E. gomphocephala – E. marginata* subsp. *marginata – Corymbia calophylla*; and closed heath on the limestone outcrops (Heddle *et al*. 1980). A small portion of the wetland (at the northernmost boundary) lies within the Herdsman Complex, which is described as sedgelands and fringing woodland of *Eucalyptus rudis – Melaleuca* spp. (Heddle *et al*. 1980).

Vegetation types

Vegetation types are more detailed than vegetation complexes and require mapping on a local scale to define. A Level 2 flora and vegetation survey to determine vegetation types in remnant wetland vegetation at Site 1 was undertaken in October 2012 by Bennett Environmental Consulting (BEC 2012). Vegetation at the site was divided into six vegetation types (Table 2, Figure 2).

Table 2 Vegetation types identified at Site 1

Vegetation code	Description
Eg	Woodland of *Eucalyptus gomphocephala* over thicket of *Spyridium globulosum* over tall sedges of *Lepidosperma longitudinale* in grey sand.
Mr	Low forest of *Melaleuca rhaphiophylla* and *Spyridium globulosum* over open low grass dominated by **Briza maxima* or **Ehrharta longiflora* over herbs dominated by **Hypochaeris glabra* or **Fumaria capreolata* over tall sedges dominated by *Baumea juncea* in grey sand.
Bl	Low forest of *Banksia littoralis* over scrub of *Hakea varia* and *Spyridium globulosum* over tall grass dominated by **Ehrharta longiflora* over open tall sedges dominated by *Lepidosperma longitudinale* in grey sand.
LB	Dense tall sedges of *Lepidosperma longitudinale* and *Baumea juncea* in damp grey sand.
Ba	Dense tall sedges of *Baumea articulata* in wet black sandy mud.
To	Dense tall sedges of **Typha orientalis* and *Baumea juncea* in wet black sandy mud.

Source: BEC 2012
* = introduced species

Threatened and Priority Flora

No Threatened Flora species were recorded during the flora and vegetation survey. One Priority 4 flora species, *Grevillea olivacea*, was recorded from the northern section of the site (BEC 2012). In the field it appeared that the one plant observed had been planted, but this taxon has been recorded from nearby Woodman Point, therefore could be endemic at Trenant Park Wetland (BEC 2012). A full list of flora species recorded at Site 1 is provided in Appendix 1.

Threatened and Priority Ecological Communities

One Threatened Ecological Community (TEC) was found within Site 1; namely, Floristic Community Type (FCT) 19, "Sedgelands in Holocene dune swales of the southern Swan Coastal Plain," as described by Gibson *et al*. (1994). FCT19 is listed as Critically Endangered under the WC Act and Endangered under the EPBC Act. Vegetation types LB, Ba and To (Table 2) are examples of FCT19 (BEC 2012).

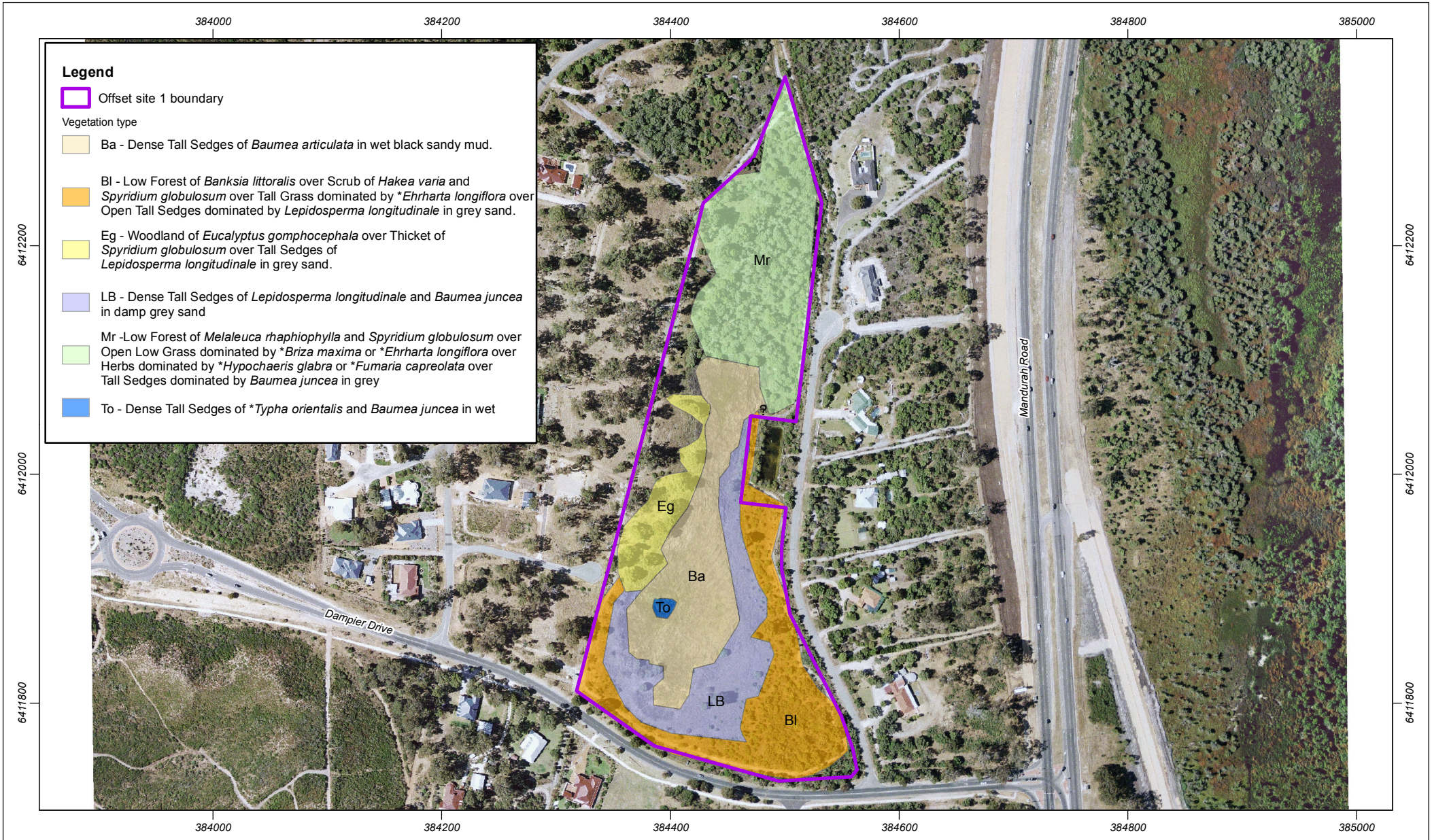

Figure 2 Site 1 (Trenant Park Wetland) vegetation mapping

Scale 1:4,500 at A4

0 20 40 60 80 100 m

N

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 18/09/2013

Author: JCrute

Source: Aerial image: SLIP, Landgate 2006. Vegetation: Bennett environmental consulting 2012

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Introduced species

DEC developed the Environmental Weed Strategy for Western Australia (DEC 1999), which outlines management priority levels for weeds based on the following criteria:

- invasiveness – ability to invade bushland in good to excellent condition or ability to invade waterways
- distribution – wide current or potential distribution including consideration of known history of wide spread distribution elsewhere in the world
- environmental impacts – ability to change the structure, composition and function of ecosystems. In particular an ability to form a monoculture in a vegetation community.

The rating of each weed was determined by the DEC (1999), using the above three criteria.

- high – scores yes for all three criteria. Rating a weed species as high indicates prioritising this weed for control and/or research, i.e., prioritising funding to it.
- moderate – scores yes for two of the above criteria. Rating a weed species as moderate indicates that control or research effort should be directed to it if funds are available, however it should be monitored (possibly a reasonably high level of monitoring).
- mild – scores yes to one of the criteria. A mild rating indicates monitoring of the weed and control where appropriate.
- low – scores yes to none of the criteria. A low ranking means that this species requires a low level of monitoring.

A total of 52 weeds were identified within Site 1 (BEC 2012). These are listed alongside their management priority rating (DEC 1999) in Table 3. *Ficus carica*, although rated moderate, appears to be aggressive in the wetland (BEC 2012).

Table 3 Weed species recorded in Site 1

Family	Species	Common name	Management priority
Aizoaceae	*Carpobrotus edulis*	Pigface	Moderate
Asphodelaceae	*Asphodelus fistulosus*	Wild onion	Mild
	Trachyandra divaricata	Onion weed	Mild
Asteraceae	*Arctotheca calendula*	Cape weed	Moderate
	Carduus pycnocephalus	Slender thistle	Moderate
	Conyza sumatrensis	-	Not listed
	Hypochaeris glabra	Smooth catsear	Moderate
	Sonchus oleraceus	Common sowthistle	Moderate
	Ursinia anthemoides	Ursinia	Moderate
Brassicaceae	*Brassica tournefortii*	Mediterranean turnip	High
	Heliophila pusilla	-	Moderate
	Rorippa nasturtium-aquaticum	-	Moderate
Campanulaceae	*Wahlenbergia capensis*	Cape bluebell	Moderate
Caryophyllaceae	*Cerastium glomeratum*	-	Low
	Petrorhagia dubia	-	Not listed
	Silene gallica	-	Low
	Stellaria media	Chickweed	Low
Convolvulaceae	*Cuscuta epithymum*	Dodder	Moderate
Crassulaceae	*Crassula colorata*	Dense stonecrop	Not listed
	Crassula glomerata		Moderate
Cyperaceae	*Isolepis marginata*	Coarse club-rush	Not listed
Euphorbiaceae	*Euphorbia terracina*	Geraldton carnation weed	Not listed

Family	Species	Common name	Management priority
Fabaceae	*Medicago polymorpha*	Burr medic	Mild
	Melilotus indicus	-	Not rated at time of publication of DEC strategy
	Vicia sativa subsp. *nigra*	-	Not rated at time of publication of DEC strategy
Geraniaceae	*Geranium molle*	Cranesbill	Low
	Pelargonium capitatum	Rose pelargonium	High
Iridaceae	*Moraea flaccida*	One-leaf cape tulip	Not listed
	Romulea rosea	Guildford grass	Not rated at time of publication of DEC strategy
Juncaceae	*Juncus acutus*	Spiny rush	Moderate
Linaceae	*Linum trigynum*	French flax	Low
Lythraceae	*Lythrum hyssopifolia*	Lesser loosestrife	Not rated at time of publication of DEC strategy
Moraceae	*Ficus carica*	Fig	Moderate
Oleaceae	*Olea europaea*	Olive	Moderate
Papaveraceae	*Fumaria capreolata*	Whiteflower fumitory	Mild
Poaceae	*Avena barbata*	Bearded oat	Moderate
	Briza maxima	Blowfly grass	Moderate
	Briza minor	Shivery grass	Moderate
	Bromus diandrus	Great brome	High
	Ehrharta calycina	Perennial veldt grass	High
	Ehrharta longiflora	Annual veldt grass	High
	Hyparrhenia hirta	Tambookie grass	High
	Lagurus ovatus	Hare's tail grass	High
	Lolium rigidum	Annual rye grass	Moderate
	Stenotaphrum secundatum	Buffalo grass	Moderate
	Vulpia bromoides	Squirrel's tail fescue	Moderate
Polygonaceae	*Acetosella vulgaris*	-	Low
Primulaceae	*Lysimachia arvensis*	Pimpernel	Not rated at time of publication of DEC strategy
Scrophulariaceae	*Dischisma arenarium*	-	Not rated at time of publication of DEC strategy
Solanaceae	*Solanum americanum*	Glossy nightshade	Moderate
	Solanum nigrum	Blackberry nightshade	Moderate
Typhaceae	*Typha orientalis*	Bullrush	High

Source: BEC 2012, DEC 1999

Bush Forever

Much of Anstey Swamp falls within Bush Forever site 379 (270.24 ha); however, Site 1 is outside of the Bush Forever site boundaries. The Bush Forever site boundary is approximately 200 m east of Site on the opposite side of Mandurah Road. Bush Forever site 379 is acknowledged to have linkages to other bushland in the area including wetlands and Bush Forever sites (Worley Parsons 2009a).

