CPS 9723/1 - Supporting information - Bunbury Water Resource Recovery Scheme – Stage 2 Pipeline Draft Offset Strategy

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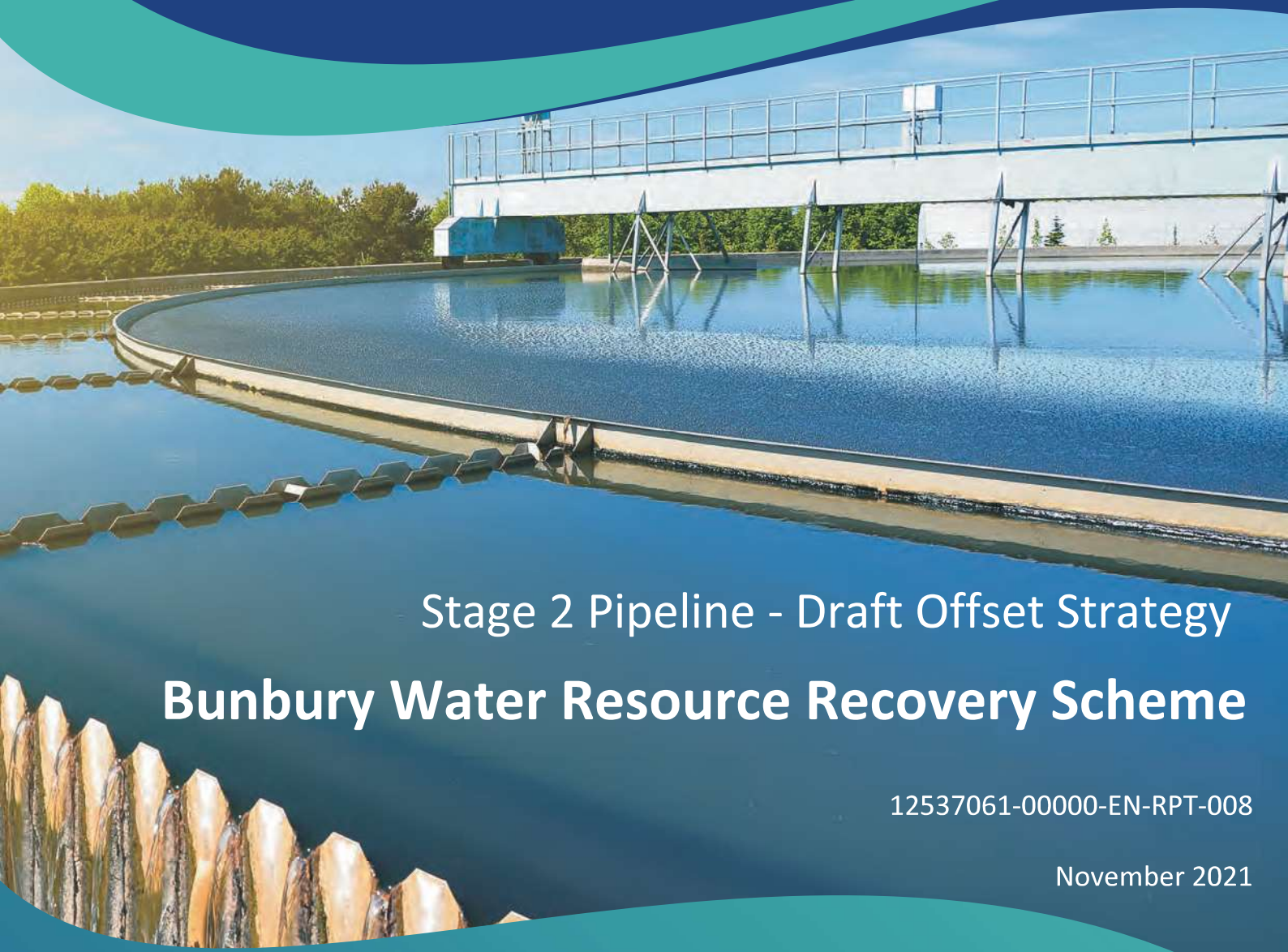

Stage 2 Pipeline - Draft Offset Strategy

Bunbury Water Resource Recovery Scheme

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November 2021

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1. Introduction

1.1 Proposed Action background

Bunbury Water Corporation, trading as Aqwest, propose to provide recycled water for the irrigation of existing open spaces within the City of Bunbury (Hay Park, Hands Oval and Forrest Park) and for construction water requirements of the Bunbury Outer Ring Road (BORR) project.