Vegetation condition

Vegetation condition of Site 1 was rated according to the vegetation condition scale used in Keighery (1994) (Figure 3). Descriptions of these condition ratings are provided in Table 4.

Table 4 Vegetation condition rating scale

Condition rating	Description
Pristine	Pristine or nearly so, no obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good	Vegetation structure altered, obvious signs of disturbance.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbance.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species.

Source: Keighery 1994

The majority of the site varied between Very Good and Good, with some of the dampland in Excellent condition (BEC 2012). Vegetation adjacent to tracks or housing (on the western side) contained many weeds and, as such, was classified as Degraded. All tracks were classified as Completely Degraded (BEC 2012, Figure 3).

Figure 3 Site 1 (Trenant Park Wetland) vegetation condition

Scale 1:4,500 at A4

0 20 40 60 80 100 m

N

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 18/09/2013

Author: JCrute

Source: Aerial image: SLIP, Landgate 2006. Vegetation: Bennett environmental consulting 2012.

Legend

- Offset site 1 boundary
- Vegetation condition
  - Excellent to Very Good
  - Very Good
  - Very Good, occasionally Good
  - Very Good to Good
  - Degraded
  - Completely Degraded

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2.1.3 Fauna and fauna habitat

Conservation significant fauna species

Coterra Environment completed a level 1 fauna survey of the wetland area of Site 1 in December 2012.

The following databases were consulted and compared against known species distributions and habitat preferences to compile a list of species that have the potential to occur in site 1 (Coterra 2013):

- EPBC Act Protected Matters search tool (DSEWPaC 2013a)
- Naturemap (DEC 2007)
- Threatened and Priority Fauna database (DEC 2013)
- Species Profile and Threats (SPRAT) database (DSEWPaC 2013b).

Results are presented in Table 5. No assessment was made of the likelihood of occurrence of each species at Site 1. More detailed assessment may indicate some of these species would be unlikely to occur due to the level of fragmentation or localised degradation of vegetation at the site.

Table 5 Conservation significant fauna potentially occurring at Site 1

Species	Common name	Conservation status (WC Act)	Conservation status (EPBC Act)
Birds			
Apus pacificus	Fork-tailed swift		Migratory, marine
Ardea alba	Great egret		Migratory, marine
Ardea ibis	Cattle egret		Migratory, marine
Ardea modesta	Eastern great egret	IA	Migratory, marine
Calidris ruficollis	Red-necked stint	IA	Migratory, marine
Calyptorhynchus banksii naso	Forest red-tailed black cockatoo	S1 - Vulnerable	Vulnerable
Calyptorhynchus baudinii	Baudin's black-cockatoo	S1 - Endangered	Vulnerable
Calyptorhynchus latirostris	Carnaby's black-cockatoo	S1 - Endangered	Endangered
Diomedea exulans gibsoni	Gibson's albatross		Vulnerable, migratory, marine
Haliaeetus leucogaster	White-bellied sea eagle		Migratory, marine
Leipoa ocellata	Malleefowl	S1 - Vulnerable	Vulnerable, migratory
Limosa lapponica	Bar-tailed godwit	IA	Migratory
Macronectes giganteus	Southern giant-petrel		Endangered, migratory, marine
Macronectes halli	Northern giant-petrel		Vulnerable, migratory, marine
Merops ornatus	Rainbow bee-eater	IA	Migratory, marine
Pluvialis squatarola	Grey plover	IA	Migratory, marine
Puffinus assimilis	Little shearwater		Marine
Rostratula australis	Australian painted snipe		Vulnerable, migratory, marine
Sterna caspia	Caspian tern		Migratory, marine
Sterna dougalii	Roseate tern		Marine
Sternula nereis nereis	Fairy tern		Vulnerable
Thalassarche cauta cauta	Shy albatross		Vulnerable, migratory, marine
Tringa nebularia	Common greenshank	IA	Migratory, marine

Species	Common name	Conservation status (WC Act)	Conservation status (EPBC Act)
Reptiles			
Lerista lineata	Lined skink	P3	
Mammals			
Bettongia penicillata ogilbyi	Woylie	S1 - Endangered	Endangered
Dasyurus geoffroii	Chuditch	S1 - Vulnerable	Vulnerable
Isoodon obesulus fusciventer	Quenda	P5	
Phascogale calura	Red-tailed phascogale	S1 – Endangered	Endangered
Phascogale tapoatafa	Southern brush-tailed phascogale	S1 - Vulnerable	
Setonix brachyurus	Quokka	S1 - Vulnerable	Vulnerable
Invertebrates			
Synemon gratiosa	Graceful sun-moth	P4	Endangered

IA = international agreement (e.g. China-Australia Migratory Bird Agreement, Japan-Australia Migratory Bird Agreement, Republic of Korea-Australia Migratory Bird Agreement); S1 = Schedule 1; P3 = Priority 3, P4 = Priority 4, P5 = Priority 5

Available fauna habitats

A number of fauna habitats are present within the wetland area of Site 1, providing shelter and potential breeding and foraging requirements for a number of species. These are described below.

Open and Low Forest / Woodland

The *Melaleuca rhaphiophylla* forest in the northern section of the wetland area provides a sheltered and productive environment for a number of fauna species, particularly small mammals and reptiles. The vegetation in this area consists of a number of large *M. rhaphiophylla* trees, with *Spyridium globulosum* over open low grass of **Briza maxima* and **Ehrharta longiflora* over herbs and tall sedges (*Baumea juncea*) (Coterra 2013). Asterisks denote introduced species.

Sedgelands and Open Water (during inundation)

Sedgeland wetlands (corresponding with FCT 19 in this instance) are comparatively rare on the Swan Coastal Plain and are important habitats for shy and uncommon waterbird species. The sedges provide visual protection from predators, greater foraging opportunities and protection from the elements for many waterbird species (Coterra 2013).

Artificial Bat Boxes

During the site visit, it was noted that eight artificial bat boxes were installed (dated November 2010) on large tuart trees in the woodland of *E. gomphocephala* over *S. globulosum* in the western portion of the wetland area of Site 1 (Coterra 2013). These were installed by Joe Tonga from Natsync Environmental. The bat boxes are intended to provide alternative habitat options for the microbat species known to occur nearby at the Baldivis Children's Forest (Natsync 2008), specifically:

- Gould's wattled bat (*Chalinolobus gouldii*)
- White-striped mastiff bat (*Tadarida australis*)
- Southern forest bat (*Vespadelus regulus*).

Habitat trees for Conservation Significant Fauna

A survey was undertaken of significant fauna habitat trees during the Level 1 fauna survey conducted by Coterra (2013). A total of 19 large tuarts of a height greater than 10 m and a diameter at breast height (DBH) greater than 500 mm were recorded. Many of these trees were recorded in the woodland *of E. gomphocephala* over *S. globulosum* and also in the *M. rhaphiophylla* forest (Coterra 2013). Tuart trees are suitable habitat for Carnaby's black-cockatoo and forest red-tailed black-cockatoo. The protection of this site will allow areas of revegetated trees to grow to a suitable size to become potential black-cockatoo roosting and breeding habitat.

2.1.4 Vegetation context and potential threatening processes

Site 1 is situated in a semi-urban environment, bounded on its southern end by Dampier Drive, and surrounded by residential properties on its eastern and western boundaries. A small area of remnant bushland is situated adjacent to the northern end of Site 1.

The *Rockingham Greening Plan* (CoR undated[a]) identifies the main threats to Site 1 as:

- development
- weed infestation
- proliferation of tracks
- dieback
- feral animals
- fire
- vehicle movement.

2.1.5 Site access

Three sealed roads (Trenant Park Gardens, Dampier road and Mandurah road) border the site on the west, south and east respectively, providing good firebreaks and access. All firebreaks within the wetland will be well maintained and 3 m in width. An emergency access road links Trenant Park Gardens with Sawley Close which provides an additional emergency exit if residents or emergency vehicles cannot leave or access via Trenant Park Gardens (CoR undated[b]).

The current access point for the wetland is off Dampier Drive, which consists of a 400 m wide farm gate with a 600 mm clearance for pedestrian access. It is proposed that two more formal access points be developed for the reserve, one at the north east for access from Trenant Park and one at the south west for access from Sawley Close. It is also proposed that the current sandy fire access track be formalised with a crushed limestone track. This will enable residents to walk the length of the wetland (CoR undated[b]).

2.2 Site 2 – Dixon Road Precinct

The location of Site 2 is illustrated in Figure 1.

2.2.1 Hydrogeology and wetlands

No wetland habitats are present within the site (Coffey 2009).

2.2.2 Flora and vegetation

Site 2 occurs on the Quindalup Dunes geomorphic setting. Vegetation has been mapped by VisionEnvironment (2005) and Cardno (2006a). Vegetation was also mapped for the Dixon Road duplication project area (BSD 2003); however, mapping as a result of this work was not available. Flora and vegetation surveys of Site 2 were conducted on two occasions. Vegetation communities as recorded by VisionEnvironment (2005) and Cardno (2006a) during these surveys are presented and aligned in Table 6. Vegetation communities as described by VisionEnvironment (2005) are illustrated in Figure 4. Native species recorded at Site 2 are listed in Appendix 2.

Table 6 Vegetation types identified at Site 2

Vegetation type description (VisionEnvironment 2005)	Vegetation type description (Cardno 2006a)
Tuart woodland with *Xanthorrhoea preissii* (Grasstree)	Tuart woodland over *Xanthorrhoea preissii*
Tall *Acacia* thicket	
Tuart woodland with *Acacia* and *Xanthorrhoea preissii* understorey	*Acacia* shrubland
Sedge-dominated damplands	*Melaleuca* woodland/sedgeland; *Acacia* shrubland
Xanthorrhoea preissii dominated damplands	Tuart woodland over *Xanthorrhoea preissii*/; *Melaleuca* woodland/sedgeland
Mostly cleared	Parkland cleared

Source: VisionEnvironment (2005), Cardno (2006a).

Conservation significant flora and vegetation

No Threatened Flora or Threatened Ecological Communities were found in surveys of Site 2 (BSD 2003, Cardno 2006a, Vision Environment 2005).

Bush Forever

Site 2 forms an approximately 56 ha area that forms the northern portion of Bush Forever Site 356, as shown in Figure 1. The overall Bush Forever site includes1617.5 ha of bushland plus the open water areas of Lake Cooloongup and Lake Walyungup.

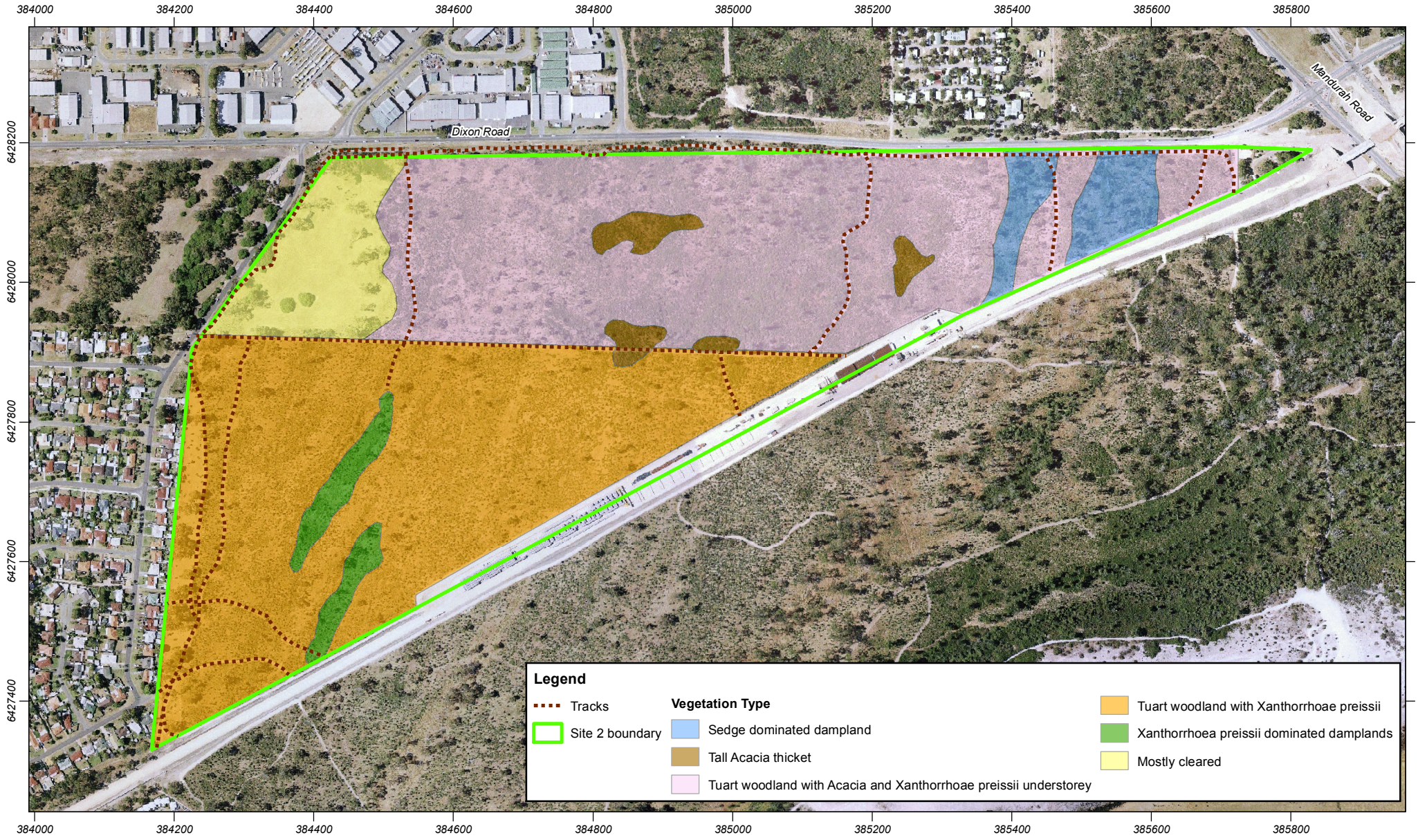

Figure 4 Site 2 (Dixon Road Precinct) vegetation mapping

Scale 1:7,500 at A4

0 50 100 150 200 m

N

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 18/09/2013

Author: JCrute

Source: Vegetation: Vision Environment 2005.

Path: Q:\GIS\Consult\2013\COR\COR13168.01\ArcMap_documents\R001\RevA\COR13168_01_R001_RevA_F004.mxd

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Introduced species

Cardno BSD undertook a flora and vegetation survey of Site 2 and prepared a four-year draft weed management plan based on the results (Cardno 2006a). This management plan has now lapsed.

Weed species recorded in Site 2, along with their management priority (DEC 1999), are listed in Table 7.

Table 7 Weed species recorded in Site 2

Family	Species	Common name	Management priority
Asparagaceae	*Agave americana*	Century plant	Low
	Asparagus asparagoides	Bridal creeper	High
Anacardiaceae	*Schinus terebinthifolius*	Japanese pepper	Not rated at time of publication of DEC strategy
Asteraceae	*Arctotheca calendula*	Cape weed	Moderate
	Conyza bonariensis	Flaxleaf fleabane	Low
	Crepis foetida	Fetid hawksbeard	Low
	Hypochaeris glabra	Smooth catsear	Moderate
Brassicaceae	*Brassica tournefortii*	Mediterranean turnip	High
Caryophyllaceae	*Petrorhagia dubia*	-	Not listed in DEC strategy
Crassulaceae	*Crassula glomerata*	-	Moderate
Euphorbiaceae	*Euphorbia terracina*	Geraldton carnation weed	High
Geraniaceae	*Geranium ?molle*	Dove's foot cranesbill	Low
	Pelargonium capitatum	Rose pelargonium	High
Iridaceae	*Romulea rosea* var. *communis*	Guildford grass/onion grass	High
Moraceae	*Ficus carica*	Common fig	Moderate
Orobanchaceae	*Orobanche minor*	Lesser broomrape	Moderate
Oxalidaceae	*Oxalis pes-caprae*	Soursob	Mild
Fabaceae	*Medicago polymorpha*	Burr medic	Not rated at time of publication of DEC strategy
	Trifolium campestre	Hop clover	Moderate
Poaceae	*Avena fatua*	Wild oat	Moderate
	Bromus rubens	Red brome	Moderate
	Holcus lanatus	Yorkshire fog	Moderate
	Lagurus ovatus	Hare's tail grass	High
	Pennisetum clandestinum	Kikuyu grass	Moderate
Primulaceae	*Lysimachia arvensis*	Pimpernel	Mild
Scrophulariaceae	*Verbascum virgatum*	Twiggy mullein	Low

Vegetation condition

Vegetation condition, as recorded by Cardno (2006a) ranges from Completely Degraded to Good, with some parkland cleared areas. The northwestern corner of Site 2 and areas cleared for tracks are described as parkland cleared. The overall area has previously been exposed to grazing and fires (Worley Parsons 2009a) and weeds are a significant ongoing threat. Vegetation types and condition distribution are shown in Figure 4 and Figure 5.

2.2.3 Fauna and fauna habitat

No detailed fauna work has been undertaken at Site 2 to date. The presence of tuarts in Site 2 indicates potential foraging, roosting and breeding habitat for Baudin's black-cockatoo and Carnaby's black-cockatoo.

2.2.4 Site history

Rehabilitation works in Site 2 follow on from work undertaken at this site previously. The work to be undertaken as part of the offset strategy for the Mundijong Road Extension is intended to build upon, and be complementary to, existing rehabilitation works, and is additionally intended to create areas of Carnaby's black-cockatoo habitat, which has not been a focus of previous and current rehabilitation efforts. Previous rehabilitation work at Site 2 is described below.

Works relating to EPA conditions for Dixon Road duplication

As part of an EPA condition relating to the duplication of Dixon Road, the City of Rockingham has undertaken a number of actions at the site. The *Dixon Road Precinct Management Plan, Rockingham Lakes Regional Park* (VisionEnvironment 2005) provided a number of management actions to be undertaken within the Dixon Road Precinct that covers the same area as Site 2.

The management actions required by the *Dixon Road Precinct Management Plan* and the status of each action item are described in Table 8. Some management actions relate to the wider Rockingham Lakes Regional Park (the Park), of which the Dixon Road Precinct is part. In relation to Table 8, it should be noted that wetlands are not present in Site 2, though lower lying areas containing vegetation typical of damp/wet areas (such as *Melaleuca* spp.) are present in places.

Figure 5 Site 2 (Dixon Road Precinct) vegetation condition

Scale 1:7,500 at A4

0 50 100 150 200 m

N

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 18/09/2013

Author: JCrute

Source: Source: Vegetation: Worley Parsons 2009.

Legend

- Tracks
- Site 2 boundary

Vegetation Condition

- Very Good
- Good
- Degraded
- Completely Degraded

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Table 8 Management actions for Site 2 (Dixon Road Precinct)

No.	Action	Completed/ ongoing
1	The area to the north of the dividing track require selective weeding to remove significant species, but other than that, it should be left to regenerate.	Completed
2	The area to the south of the dividing track requires selective replanting with native species particularly in the areas lacking understorey.	Ongoing
3	Juvenile trees and shrubs should be identified and protected from being grazed by rabbits.	Ongoing
4	The wetlands should have all weeds removed.	Ongoing
5	Opportunities be sought to transplant dampland threatened ecological communities from sites throughout Rockingham that are to be cleared, including the Railway Reserve.	Ongoing
6	Community groups should be encouraged to be involved in the rehabilitation works.	Ongoing
7	The tracks need to be rationalized as shown in Figure 20c subject to any changes required should the underpass be constructed.	Completed
8	The City should work with DEC to develop a program for fauna management, feral animal control and fauna monitoring within the Park.	Ongoing
9	Fauna management within the Park be implemented.	Ongoing
10	The section of Dixon Road should have signs warning drivers of the possibility of wildlife crossing. This should be done as part of the road works.	Completed
11	A detailed survey of weeds in the precinct should be carried out to identify noxious weeds species that will need to be removed and make recommendations for treatment and on-going control.	Completed
12	The Japanese pepper trees around the heritage precinct need to be removed.	Completed
13	Selective aspects of weeding should be carried out with the involvement of community groups.	Ongoing
14	The tracks that border the precinct and the main east-west track should be maintain at a standard that allows fire vehicles access and to act as fire breaks.	Completed
15	The main entry point to the precinct should be the existing entry off Darile Street at the end of the main E-W track.	Completed
16	An additional low key entry point should be provided on Dixon Road opposite the end of the eastern most north-south track.	Completed
17	Off road vehicles should be prohibited from the precinct and signs put up at the entry points stating this.	Completed
18	Horses should be prohibited from the precinct and signs put up at the entry points stating this.	Completed
19	A 'kiosk' with educational signage should be placed at the two precinct entries: • reminding users that dumping of rubbish is prohibited and the dangers of weed invasion • notifying dog owners that dogs are permitted subject to adequate controls being exercised.	Completed
20	Interpretative signage should be placed in the 'kiosk' at the two precinct entries that includes, amongst other thing a description of the history of the area and the vegetation, especially the wetland vegetation.	Completed
21	Signage should be compatible with but not necessarily the same as the signs in the rest of the Park.	Completed
22	Other forms of interpretative material e.g. pamphlets, internet should be considered, some of which could be included form in the 'kiosk'.	Completed
23	Direct drainage from the surrounding roads should not be allowed, although overflow drainage in extreme storm events would be allowed as per Dixon road drainage strategy.	Completed
24	Bushland monitoring programme should be established by having at least one transect that runs north south through the precinct passing through one of the wetland areas.	Completed
25	A botanist should be employed to advise on the location of the transect that will be used as the base-line survey transect.	Completed

No.	Action	Completed/ ongoing
26	Schools and other relevant institution be approached with the offer of establishing other transects in the precinct.	Completed
27	The details of the heritage precinct development and management should be finalised by the end of 2006 and should include: • grassed areas • areas to be rehabilitated.	Ongoing
28	All the tracks to retained in the precinct should be maintain at a standard that allows fire vehicles access and to act as fire breaks.	Completed
29	Work with the local Aboriginal groups and elders to identify the significance of the area to Aborigines.	Completed
30	Work with the local Aboriginal groups and elders to incorporate the non-Aboriginal heritage information into the interpretive material.	Completed
31	Establish a Friends of Dixon Road precinct to coordinate the implementation of the final management plan for the precinct.	Ongoing
32	The signs for the precinct should warn users that snakes are found in the area especially near the wetland areas.	Completed

Current and previous rehabilitation works

Revegetation has occurred along the northern section of the railway in response to the requirements of the *Dixon Road Precinct Management Plan* (VisionEnvironment 2005). Other rehabilitation works throughout Site 2 include weed control, and surveying and management of feral animals. Feral animal control has included fox and cat trapping, along with rabbit baiting, undertaken in early 2012.