The Project will be constructed in two stages:

- Water Resource Recovery Scheme (WRRS) Stage 1 – Open Space Irrigation in City of Bunbury ('Stage 1')
  - Stage 1 pipeline route lies from the Recycled Water Treatment Plant (RWTP) to Parade Road, and north to City of Bunbury public open spaces, a distance of approximately seven kilometres (km).
- WRRS Stage 2 – BORR construction water ('Stage 2')
  - Stage 2 pipeline route is located from Parade Road bifurcation to BORR point-of-use at South Western Highway / Centenary Road intersection.

After completion of environmental assessments and engineering design, the clearing of native vegetation has been avoided for Stage 1.

Stage 2 has undergone an extensive route selection and impact avoidance process, however there are unavoidable residual impacts to threatened species and communities.

This Draft Offset Strategy has been prepared to offset residual impacts associated with construction of the Stage 2 distribution pipeline (the Proposed Action). The Proposed Action Area is approximately 5.5 km in length, with a disturbance area of approximately 6.67 ha (Figure 1).

1.2 Purpose of this report

This Draft Offset Strategy provides preliminary assessment of the proposed direct offsets. This includes offset impact, offset quantification and assessment against the Commonwealth and State offset policies and guidelines.

This Draft Offset Strategy demonstrates Aqwest's commitment to offset the Proposed Action's significant residual impacts.

1.3 Scope and limitations

This report: has been prepared by GHD for Aqwest and may only be used and relied on by Aqwest for the purpose agreed between GHD and Aqwest as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Aqwest arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

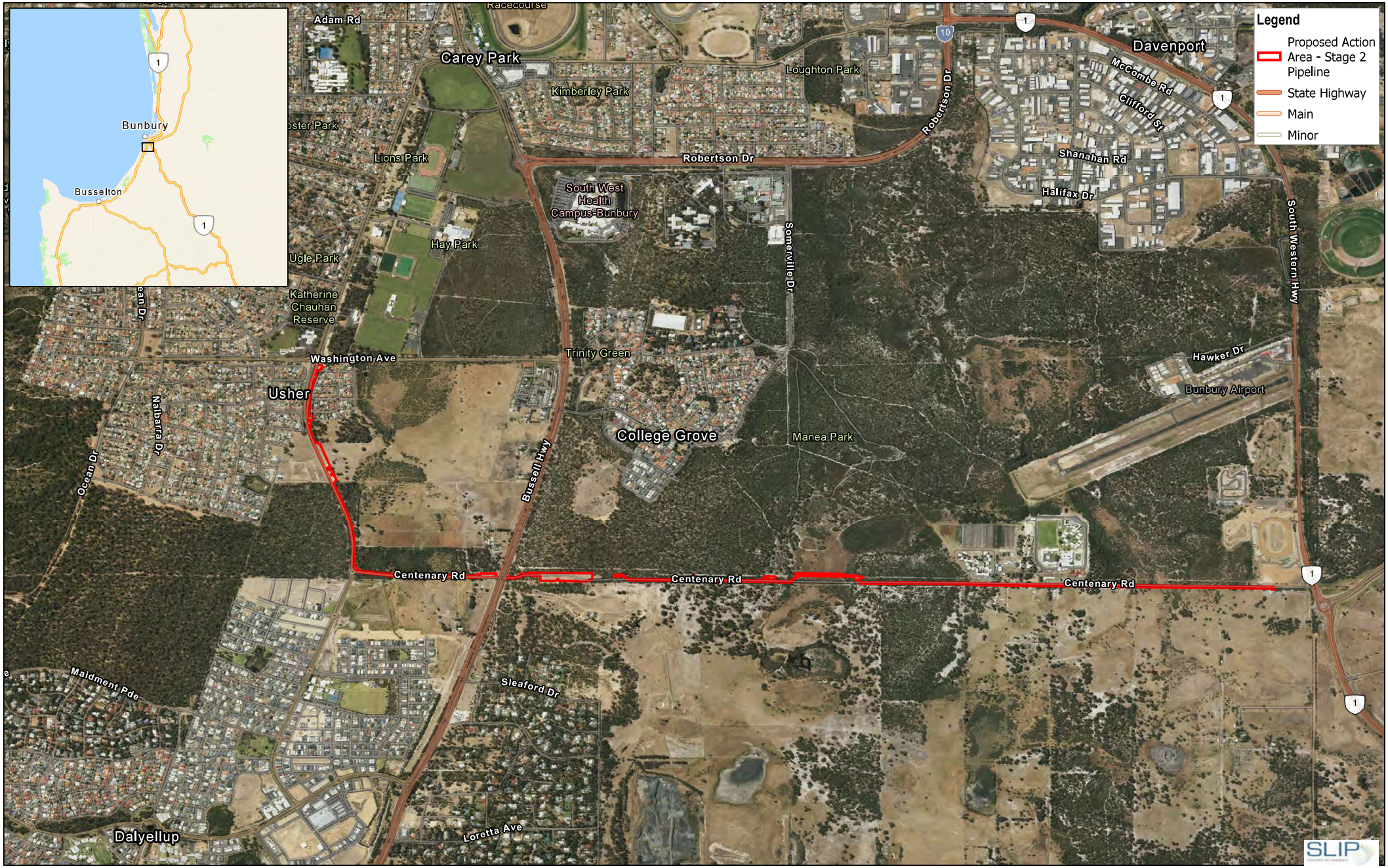
The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