2.2.5 Vegetation context and potential threatening processes

Site 2 is situated in a semi-urban environment. Site 2 is bounded to the south by a railway line, to the west by residential properties and to the north by Dixon Road. The area has been exposed to grazing and fires in the past and weeds are considered to be an ongoing threat.

2.2.6 Site access

All the major linkages in Site 2 have been formalised with the application of 75 mm crushed limestone. This allows for fire vehicle access as well as allowing pedestrian access to the park. All other ancillary tracks will be revegetated with local endemic species during the following winter seasons (CoR undated[c]).

3. Offset area management actions

3.1 Objectives

The overall aim for the offset sites will be 'rehabilitation of native vegetation to a condition that will, in the future, likely support a self-sustaining plant community with improved density and diversity to the pre-existing vegetation' (DEC 2009).

More specifically, the management objectives are to protect and maintain the offset sites by:

- improving and maintaining habitat suitable for foraging, breeding and roosting by black-cockatoo species
- managing introduced species (weeds and feral animals)
- applying the appropriate conservation tenure to ensure long-term protection
- controlling access by pedestrians and vehicles.

General rehabilitation procedures, dieback hygiene procedures and fencing requirements suitable for DPaW Regional Parks are provided in Appendix 4 through Appendix 6.

3.2 Values requiring protection

The offset sites consist of 63.3 ha of remnant vegetation, comprising potential foraging habitat for Carnaby's and forest red-tailed black-cockatoos, as well habitat for other native fauna. Site 1 includes part of the Anstey Swamp, a Conservation Category wetland.

3.3 Management objectives and actions

3.3.1 Management objectives

The environmental performance objectives and indicators for management of the offset sites are detailed in Table 9.

Table 9 Management objectives for offset sites

Management objective	Target	Performance indicators
To protect offset sites in conservation tenure	Offset sites secured in conservation covenants	Conservation covenant finalised
Damage to native vegetation and revegetation to be prevented	Fencing adequate and well maintained	Visual observations indicate no damage to fencing
To prevent the introduction and spread of weeds	Composition and cover of weed species within each zone reduced or unchanged from baseline surveys	Monitoring indicates a reduction or no increase in extent and distribution of weed species
To prevent the introduction and spread of dieback	No introduction of dieback	Monitoring and visual observations indicate dieback absent
To prevent increase in abundance of feral animals	No increase in abundance of feral animals or introduction of new feral species	Monitoring and visual observations indicate no additional damage to vegetation beyond that observed in baseline monitoring surveys
To prevent unauthorised use and access	No damage to existing vegetation or revegetation caused by unauthorised human use/access	Monitoring and visual observations indicate no additional damage to vegetation beyond that observed in baseline monitoring surveys
To prevent fire incidents	No unauthorised fires	Absence of fire

3.3.2 Management actions

Management actions proposed to be undertaken to achieve management objectives are listed in Table 10. Where relevant, management actions are informed by the specific advice provided by DEC (2009) in relation to the offset sites. Management actions apply to all of Sites 1 – 3 unless otherwise specified. Approximately 30 ha of seedlings is intended to be planted.

Regular or ongoing management actions must be undertaken for eight years from (as per Condition 3[xiii], Section 1.4.2) commencement of construction, or until management responsibility has transferred to an approved conservation organisation.

Table 10 Management actions for offset sites

Parameter	Action	Timing	Responsibility
Conservation covenant	Apply conservation covenant to site.	As soon as practicable	City of Rockingham
Baseline studies (Site 1 only)	Undertake flora and fauna surveys at site to: • confirm and map the vegetation type and condition • identify the Threatened or Priority flora and Declared Plant species • identify the presence or absence of dieback • identify protected fauna or their habitat.	As soon as practicable	Land manager
Weeds	Weed control (informed by baseline study/s) to be undertaken prior to undertaking direct seeding and planting.	Spring months, prior to revegetation	Land manager
	Weed control methods to be acceptable to relevant City of Rockingham and DPaW standards.	During weed control	Land manager
	Control methods for any weeds listed as Declared Plants to be undertaken in accordance with guidelines of the Department of Agriculture and Food WA.	During weed control	Land manager
	Weed infestations immediately adjacent to watercourses should be removed by hand where practicable or be sprayed in a manner which prevents overspray to the watercourse.	During weed control	Land manager
	Develop an ongoing weed management program to be implemented for the offset sites.	Ongoing	Land manager
Dieback	Limit vehicles to designated tracks.	Ongoing	Land manager
	Quarantine any areas identified to be infected with dieback in the baseline studies.	Following baseline studies	Land manager
	Ensure any soil or mulch used on site is certified dieback free.	During revegetation works	Land manager
Feral animals	Conduct rabbit control in offset sites.	Prior to revegetation	Land manager
	Erect agricultural fencing around boundary of site.	Prior to revegetation	Land manager
Access	Assess and rationalise existing pathways and public access points.	Prior to revegetation	Land manager
Fauna	Provide habitat by placement of habitat logs and tree hollows from the Development Site.	After clearing of Development Site	Land manager
Signage	Install interpretive and educational signage.	Prior to revegetation	Land manager
Seed collection	Compile list of appropriate species to be planted in revegetation areas based on flora and vegetation surveys of each offset site.	Prior to seed collection	Land manager
	Prior to clearing Development Site, collect seed from any suitable species (i.e., Carnaby's black-cockatoo habitat species and species suitable to vegetation types recorded in offset sites).	September to April prior to clearing of Development Site	Land manager
	If sufficient seed is not available from other sources, will be collected preferably from Bush Forever site 379 (for Site 1) and Bush Forever Site 356 (for Site 2).	December to March prior to seeding	Land manager

Parameter	Action	Timing	Responsibility
	Appropriate licences to be obtained from DER for seed collection within any DPaW managed land.	Prior to seed collection	Land manager
Site preparation	Undertake site preparations (e.g. cultivation/scarification in compacted bare areas, pre-planting weed removal, placement of habitat logs, placement of topsoil).	February to March, prior to revegetation	Land manager
	Except where cultivation/scarification is required, ensure soil disturbance is minimised to prevent weed germination.	Prior to revegetation	Land manager
	Topsoil from weed and dieback free areas of the Development Site to be transferred to any suitable areas of rehabilitation sites (i.e., accessible by vehicle, in Degraded – Completely Degraded condition).	Immediately after removal from Development Site (if practicable); otherwise prior to revegetation	Land manager
Revegetation	Determine areas suitable for revegetation.	Prior to site preparation	Land manager
	Undertake direct seeding of 5 kg/ha (in revegetation areas in Degraded – Completely Degraded condition).	May – June after site preparation completed	Land manager
	Plant seedlings in areas where insufficient seed is available for species appropriate to the vegetation type, or where rapid results are required (e.g. where heavy weed invasion is likely to outcompete native seed germination).	May – June after site preparation completed	Land manager
	Propagate seedlings from seed collected from Development Site.	Prior to clearing of Development Site	Land manager
	Procure seedlings of local plant species from appropriate, certified dieback-free nurseries (as advised by DEC [2003]) if insufficient seedlings obtained from Development Site seed.	Prior to revegetation	Land manager
	Ensure any seedlings brought to site are grown at a dieback-free certified nursery.	Ongoing	Land manager
	Protect seedlings with tree guards.	During seedling planting	Land manager
	Ensure 75% of plants used in revegetation are suitable as foraging, breeding or roosting habitat for Carnaby's black-cockatoo Appendix 3) and appropriate for mapped vegetation type of rehabilitation site.	During revegetation	Land manager
	Procure seedlings to conduct top-up planting in any areas not meeting 80% survival rates, as determined by monitoring.	As required	Land manager
Fire	All firebreaks within the wetland to be maintained to 3 m in width (Site 1 only).	Ongoing	Land manager
	All (non-wetland) firebreaks should be maintained to 4 m wide and have a height clearance of 4m with pass and turn around points (Site 2 only).	Ongoing	Land manager
	Any shelters or rest areas should be built giving consideration to prevalent wind and fire behaviour from materials that are fire resistant, and located in low fuel zones (Site 2 only).	Ongoing	Land manager
	The tracks that border the precinct and the main east-west track should be maintained at a standard that allows fire vehicles access and to act as fire breaks (Site 2 only).	Ongoing	Land manager
Contingency actions	Implement contingency actions to address site environmental issues as per triggers described in Table 12.	Ongoing	Land manager

4. Monitoring and reporting

Table 11 provides monitoring actions to enable an assessment of the effectiveness of controls for the protection and management of the offset sites.

Table 11 Monitoring actions for offset sites

Parameter	Frequency and responsibility	Location and sampling setup	Purpose	Reporting requirement
Revegetation success	Once-off, prior to site preparation	Establish at least three quadrats per offset site for regular monitoring, in areas to receive dense seedling planting coverage.	Develop understanding of baseline conditions of offset sites.	
	Once-off, prior to site preparation	Conduct baseline monitoring of quadrats including: • recording native and weed species at each quadrat • recording density of native plants • recording vegetation condition • recording any areas of poor/declined vegetation health or failure of vegetation to establish or regenerate • opportunistically recording any additional species revegetating outside of quadrats • recording locations of any Declared Plant infestations • photopoint monitoring of quadrats to record levels of germination, change in weed cover and weed outbreaks. Photopoint locations should be readily recognisable to enable repeat monitoring in subsequent years.	Develop understanding of baseline conditions of offset sites.	Prepare a report including: • monitoring results of items outlined under Location and Sampling Setup • calculations of species diversity and density • comparison of results against previous monitoring events • an assessment of whether any native species have regenerated from original onsite species or recruitment from nearby vegetation • assessment of whether revegetation is approaching the same structure and diversity of nearby remnant vegetation and its potential fauna habitat value • assessment of whether structure is on target to achieve the overall aim of a self-sustaining plant community within 10 years • dated and labelled photo plates from each photopoint determination of requirements for further management e.g. infill planting • weed monitoring items outlined below.
	Six-monthly (spring and autumn)	Conduct monitoring of quadrats for parameters described for baseline monitoring.	Assess success of rehabilitation works .	Prepare a report including parameters described for baseline monitoring report.
	Spring, three years from commencement of monitoring program	Monitor areas where seedlings have been planted and record approximate percentage survival of seedlings.		
	Spring, five years after commencement of monitoring program	Monitor areas where seedlings have been planted and record approximate percentage survival of seedlings.		
Weeds	Six-monthly (spring and autumn)	Conduct weed monitoring in quadrats to compile weed species list, estimation of the density and distribution of each species, record new infestation areas, record areas where previous infestations have not recurred.	To determine whether any major weed infestations are present or any existing infestations have increased.	Include results in six-monthly report.

Parameter	Frequency and responsibility	Location and sampling setup	Purpose	Reporting requirement
	Six-monthly (spring and autumn)	Conduct site walk-through to assess areas outside of quadrats for any new infestations.	To determine whether any major weed infestations are present or any existing infestations have increased.	Include results in six-monthly report.
	Six-monthly (spring and autumn)	Conduct visual inspection to assess areas previously treated for weed infestation and map extent of any persistent infestation.	To determine the success of weed control program.	Include results in six-monthly report.
	Six-monthly (spring and autumn)	Conduct visual inspection around perimeter of offset sites.	To ensure weed infestations do not occur along boundaries of offset sites, causing edge effects.	Include results in six-monthly report.
Fencing condition	Six-monthly (spring and autumn)	Visual inspection around perimeter of offset sites.	To ensure the fencing is in good condition and that there has been no unauthorised access beyond the fence.	Include results in six-monthly report.
Feral fauna	Six-monthly (spring and autumn)	Visual inspection around perimeter of offset sites and opportunistic observations throughout offset sites during monitoring activities.	To assess whether rabbits have established within offset sites.	Include results in six-monthly report.
Waste	Six-monthly (spring and autumn)	Visual inspection around perimeter.	To ensure no waste is dumped in offset sites.	Include results in six-monthly report.

5. Remedial actions

Table 12 identifies the remedial actions to be initiated in the event that the objectives for the protection and management of offset sites are not being met.

Table 12 Remedial actions for offset sites

Trigger	Action	Responsibility
Increase in distribution, abundance or density/cover of a specific weed species within or along boundaries, or persistence of weed infestation subsequent to treatment	1. Map the revised extent of the specific weed species within the site. 2. Identify activities that may have potentially increased the abundance, distribution or density/cover of weed species. 3. Review and revise (if required) weed control program (may involve seeking advice from relevant authorities) according to findings from point 2. 4. Implement revised hygiene control and education measures.	Land manager
New weed species observed within monitoring quadrats or during walk-through of offset sites	1. Map the distribution of the newly introduced weed species. 2. Identify activities that may have potentially introduced the weed species. 3. Review and revise (if required) weed control program (may involve seeking advice from relevant authorities) to include relevant controls for new species. 4. Implement revised hygiene control and education measures.	Land manager
Unrestricted or unauthorised access	1. Determine how access was gained and, if possible, the likely time of access. 2. Implement remedy, which could include: • repair fence/s • erect signs to highlight private property • install barriers around pedestrian paths. 3. Monitor success of control.	Land manager
Increase in distribution, abundance or density/cover of feral animals observed	1. Investigate cause. 2. Review, revise (if required) and implement control program (may involve seeking advice from relevant authorities). 3. Monitor success of remedy.	Land manager
Fire incident	1. Respond to fire in accordance with fire response procedures. 2. Investigate cause of fire. 3. Implement any remedial actions, if practicable, to prevent future fire incidents, seeking advice of FESA if necessary. 4. Monitor success of remedy.	Land manager
Waste dumping	1. Remove waste items. 2. Investigate cause. 3. Implement any remedial actions, if practicable, to prevent future waste dumping. 4. Monitor success of remedy.	Land manager

Trigger	Action	Responsibility
Observations indicate presence of dieback in previously uninfected areas	1. Identify potential sources of dieback spread and determine likely cause. 2. Update mapped distribution of dieback affected areas. 3. Undertake dieback control. Control methods may include phosphite treatment to minimise the spread of dieback. 4. Review success of dieback control methods and continue monitoring. 5. Review and update management plan accordingly.	Land manager
Target survival rate for planted seedlings (80%) not achieved	1. Map the extent of seedling deaths to obtain approximate percentage of dead seedlings. 2. Identify potential causes of deaths and implement any appropriate management. 3. Procure sufficient seedlings to replace the number dead within 12 months. 4. Plant seedlings , avoiding any areas where high seedling deaths were noted. 5. Monitor annually for a further two years.	Land manager

6. Implementation

6.1 Timing

Timing of some activities such as placement of habitat logs and collection of seed from the Development Site is ultimately dependent on the timing that clearing occurs. Indicative timing for ongoing activities is provided in Table 10 and Table 11.

The following items have been completed, are currently underway or have been commissioned:

- revegetation along northern section of train line in Site 2
- surveying and control of feral rabbits, foxes and cats in Site 2
- weed control in Site 2.

The indicative time line presented in Table 13 does not factor in any works done prior to the publication of this EOMP, and indicates either optimal timing (e.g. in the case of baseline surveys) or required timing (e.g. weed monitoring). Where all months are highlighted, the action may be undertaken at any time, as required.

Table 13 Indicative timing for selected management actions

Action													Year
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Baseline surveys													Year 1 only
Seed collection from Development Site													Year 1 only
Seed collection from offset sites and Bush Forever sites													Year 1 only
Site preparation													Year 1 only
Procure seedlings													Year 1, then as required
Seedling propagation													Year 1, then as required
Revegetation (seeding, planting)													Year 1, then as required
Revegetation monitoring													All years
Top-up planting (if required)													As required
Weed monitoring													All years
Weed control													All years
Feral fauna control													As required

6.2 Reporting requirements

6.2.1 Reporting required by DER

City of Rockingham will report to the DER Native Vegetation Conservation Branch after a 1, 5 and 10-year period, with the following details:

- a summary of surveys carried out in the period such as flora surveys
- details of vegetation improvement actions including planting or seeding density and species
- confirmation that weeding has been carried out annually and a summary of weed spread or reductions over the period
- location of newly constructed fencing details and/or statement of ongoing maintenance
- a summary of other environmental activities carried out in addition to the required offset activities, for example facilitating community groups interested in the site
- environmental incidents at the site that have not previously been reported to DPaW under other legislative requirements (for example, trail bike use that had been discovered and how it was managed)
- any ownership or stewardship changes to the property.

Reporting conditions of Clearing Permit

Relevant conditions of the Clearing Permit, issued by DEC on 26 October 2011, are described below. Clearing Permits are now administered by the DER.

Condition 10: Offsets

> The Permit Holder must implement and adhere to the offset proposal 'Mundijong Road Extension – Environmental Offsets Strategy, 15 April 2009' and 'Attachment A: Proposed Rehabilitation Methods and Measurement, 5 May 2009.'

Record keeping and reporting conditions of the Clearing Permit, relevant to the offset sites, are as follows:

Condition 11: Records must be kept

> The Permit Holder must maintain the following records for activities done pursuant to this Permit, as relevant:
>
> (c) in relation to the offsets of areas pursuant to condition 10:
>
> > (i) the location of any offsets recorded using a Global Positioning System (GPS) unit set to Geocentric Datum of Australia 1994 (GDA94), expressing the geographical coordinates in Eastings and Northings or decimal degrees;
> >
> > (ii) a description of the offset activities undertaken; and
> >
> > (iii) the size of the offset area (in hectares).

Condition 12: Reporting

> (a) The Permit Holder must provide to the CEO, on or before 30 June of each year, a written report of records required under condition 11 and activities done by the Permit Holder under this Permit between 1 January and 31 December of the preceding year.
> (b) Prior to 18 October 2013, the permit holder must provide to the CEO a written report of records required under condition 11 where these records have not already been provided under condition 12(a).

6.2.2 Reporting required by DSEWPaC

City of Rockingham will undertake the following reporting in relation to conditions of the Commonwealth approval:

- within two years of the commencement of construction of the Development Site, provide DSEWPaC with written evidence that the offset areas have been placed under an irrevocable conservation covenant for protection in perpetuity
- provide to DSEWPaC a description and map clearly defining the location and boundaries of the offset sites, to be accompanied with the offset attributes and a shapefile, by 30 March 2014
- publish all management plans referred to in the conditions of the Commonwealth approval on the City of Rockingham website, unless otherwise agreed to in writing by the Minister, for the length of the approval, within 1 month of the management plan being approved
- maintain accurate records substantiating all activities associated with or relevant to the conditions of the Commonwealth approval, including measures taken to implement the plan(s) required by the approval, and make them available upon request to DSEWPaC
- publish a report on City of Rockingham website addressing compliance with each of the conditions of the Commonwealth approval within three months of every 12 month anniversary of the commencement of the action, the report to stay on the website for at least five years
- documentary evidence providing proof of the date of publication and non-compliance with any of the conditions of the Commonwealth approval must be provided to DSEWPaC at the same time as the compliance report is published
- **i**f any activity is proposed to be undertaken otherwise than in accordance with the plan(s) as specified in the Commonwealth approval conditions, the person taking the action must submit to the Department for the Minister's written approval a revised version of that plan.

6.3 Maintenance of management plan

This Management Plan will be reviewed and revised after two years of implementation. If monitoring results suggest that the Management Plan be reviewed prior to this period, the following will be undertaken:

1. Redefine management actions to better reflect environmental requirements.
2. Revise monitoring program to provide a better mechanism for assessment.
3. Revise remedial actions if monitoring program indicates ineffective.

Notwithstanding Condition 10 of the DSEWPaC approval, minor changes to actions and timing which may be required to achieve outcomes, but have not previously been anticipated, will be considered to be minor changes to the EOMP. Any such change, which does not alter outcomes, but is operational in nature in response to factors such as seasonal variability (e.g. seed availability, changes to site conditions, seasonal climatic factors, etc) will not be considered to trigger the requirement for DSEWPaC approval under Condition 10.

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Appendix 1

Flora species recorded at Site 1

Table 1-1 Native flora species recorded at Site 1

Family	Taxon
Apiaceae	*Centella asiatica*
	Daucus glochidiatus
	Homalosciadium homalocarpum
Araliaceae	*Trachymene pilosa*
Asparagaceae	*Acanthocarpus preissii*
	Dichopogon capillipes
	Sowerbaea laxiflora
	Thysanotus manglesianus
Asteraceae	*Olearia axillaris*
	Podotheca gnaphalioides
	Senecio pinnatifolius
Campanulaceae	*Lobelia anceps*
Centrolepidaceae	*Centrolepis aristata*
	Centrolepis drummondiana
Chenopodiaceae	*Rhagodia baccata* subsp. *baccata*
Cyperaceae	*Baumea articulata*
	Baumea juncea
	Gahnia trifida
	Lepidosperma gladiatum
	Lepidosperma longitudinale
Ericaceae	*Leucopogon parviflorus*
	Leucopogon propinquus
Fabaceae	*Acacia cyclops*
	Acacia pulchella var. *pulchella*
	Acacia saligna
	Hardenbergia comptoniana
	Jacksonia furcellata
	Kennedia prostrata
	Viminaria juncea
Haemodoraceae	*Anigozanthos manglesii*
	Conostylis candicans
Hemerocallidaceae	*Dianella revoluta* var. *divaricata*
Iridaceae	*Patersonia occidentalis* var. *angustifolia*
Lauraceae	*Cassytha racemosa* forma *racemosa*
Myrtaceae	*Eucalyptus gomphocephala*
	Melaleuca rhaphiophylla
	Melaleuca teretifolia
Orchidaceae	*Caladenia arenicola*
	Caladenia flava
	Caladenia latifolia
	Eriochilus dilatatus subsp. *dilatatus*
	Microtis media subsp. *media*
	Prasophyllum drummondii
	Pterostylis vittata
	Pyrorchis nigricans