1.4 Assumptions

This Draft Offset Strategy is based on the Proposed Action, as detailed in Figure 1. Any changes to the Proposed Action that alter the predicted impacts to threatened species and communities would require revision of the strategy.



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Aqwest Bunbury Water Corporation
Bunbury WRRS Stage 2 Pipeline

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Proposed Action Area

FIGURE 1

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Data source: World Imagery: Earthstar Geographics
Hybrid Reference Layer: Esri, HERE, Garmin, METI/NASA, USGS
World Navigation Map: Esri, HERE, Garmin, FAO, NOAA, USGS

2. Environmental Offset Policy Framework

Environmental offsets are conservation actions that provide environmental benefits intended to counterbalance the significant residual environmental impacts associated with a proposed action (GoWA, 2014). Aqwest intends to counterbalance the residual impact of the Proposed Action through implementation of an environmental offset strategy. The strategy will be prepared in accordance with the WA Government's *Environmental Offset Policy* (GoWA, 2011), *WA Offset Guideline* (GoWA, 2014) and the Australian Government's *EPBC Act Environmental Offsets Policy* (DSEWPAC, 2012a).

The section provides information on the draft offset strategy for the Proposed Action. Offset requirements have been determined through assessment of the direct residual impacts of the Proposed Action based on the revised design, field survey and site assessment.

Further assessment of offsets will be undertaken, and an offset implementation plan developed as part of the final strategy. This will include details for targets for each offset, the management actions (including their timing), responsible parties, monitoring and corrective actions.

The Commonwealth *Offsets Assessment Guide* (DSEWPaC (2012b and 2012c) has been used to define the quantum of impact and extent of offset provided by each offset area. Summary tables are provided herein that detail the key inputs and outcomes of the assessment against the Commonwealth *Offsets Assessment Guide*.

2.1 EPBC Act Environmental Offsets Policy (DSEWPAC, 2012a)

The *EPBC Environmental Offsets Policy* (DSEWPAC, 2012a) requires the following Principles are met by an offset:

- Suitable offsets must deliver an overall conservation outcome that improves or maintains the viability of the protected matter
- Suitable offsets must be built around direct offsets, but may include other compensatory measures
- Suitable offsets must be in proportion to the level of statutory protection that applies to the protected matter
- Suitable offsets must be of a size and scale proportionate to the residual impacts on the protected matter
- Suitable offsets must effectively account for and manage the risks of the offset not succeeding
- Suitable offsets must be additional to what is already required, determined by law or planning regulations, or agreed to under other schemes or programs
- Suitable offsets must be efficient, effective, timely, transparent, scientifically robust and reasonable
- Suitable offsets must have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.

2.2 WA Environmental Offsets Policy (GoWA, 2011)

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

- Environmental offsets will only be considered after avoidance and mitigation options have been pursued

- Environmental offsets are not appropriate for all projects
- Environmental offsets will be cost-effective, as well as relevant and proportionate to the significance of the environmental value being impacted
- Environmental offsets will be based on sound environmental information and knowledge
- Environmental offsets will be applied within a framework of adaptive management
- Environmental offsets will be focused on longer term strategic outcomes.