Family	Taxon
Poaceae	*Austrostipa compressa*
	Austrostipa flavescens
	Poa poiformis
Polygonaceae	*Muehlenbeckia adpressa*
Portulacaceae	*Calandrinia corrigioloides*
Primulaceae	*Samolus junceus*
Proteaceae	*Banksia littoralis*
	Conospermum triplinervium
	Grevillea olivacea
	Hakea prostrata
	Hakea varia
Ranunculaceae	*Clematis linearifolia*
Restionaceae	*Desmocladus flexuosus*
Rhamnaceae	*Spyridium globulosum*
Rosaceae	*Cotoneaster glaucophyllus*
Rubiaceae	*Opercularia hispidula*
	Opercularia vaginata
Santalaceae	*Exocarpos sparteus*
Solanaceae	*Solanum simile*
Thymelaeaceae	*Pimelea rosea*
Xanthorrhoeaceae	*Xanthorrhoea brunonis* subsp. *brunonis*
Zamiaceae	*Macrozamia riedlei*

Source: BEC 2012

Appendix 2

Native flora species recorded at Site 2

Table 2-1 Native flora species recorded in Site 2 during vegetation monitoring

Species	Transect 1 (central Site 2)	Transect 2 (eastern Site 3)	Transect 3 (central Site 3)
Acacia applanata	x	x	x
Acacia pulchella subsp. *pulchella*	x	x	x
Acacia rostellifera	x	x	x
Acacia saligna	x	x	x
Acanthocarpus preissii	x	x	x
Austrostipa flavescens	x	x	x
Calandrinia sp.		x	
Carex preissii			
Carpobrotus sp.			x
Clematis linearifolia	x	x	x
Conostylis aculeata subsp. *aculeata*	x	x	
Crassula colorata var. *colorata*	x	x	x
Desmocladus fasicularis	x	x	x
Dianella revoluta subsp. *divaricata*	x	x	x
Drosera sp.	x	x	x
Eucalyptus gomphocephala	x	x	x
Gompholobium capitatum	x	x	x
Hardenbergia comptoniana	x	x	x
Hibbertia racemosa	x	x	x
Kennedia prostrata	x		
Lepidosperma longitudinale	x		
Lepidosperma pubisquameum	x	x	x
Leucopogon parviflorus	x	x	x
Lomandra maritima	x	x	x
Opercularia vaginata	x		
Oxalis perennans		x	x
Phyllanthus calycinus	x	x	x
Rhagodia baccata	x	x	x
Spyridium globulosum	x	x	x
Thomasia cognata	x	x	x
Wurmbea monantha	x		
Xanthorrhoea brunonis	x	x	x
Xanthorrhoea preissii	x	x	x

Source: Coffey 2009 and 2010

Appendix 3
Plants used by Carnaby's black-cockatoo (DEC 2011)

Plants Used by Carnaby's Black Cockatoo

Department of Environment and Conservation

List prepared by Christine Groom, Department of Environment and Conservation 15 April 2011

For more information on plant selection or references used to produce this list please visit the Plants for Carnaby's Search Tool webpage at www.dec.wa.gov.au/plantsforcarnabys

Our environment, our future

	Used for						Soil type					Soil drainage				
Species	**Feeding**	**Nesting**	**Roosting**	**Priority for planting for Carnaby's**	**Growth form**	**Flower colour**	**Clayey**	**Gravelly**	**Loamy**	**Sandy**	**Sun exposure**	**Well drained**	**Poorly drained**	**Waterlogged**	**Salt affected**	**Origin**
Acacia baileyana (Cootamundra wattle)*	■			Low	Tree	Yellow	■		■		○ ◗	■	■	■		Australian native
Acacia pentadenia (Karri Wattle)	■			Low	Tree	Cream			■		○ ◗ ●	■				WA native
Acacia saligna (Orange Wattle)	■			Low	Tree	Yellow			■	■	○ ◗	■	■			WA native
Agonis flexuosa (Peppermint Tree)	■			Low	Tree	White		■		■	○ ◗ ●	■	■			WA native
Araucaria heterophylla (Norfolk Island Pine)	■			Low	Tree	Green				■	○ ◗ ●	■				Exotic to Australia
Banksia ashbyi (Ashby's Banksia)	■			Medium	Tree or Tall shrub	Yellow, Orange				■	○ ◗	■				WA native
Banksia attenuata (Slender Banksia)	■			High	Tree	Yellow			■	■	○ ◗	■				WA native
Banksia baxteri (Baxter's Banksia)	■			Medium	Tall shrub	Yellow	■		■	■	○ ◗	■				WA native
Banksia carlinoides (Pink Dryandra)	■			Medium	Medium or small shrub	White, cream, pink	■		■	■	○ ◗	■				WA native
Banksia coccinea (Scarlet Banksia)	■			Medium	Tree	Red		■	■	■	○ ◗	■				WA native
Banksia dallanneyi (Couch Honeypot Dryandra)	■			Low	Medium or small shrub	Orange, brown			■	■	○	■				WA native
Banksia ericifolia (Heath-leaved Banksia)	■			Medium	Tall shrub	Orange			■	■	○	■				Australian native
Banksia fraseri (Dryandra)	■			Medium	Medium or small shrub	Orange		■		■	○ ◗	■				WA native
Banksia gardneri (Prostrate Banksia)	■			Low	Medium or small shrub	Orange	■	■	■	■	○ ◗	■				WA native
Banksia grandis (Bull Banksia)	■			High	Tree	Yellow		■	■	■	○ ◗	■				WA native
Banksia hookeriana (Hooker's Banksia)	■			Medium	Tall shrub	Orange				■	○ ◗	■				WA native
Banksia ilicifolia (Holly Banksia)	■			High	Tree	Cream				■	○ ◗	■				WA native
Banksia kippistiana (Dryandra)	■			Medium	Medium or small shrub	Yellow		■		■	○ ◗	■				WA native
Banksia leptophylla	■			Low	Medium or small shrub	Yellow				■	○ ◗	■				WA native
Banksia littoralis (Swamp Banksia)	■			High	Tree	Yellow	■	■	■	■	○ ◗	■				WA native
Banksia menziesii (Firewood or Menzie's Banksia)	■			High	Tree	Yellow, pink, red				■	○ ◗	■				WA native
Banksia mucronulata (Swordfish Dryandra)	■			Medium	Medium or small shrub	Yellow	■		■	■	○ ◗	■				WA native
Banksia nivea (Honeypot Dryandra)	■			High	Medium or small shrub	Orange		■		■	○ ◗	■				WA native
Banksia nobilis (Golden Dryandra)	■			Medium	Tall shrub	Orange	■	■	■	■	○	■				WA native
Banksia praemorsa (Cut-leaf Banksia)	■			Medium	Tall shrub	Red, yellow, green				■	○	■				WA native
Banksia prionotes (Acorn Banksia)	■			High	Tree	Orange				■	○	■				WA native

Species	Used for			Priority for planting for Carnaby's	Growth form	Flower colour	Soil type				Sun exposure	Soil drainage				Origin
	Feeding	Nesting	Roosting				Clayey	Gravelly	Loamy	Sandy		Well drained	Poorly drained	Waterlogged	Salt affected	
Banksia quercifolia (Oak-leaved Banksia)	■			Medium	Tall shrub	Brown			■	■	○	■				WA native
Banksia sessilis (Parrot Bush)	■			High	Tree	Cream		■		■	○ ◢	■				WA native
Banksia speciosa (Showy Banksia)	■			High	Tree	Yellow	■			■	○ ◢	■				WA native
Banksia squarrosa (Pingle)	■			High	Tall shrub	Yellow	■	■	■	■	○	■				WA native
Banksia tricuspis (Lesueur Banskia or Pine Banksia)	■			Medium	Tree	Orange				■	○ ◢	■				WA native
Banksia undata (Urchin or Cut-leaf Dryandra)	■			High	Tall shrub	Yellow	■	■	■	■	○ ◢	■				WA native
Banksia verticillata (Granite Banksia)	■			Low	Tree	Yellow			■	■	○ ◢	■				WA native
Brassica campestris (Canola, Rape)**	■			Low	Herb	Yellow			■	■	○ ◢ ◢	■				Exotic to Australia
Callistemon viminalis (Captain Cook Bottlebrush)	■			Medium	Tall shrub	Red	■	■	■	■	○	■				Australian native
Callitris sp.	■			Medium	Tree		■		■	■	○	■				WA native
Carya illnoinensis (Pecan)	■			Low	Tree	Yellow			■	■	○ ◢	■				Exotic to Australia
Casuarina cunninghamiana (River Sheoak)*	■			Low	Tree	Red	■	■	■	■	○	■	■	■		Australian native
Citrullus lanatus (Pie or Afghan Melon)*	■			Low	Scrambler, climber or percher	Yellow	■	■	■	■	○	■				Exotic to Australia
Corymbia calophylla (Marri)	■	■	■	High	Tree	Cream	■	■	■	■	○ ◢	■	■			WA native
Corymbia ficifolia (Red Flowering Gum)	■			Medium	Tree	Red		■	■	■	○	■				WA native
Corymbia haematoxylon (Mountain Marri)	■			Medium	Tree	White				■	○	■				WA native
Corymbia maculata (Spotted Gum)			■	Low	Tree	White		■			○	■				Australian native
Darwinia citriodora (Lemon-scented Darwinia)	■			Low	Medium or small shrub	Red, orange, yellow		■			○ ◢	■				WA native
Diospryros sp. (Sweet Persimmon)	■			Low	Tree				■	■	○	■				Exotic to Australia
Eremophila glabra (Tarbush)	■			Low	Tall shrub	Various	■		■	■	○ ◢	■				WA native
Erodium aureum (Corkscrew Grass or Storksbill)*	■			Low	Herb	Pink			■	■	○	■				Exotic to Australia
Erodium botrys (Corkscrew Grass or Storksbill)*	■			Low	Herb	Purple					○	■				Exotic to Australia
Eucalyptus caesia (Silver Princess)	■			Medium	Tree	Pink			■		○	■				WA native
Eucalyptus camaldulensis (River Red Gum)			■	Low	Tree	Cream, yellow	■				○		■	■	■	Australian native
Eucalyptus citriodora (Lemon Scented Gum)	■		■	Medium	Tree	Red		■	■		○	■				Australian native
Eucalyptus diversicolor (Karri)		■		Low	Tree	Cream			■	■	○	■				WA native
Eucalyptus globulus (Tasmaniam Blue Gum)			■	Low	Tree	White	■	■	■		○	■				Australian native
Eucalyptus gomphocephala (Tuart)	■	■	■	High	Tree	White			■	■	○	■				WA native
Eucalyptus grandis (Flooded Gum, Rose Gum)			■	Low	Tree	White, cream	■		■	■	○	■				Australian native
Eucalyptus longicornis (Red Morrell)		■		Low	Tree	White	■		■		○	■				WA native
Eucalyptus loxophleba (York Gum)	■	■		Low	Tree	White		■	■	■	○	■				WA native
Eucalyptus marginata (Jarrah)	■		■	Medium	Tree	White	■	■	■	■	○	■				WA native
Eucalyptus occidentalis (Swamp Yate)		■		Low	Tree	Cream	■		■		○		■	■		WA native
Eucalyptus patens (Blackbutt)	■		■	Medium	Tree	White	■	■	■	■	○	■				WA native
Eucalyptus pleurocarpa (Tallerack)	■			Medium	Tree	White				■	○	■				WA native