3. Existing environment and predicted impacts

3.1 Identification of significant communities and species

To identify the potential occurrence of conservation significant communities and species associated with the Proposed Action, biological surveys were undertaken across spring 2020 and summer-autumn 2021. The surveys were:

- Detailed and targeted flora and vegetation survey (October, December 2020, April 2021) (GHD, 2021)
- Dieback survey and report by accredited assessor (October 2020) (GSBL, 2021)
- Basic fauna survey (October 2020) and targeted Western Ringtail Possum (WRP) surveys (October 2020, April 2021) and Black Cockatoo foraging, breeding and roosting habitat surveys (October 2020, April 2021) (Biota, 2021)
- Clay Pans TEC site visit with the Department of Biodiversity, Conservation and Attractions (DBCA) flora officer on 17 June 2020.

The ecological surveys have confirmed the presence of two threatened ecological communities (TECs) and two conservation significant species within the Proposed Action (Table 1). An additional TEC occurs adjacent to the to the Proposed Action however has been avoided through design.

Table 1 Conservation significant communities and species

Community / Species	Short Description	Status EPBC Act	Status Western Australia
Banksia Woodlands of the Swan Coastal Plain (TEC) Banksia dominated woodlands of the Swan Coastal Plain IBRA region (Priority Ecological Community (PEC))	The ecological community is a woodland associated with the Swan Coastal Plain. A key diagnostic feature is a prominent tree layer of Banksia, with scattered eucalypts and other tree species often present among or emerging above the Banksia canopy. The understorey is a species rich mix of sclerophyllous shrubs, graminoids and forbs. The ecological community is characterised by a high endemism and considerable localised variation in species composition across its range (TSSC, 2012.	Endangered TEC	Priority 3 PEC
Tuart (*Eucalyptus gomphocephala*) woodlands and Forests of the Swan Coastal Plain (TEC) Tuart (*Eucalyptus gomphocephala*) woodlands of the Swan Coastal Plain (PEC)	Mostly confined to Quindalup Dunes and Spearwood Dunes from Jurien Bay to the Sabina River, with outliers along some rivers. Tuart is the key dominant canopy species however Tuart communities comprise a variety of flora and fauna assemblages. Flora commonly occurring with Tuart include *Agonis flexuosa, Banksia attenuata, B. grandis, Allocasuarina fraseriana, Xylomelum occidentale, Macrozamia riedlei, Xanthorrhoea preissii, Spyridium globulosum, Templetonia retusa* and *Diplolaena dampieri*	Critically Endangered TEC	Priority 3 PEC

Community / Species	Short Description	Status EPBC Act	Status Western Australia
Claypans of the Swan Coastal Plain TEC WA TEC Herb rich saline shrublands in clay pans (Floristic Community Type (FCT) 07)/ Dense shrublands on clay flats (FCT09)	The seasonal clay-based wetlands are the most floristically diverse of the Swan Coastal Plain wetlands. The deeper pools and wet flats are characterised by temporally overlapping suites of annual herbs and geophytes (plants that die down to bulbs corms or tubers over summer) that flower and set seed as the pools dry through spring. Over summer the clay substrates dry to impervious pans. At least 50% of the flora comprise annual or perennial herbs, many endemic to the claypans. These clay pan communities are otherwise known as 'floristic community type 7, 8, 9, and 10a' as defined in the 1994 report by Gibson et al. entitled 'A floristic survey of the southern Swan Coastal Plain'.	Critically Endangered TEC	TEC Vulnerable
Black Cockatoo species	Black Cockatoos, belonging to the *Calyptorhynchus* genus, are large, black-feathered cockatoos that have loud, distinctive calls and are most often observed flying and feeding in small to large flocks. There are three threatened species of Black Cockatoo that are found in Western Australia.	Threatened (Carnaby's, and Baudin's) Vulnerable (Forest Red-tailed black cockatoo)	Endangered (Carnaby's, and Baudin's) Vulnerable (Forest Red-tailed black cockatoo)
Western Ringtail Possum	The Western Ringtail Possum (*Pseudocheirus occidentalis*) is a small to medium sized leaf-eating arboreal marsupial, with adults weighing approximately 700 g to 1.3 kg, a head/body length of 30-40 cm and a tail as long as its body. Its tail is strongly prehensile which is used to support the possum while foraging in the tree canopy. The WRP is a threatened species under State and Commonwealth legislation.	Critically Endangered	Critically Endangered

3.2 Impact avoidance

The WA *Environmental Offsets Policy* (2011) notes that environmental offsets will only be considered after avoidance and mitigation options have been pursued. Aqwest operates on a hierarchy of avoid, minimise, reduce, rehabilitate and offset environmental impacts. This hierarchy has been applied through changes in scope and design, development of strategies and finally, an offset proposal.