	Used for						Soil type					Soil drainage				
Species	**Feeding**	**Nesting**	**Roosting**	**Priority for planting for Carnaby's**	**Growth form**	**Flower colour**	**Clayey**	**Gravelly**	**Loamy**	**Sandy**	**Sun exposure**	**Well drained**	**Poorly drained**	**Waterlogged**	**Salt affected**	**Origin**
Eucalyptus preissiana (Bell-fruited Mallee)	■			Medium	Tree	Yellow		■	■	■	○	■	■			WA native
Eucalyptus robusta (Swamp Mahogany)	■		■	Medium	Tree	White	■	■	■	■	○	■	■	■	■	Australian native
Eucalyptus rudis (Flooded Gum)			■	Low	Tree	White	■		■	■	○	■				WA native
Eucalyptus salmonophloia (Salmon Gum)	■	■		High	Tree	White	■	■		■	○	■				WA native
Eucalyptus salubris (Gimlet)		■		Medium	Tree	White, cream		■	■	■	○	■				WA native
Eucalyptus todtiana (Coastal Blackbutt or Prickley Bark)	■			Medium	Tree	White				■	○	■				WA native
Eucalyptus wandoo (Wandoo)	■	■	■	High	Tree	White	■	■	■	■	○	■				WA native
Ficus sp. (Fig)	■			Low	Tree		■		■	■	○ ◓ ◓	■				Australian native
Grevillea armigera (Prickly Toothbrushes)	■			Medium	Tall shrub	Green, yellow, black		■		■	○ ◓	■				WA native
Grevillea bipinnatifida (Fuschia Grevillea)	■			Medium	Medium or small shrub	Red	■	■	■	■	○ ◓	■				WA native
Grevillea hookeriana (Red Toothbrushes)	■			Medium	Tall shrub	Red		■	■	■	○	■				WA native
Grevillea hookeriana subsp. apiciloba (Black Toothbrushes)	■			Medium	Medium or small shrub	Black				■	○	■				WA native
Grevillea paniculata (Kerosene Bush)	■			Medium	Tall shrub	White	■	■	■	■	○ ◓	■				WA native
Grevillea paradoxa (Bottlebrush Grevillea)	■			Medium	Medium or small shrub	Cream, pink		■	■	■	○	■				WA native
Grevillea petrophiloides (Pink Poker)	■			Medium	Tall shrub	Pink		■		■	○	■				WA native
Grevillea robusta (Silky Oak)	■			Medium	Tree	Orange	■		■	■	○	■				Australian native
Hakea auriculata	■			Medium	Tall shrub	White		■	■	■	○ ◓	■				WA native
Hakea candolleana	■			Medium	Medium or small shrub	White	■		■	■	○	■				WA native
Hakea circumalata (Coastal Hakea)	■			Medium	Medium or small shrub	White, pink	■	■		■	○ ◓	■				WA native
Hakea commutata	■			Medium	Medium or small shrub		■	■	■	■	○ ◓	■		■		WA native
Hakea conchifolia	■			Medium	Medium or small shrub	White, cream, pink		■	■	■	○	■				WA native
Hakea costata (Ribbed Hakea)	■			Medium	Medium or small shrub	White		■	■	■	○	■				WA native
Hakea cristata (Snail Hakea)	■			Medium	Medium or small shrub	White		■	■		○ ◓	■				WA native
Hakea cucullata (Snail Hakea)	■			Medium	Tall shrub	Pink		■	■	■	○	■				WA native
Hakea cyclocarpa (Ramshorn)	■			Medium	Medium or small shrub	White	■	■	■		○ ◓	■				WA native
Hakea eneabba	■			Medium	Medium or small shrub	Yellow			■	■	○	■				WA native
Hakea erinacea (Hedgehog Hakea)	■			Medium	Medium or small shrub	Cream	■	■	■	■	○ ◓	■				WA native
Hakea falcata (Sickle Hakea)	■			Medium	Tall shrub	White	■	■	■	■	○ ◓		■	■		WA native
Hakea flabellifolia (Fan-leaved Hakea)	■			Medium	Medium or small shrub	Brown		■	■	■	○	■				WA native
Hakea gilbertii	■			Medium	Medium or small shrub	White	■	■	■	■	○	■				WA native
Hakea incrassata (Golfball or Marble Hakea)	■			Medium	Medium or small shrub	Cream		■	■	■	○ ◓	■				WA native
Hakea lasiantha (Woolly Flowered Hakea)	■			Medium	Tall shrub	White		■	■	■	○ ◓	■				WA native
Hakea lasianthoides	■			Medium	Tall shrub	White	■	■	■		◓	■				WA native
Hakea laurina (Pin-cushion hakea)	■			Medium	Tree	Red	■	■		■	○ ◓	■				WA native
Hakea lissocarpha (Honeybush)	■			Medium	Medium or small shrub	White		■	■	■	○ ◓	■				WA native

Species	Used for			Priority for planting for Carnaby's	Growth form	Flower colour	Soil type				Sun exposure	Soil drainage				Origin
	Feeding	Nesting	Roosting				Clayey	Gravelly	Loamy	Sandy		Well drained	Poorly drained	Waterlogged	Salt affected	
Hakea megalosperma (Lesueur Hakea)	■			Medium	Medium or small shrub	White, cream, pink, red		■		■	○	■				WA native
Hakea multilineata (Grass Leaf Hakea)	■			Medium	Tall shrub	Pink	■	■	■	■	○ ◗	■				WA native
Hakea obliqua (Needles and Corks)	■			Medium	Tall shrub	White			■	■	○	■				WA native
Hakea oleifolia (Dungyn or Olive-leaved Hakea)	■			Medium	Tree	White	■	■	■	■	○	■				WA native
Hakea pandanicarpa subsp. crassifolia (Thick-leaved Hakea)	■			Medium	Tall shrub	Cream		■	■	■	○ ◗	■				WA native
Hakea polyanthema	■			Medium	Medium or small shrub	White		■	■	■	○	■				WA native
Hakea petiolaris (Sea Urchin Hakea)	■			Medium	Tall to medium shrub	Cream, pink		■	■	■	○ ◗	■				WA native
Hakea preissii (Needle Tree)	■			Medium	Tall shrub	Yellow	■	■	■	■	○	■		■	■	WA native
Hakea prostrata (Harsh Hakea)	■			High	Tall to mediumshrub	White	■	■	■	■	○	■				WA native
Hakea psilorrhyncha	■			Medium	Tall shrub	Cream			■	■	○	■				WA native
Hakea ruscifolia (Candle Hakea)	■			Medium	Tall shrub	White		■	■	■	○ ◗	■				WA native
Hakea scoparia (Kangaroo Bush)	■			Medium	Tall shrub	Cream	■	■	■	■	○ ◗	■				WA native
Hakea smilacifolia	■			Medium	Medium or small shrub	White		■	■	■	○	■				WA native
Hakea spathulata	■			Medium	Medium or small shrub	Red			■	■	○	■				WA native
Hakea stenocarpa (Narrow-fruited Hakea)	■			Medium	Medium or small shrub	White	■	■	■	■	○ ◗	■	■			WA native
Hakea sulcata (Furrowed Hakea)	■			Medium	Medium or small shrub	White		■	■	■	○ ◗	■		■		WA native
Hakea trifurcata (Two-leaved Hakea)	■			High	Tall shrub	White		■	■	■	○ ◗ ◗	■				WA native
Hakea undulata (Wavy-leaved Hakea)	■			High	Tall shrub	White	■	■	■	■	○ ◗	■	■			WA native
Hakea varia (Variable-leaved Hakea)	■			Medium	Tall shrub	White	■	■	■	■	○ ◗	■	■	■		WA native
Helianthus annuus (Sunflower)*	■			Low	Herb	Yellow					○	■				Exotic to Australia
Hibiscus sp. (Hibiscus)	■			Low	Tall shrub	Various					○ ◗ ◗	■				Exotic to Australia
Isopogon scabriusculus	■			Medium	Medium or small shrub	Pink		■	■	■	○	■				WA native
Jacaranda mimosifolia (Jacaranda)	■			Low	Tree	Blue, purple			■	■	○ ◗	■				Exotic to Australia
Jacksonia furcellata (Grey Stinkwood)	■			Medium	Tall shrub	Orange				■	○ ◗	■				WA native
Lambertia inermis (Chittick)	■			Medium	Tree	Red, orange, yellow		■	■	■	○ ◗	■				WA native
Lambertia multiflora (Many-flowered Honeysuckle)	■			Medium	Medium or small shrub	Orange, yellow	■	■		■	○	■				WA native
Liquidamber styraciflua (Liquid Amber)	■			Medium	Tree	Green					○ ◗	■				Exotic to Australia
Lupinus sp. (Lupin)*	■			Low	Herb	Yellow, blue					○	■				Exotic to Australia
Macadamia integrifolia (Macadamia)	■			Medium	Tree	White		■	■	■	○	■				Australian native
Malus domestica (Apple)	■			Low	Tree	White					○	■				Exotic to Australia
Melaleuca leuropoma	■			Medium	Medium or small shrub	Cream, purple, yellow				■	○	■				WA native
Melia azedarach (Cape Lilac or White Cedar)**	■			Low	Tree	Purple			■	■	○ ◗	■				Exotic to Australia
Mesomeleana sp.	■			Medium	Grassy or strappy						○	■				WA native
Protea repens	■			Medium	Tree or medium to small shrub	White, cream, pink		■		■	○ ◗	■				Exotic to Australia
Protea 'Pink Ice'	■			Medium	Tree or medium to small shrub	White, cream, pink		■		■	○ ◗	■				Exotic to Australia

Species	Used for			Priority for planting for Carnaby's	Growth form	Flower colour	Soil type				Sun exposure	Soil drainage				Origin
	Feeding	Nesting	Roosting				Clayey	Gravelly	Loamy	Sandy		Well drained	Poorly drained	Waterlogged	Salt affected	
Pinus canariensis (Canary Island Pine)	■			Low	Tree	Brown	■	■	■	■	○	■				Exotic to Australia
Pinus caribea (Caribbean Pine)	■			Low	Tree	Brown					○	■				Exotic to Australia
Pinus pinaster (Pinaster or Maritime Pine)**	■		■	Medium	Tree	Brown			■	■	○	■				Exotic to Australia
Pinus radiata (Radiata Pine)**	■		■	Medium	Tree	Brown			■	■	○ ◗	■				Exotic to Australia
Prunus amygdalus (Almond Tree)	■			Medium	Tree				■	■	○	■				Exotic to Australia
Raphanus raphanistrum (Wild Radish)*	■			Low	Herb	Various	■	■	■	■	○	■				Exotic to Australia
Tipuana tipu (Tipu or Rosewood Tree)**	■			Low	Tree	Yellow	■	■	■	■	○	■				Exotic to Australia
Xanthorrhoea preissii (Grass Tree)	■			Medium	Grassy or strappy	Cream		■	■	■	○	■				WA native

* Weed

** Potential weed

Appendix 4
General rehabilitation procedures

Topsoil transfer

Topsoil is an excellent source of native plant seed and soil biota for land rehabilitation. Topsoil from the Development Site will be exported to some of the revegetation areas of the offset sites. Any areas of soil known to be, or potentially, infected with dieback (*Phythophthora cinnamomi*) should not be transferred.

Some general procedures for respreading topsoil at the relevant rehabilitation sites includes:

- respread topsoil to a maximum thickness of 150 mm using appropriate machinery (e.g. loader, bobcat); areas of various thicknesses not more than 150 mm may be utilised for the purposes of trials and research
- spread topsoil close to, and amongst, existing vegetation in order to cover as much of the in situ soil as possible – however avoid burial of native plants
- work parallel with the contours as far as practicable, to minimise erosion by the creation of favoured drainage routes
- once respreading of topsoil is complete, rake the topsoil parallel to the slope contour to remove excessive mounds and hollows, improve water infiltration and minimise compaction.

Deep ripping

Wetlands and lower lying areas to be revegetated may be subject to shallow inundation during wetter months. This may lead to problems from water-logging for seedlings and the potential for newly broadcast seed to float and be concentrated in small areas or to be washed off site. To counter these concerns, it may be possible to rip and mound the site to improve drainage, improve root penetration and create non-waterlogged bed areas for seed and seedling establishment.

Ripping and mounding will be conducted over summer or early autumn to 'shatter' the soil if possible, when it is most dry (ripping the soil when wet can lead to glazing which can limit effective root growth). The other advantage of mounding during the summer is that mounds have time to settle removing air pockets prior to planting and the risks of bogging machinery are reduced.

This method may not be suitable for all sites and consultation with revegetation experts is required.

Scarifying

All areas to be direct seeded should be lightly scarified to 'fluff up' the soil surface – this will provide small niches for seed and organic matter to settle in and allow rainfall to concentrate on germinating seed. This should occur immediately prior to the direct seeding.

Seed collection

An experienced seed collector licensed by DPaW should be engaged to undertake the works. A DEC Regulation 4 Authority will also be required by the contractor to undertake the work within DEC-managed lands.

Seed should all be local provenance (unless authorised otherwise by DPaW). Detailed record sheets will have to be maintained by the seed collector to provide evidence that the seed is local provenance.

Seed viability and germination testing could be undertaken if deemed necessary.

Seed should be stored in a dry, cool place – about 10-15˚C to ensure seed viability.

Prior to direct seeding, seed should undergo the appropriate treatments required to break dormancy and improve germination rates. The treatments could include smoking, freezing, boiling or scarifying.

Direct seeding

These instructions relate to the preliminary requirements and actual direct seeding of an area:

These instructions relate to the preliminary requirements and actual direct seeding of an area:

- Environmental Supervisor to determine the appropriate mix of seed required to achieve the vegetation assemblages in accordance with performance indicators. Expert advice may need to be sort in terms of the plants that germinate well from seed.
- Contract experienced seed collector licensed by the DPaW (Nature Conservation Division) to undertake the works. Monitor the progress of the seed collector.
- Seed should be predominantly local provenance. Detailed record sheets will have to be maintained by the seed collector to provide evidence that the seed is provenance.
- Seed viability and germination testing could be undertaken if deemed necessary.
- Seed should be stored in a dry, cool place – about 10-15˚C to ensure seed viability.
- Prior to direct seeding, seed should undergo the appropriate treatments required to break dormancy and improve germination rates. The treatments could include smoking, freezing, boiling or scarify.
- After achieving required weed control, area should be raked in preparation for direct seeding.
- The treated seed should be combined with an appropriate medium (e.g. yellow sand or vermiculite) and manually distributed by an experienced operator, ensuring an even coverage over the whole area.

Seedling planting

The community could be involved in the revegetation of these areas (including residents, Friends groups or local education institutions), incorporating an eco-education exercise. The planting instructions outlined below relate to the preliminary requirements and actual installation of a plant:

- Environmental Supervisor to determine the quantity of various native flora species required and then engage Contractors to undertake the necessary seed collection and plant propagation. The majority of plants should be produced from local provenance seed, as outlined in the performance targets. The plants should be produced in forestry tubes (50 mm x 50 mm x 125 mm) and be in a healthy, non-root bound condition upon pick-up or delivery. A number of native plant nurseries are outlined below, their Accreditation status should be confirmed to reduce the risk of introducing dieback via the revegetation plants.
- Environmental Supervisor to determine the appropriate location for the various species of plantings (consultation with an expert may be required).
- Every attempt should be made to plant seedlings in such a way as to avoid ‘artificial’ patterns (e.g. no straight lines of single species, no repetitive planting pattern) in order to mimic the ‘ordered chaos’ of natural bushland. However planting should still be undertaken so as to meet the ratios/densities required by approval conditions (e.g. percentage of Carnaby’s black-cockatoo habitat species as outlined in Table 10).
- Dig a hole that is twice the size of the plant pot. In the case of wetland species, the depth at which the seedling is planted should be sufficient to prevent predation by birds and impact from inundation.
- Determine the appropriateness of additives, which could include Seasol, water granules, soil breaker, water retainer, wetting agent or fertiliser tablets. If they are required, add at the relevant time (i.e. in the hole prior to planting or upon watering in plants).
- Remove the plant from the pot and place it in the hole, ensuring the base of the plant is slightly below the original soil surface.
- Fill the soil in around the plant ensuring it sits in a basin that is approximately 200-300 mm in diameter and 50 mm deep to provide adequate water capture. Ensure the base of the plant is flush with the soil surface within the basin to prevent collar rot.
- Water in seedlings when planted, if required
- Install 3 stakes (10-12 mm diameter) and a protective guard (plastic) around the seedlings to protect them from rabbits. All bags should be upright (towards the sky) rather than perpendicular

to the landscape. They should be tight to reduce risk of losing the bags under certain weather conditions.

- Where necessary, install a weed mat (approximately 300 mm x 300 mm) around the base of the plant; these will break down over time, and suppress weeds.
- Remove soil from the tools used and wash down all tools according to Dieback Hygiene Procedures.

Habitat log importation

During clearing of the Development Site, habitat logs will be salvaged and collected to be used in rehabilitation of offset sites. Habitat logs are the logs from the largest trees cleared on site. Much of the foliage, roots and branches will be removed from the logs prior to stockpiling at the Development Site before translocation to the rehabilitation sites.

These instructions relate to the importation of habitat logs:

- preference should be given to the largest logs and those with hollows as these will improve the log's habitat value within the rehabilitation site
- logs should be spaced evenly around the site whilst avoiding the creation of a straight-line grid pattern with the log
- logs should be placed singly or in mini-piles of two or three (if logs are small). Piles of more than three logs may result in a fire risk
- excessive mounds or hollows made by machinery used to move logs should occur after the logs have been placed in their final position.

Appendix 5
Dieback hygiene procedures

These hygiene measures were sourced from *Managing Phytophthora Dieback – Guidelines for Local Government*, prepared by the Dieback Working Group (2000). The general measures apply to all activities undertaken in revegetation areas.

General

These measures are to be implemented at all times, including when earth works, construction and maintenance is required. These measures apply to the developer's staff, contractors, lessees and community members.

1. Where practicable, schedule activities that involve soil disturbance for dry summer months (November – March). Maximise the activities that occur when the soil is dry as much as practicable, given some areas are low-lying.
2. Always plan activities so they are completed in the remnant bushland first, then move to the cleared areas.
3. Minimise soil disturbance – consider mowing, slashing or using herbicide, rather than ploughing, or grading, whenever possible or practical.
4. Do not bring in soil/sand/gravel/mulch to remnant areas.
5. If soil/sand/gravel/mulch must be brought in, they should be tested for the presence of *Phytophthora cinnamomi*, or from a supplier who provides dieback free materials, and transports and stores the materials hygienically (soil suppliers accredited by the Nursery Industry Association maintain high standards of hygiene).
6. Avoid walking between the cleared and remnant areas when the soil is wet.
7. Encourage visitors to avoid visiting the bushland when it is wet, and to keep to existing tracks.
8. Prior to entry on site ensure all machinery (including vehicle tyres, mudflaps, body and underbody), equipment, tools and footwear is free of mud/soil.
9. Ensure all machinery (including vehicles), equipment, tools and footwear are free of mud/soil when leaving all areas.
10. Cleaning
    - cleaning will be easier and more effective if it is completed at a depot or a permanent/ designated cleaning area
    - if cleaning is to occur in the field:
        - select a site with a hard, well-drained surface (e.g. road) that is well away from remnant vegetation
        - try to remove soil and mud when it is dry (a stiff brush may assist this process), and use a brush or stick to remove compacted soil
        - if possible, wash down in an area that is close to the area you have been operating in
        - minimise the amount of water used
        - wash down on ramps if possible
        - do not allow mud and wash-down effluent to drain into bushland
    - do not drive through wash-down effluent
    - pay particular attention to mudflaps and tyres
    - collect all mud and soil removed in a bag or bucket. Dispose of this material at a site that is already infected with dieback, or a site that contains no remnant vegetation (do not allow this material to enter bushland).
11. No drainage water should be discharged into the revegetation areas, except where in conjunction with storm water management.
12. Do not dump plant material or soil in revegetation areas.
13. Reduce access for horses/livestock/feral animals and off-road vehicles/motorcycles to reduce dieback spread.

Revegetation areas

Weeding

1. Conduct weeding when the bushland is dry, where practicable.
2. Control weeds using herbicide where practicable to reduce the disturbance of soil.
3. If manually removing weeds, immediately place them in a bag (or similar) to prevent soil falling into other parts of the bushland.

Revegetation

1. Consider direct seeding, or purchase the plants from a nursery with excellent hygiene practices (Nurseries with Nursery Industry Association Wholesale Accreditation maintain very high standards of hygiene).
2. Only use mulch if it has been well composted (the heating part of the composting process kills *P. cinnamomi*).
3. Complete revegetation when the soil is moist but not wet.

Appendix 6
Fencing requirements for Regional Parks

Regional Parks Field Construction Standards - Agricultural Fence (Ringlock style)

The former DEC (now DPaW) Regional Parks Branch devised the following as a standard for any new agricultural fencing within Regional Parks Branch managed land.

Material specifications

- galvanized 7/90/30 Ring lock or equivalent (e.g. Stocklock), agricultural fence (NOT Griplock)
- galvanized 2.5 mm single strand High Tensile Plain Wire
- 100-125 mm x 2.1 m CCA H4 treated pine log (for uprights)
- 150-175 mm x 2.4 m CCA H4 treated pine log (for box strainers)
- 1.8 m galvanised Star Pickets, (ensure holes match up with agricultural fencing wire)
- Short, white PVC Star Picket Caps allowing wire to be strung through them and through the top hole of the star picket
- 3.6 m x 1200 mm high galvanized Weldmesh agricultural farm gate (with Brooker threaded hinges)
- 1.57 mm galvanized Tie Wire.

Construction specifications

- box strainers are to be constructed out of treated pine logs and pinned
- box strainers to be placed on both sides of agricultural gates
- double box strainers at all corners and change in direction of fence
- box strainers to be placed at maximum distance of 200m intervals along fence
- ringlock to be fastened 50mm above ground level
- all strands on Ringlock to be stapled to box strainers
- four strands on Ringlock to be stapled evenly to pine uprights
- four horizontal strands of Ringlock to be tied evenly to star pickets
- ratio of star pickets to pine uprights is one in four (i.e. one pine upright to three star pickets) at spacing of 4 m
- all ends, joins and ties to be finished neatly with no wire protrusions
- wire to be wrapped around pine posts twice, then wound back around wire three times and cut off flush
- all pine uprights to be buried to a depth of 900 mm
- all box strainers to be buried to a depth of 1200 mm
- all star pickets to be capped, with wire running through the white star picket caps and through the top hole of the star pickets
- fencing wire to be fixed to outside of posts and pickets at all times (i.e. on side facing outside Regional Parks Unit managed land)
- fence to smoothly follow the overall contours of the land (not to have sudden dips and rises)
- use 10 mm x 900 mm long High Tensile locking chain (non rusting) for Agricultural Gates and 600 mm long chain for Low Vehicle Gates
- use Silver coloured Abus 83/50 padlocks (or equivalent) with No 51 key barrels
- don't over tension fence, ensuring all vertical wires are in line
- gate nuts on hinges to be tack welded, not bent or burred over.