Table 2 provides a summary of the key measures implemented to avoid and mitigate potential impacts to the environment, and to conservation significant communities and species from this Proposal.

Table 2 Summary of mitigation hierarchy application

Aspect	Summary	Outcome
Detailed ecological surveys to identify environmental constraints and opportunities for avoidance	GHD (2021) and Biota (2021) have carried out surveys that have identified the presence of conservation significant communities, species and their habitat. Site visit with DBCA flora officer to confirm and map the extent of Clay Pans TEC.	Conservation significant areas have been identified, and communicated to the design team. The design team has avoided impacts to these areas wherever possible. The detailed mapping and confirmation by DBCA flora officers enabled the design to avoid areas of Clay Pans TEC.

Aspect	Summary	Outcome
Avoidance and minimisation through design / construction	Route selection assessment undertaken	Avoid impacts of clearing by using cleared areas where possible and reduce width Trenchless techniques to avoid impacts to vegetation (where possible)
	Avoidance of direct impact to Clay Pans TEC	The pipeline alignment and construction corridor has been positioned to avoid clearing of the Clay Pans TEC.
Reduce potential indirect tree death through construction techniques	Trenchless construction – reduce the impact to root balls of trees and the likelihood of detrimental impacts or tree death	Trees retained alongside areas of construction works occurring
Minimisation through construction management	Construction Environmental Management Plan (CEMP) to be implemented	– Clearing management – Fauna spotter – Excavations managed to ensure egress – Hazardous materials contained and managed using MSDS – Waste management processes implemented – Dust management processes implemented – Noise mitigated – Stabilisation processes implemented to minimise erosion – ASS risk managed – Hygiene managed to avoid introduction and spread of dieback / weeds – Revegetation undertaken where possible
Offsets for residual significant impacts	Flora and vegetation survey undertaken	Two direct offsets identified

3.3 Significant residual impacts

Residual impacts associated with the Proposed Action have been determined through application of the residual impact significance model detailed in the WA *Environmental Offsets Guidelines* (GoWA, 2014) (Table 3). Due to residual impacts being related to threatened species or communities the *Environmental Protection and Biodiversity Conservation Act* 1999 (EPBC Act) *Environmental Offsets Policy* and Offset Assessment Guide calculator has been applied (DSEWPAC, 2012a).

The residual impacts that apply to this document are shown in Figure 2 and include two TECs and habitat for two conservation significant fauna species.

Table 3 Significant residual impacts (modified from Page 11 of the GoWA Environmental Offsets Guidelines *(2014)*

EPA Factor	Flora and Vegetation		Terrestrial Fauna	Inland Waters	Social Surrounds
Aspect	Native vegetation extent	Threatened ecological communities	Habitat for fauna	Native vegetation associated with wetlands	Amenity
Residual impact that is environmentally unacceptable or cannot be offset	N/A	N/A	N/A	N/A	N/A
Significant residual impacts that will require an offset – All significant residual impacts to species and ecosystems protected by statute or where the cumulative impact is already at a critical level	N/A	Loss of: – 0.23 ha of Tuart Woodland TEC that is in Degraded (0.04 ha) and Good (0.19 ha) condition. – Loss of 0.89 ha of Banksia Woodland TEC that is in Very Good (0.31 ha), Good (0.4 ha), Degraded / Completely Degraded (0.18 ha) condition.	Loss of: – Western Ringtail Possum habitat: 1.31 ha with 1.09 ha Core habitat and 0.22 ha supporting habitat) – Black Cockatoo habitat: 1.31 ha with 1.09 ha high quality foraging / potential roosting and 0.22 ha Moderate quality foraging. – Loss of 18 potential breeding trees (suitable species > 50 cm, none with hollows suitable for breeding)	N/A	N/A
Residual impacts that are not significant	A total Proposed Action impact area of 6.67 ha, that includes 5.23 ha of Completely Degraded area / cleared areas 1.44 ha of native vegetation in the following condition: – 0.53 ha of Degraded Vegetation – 0.58 ha of Good quality vegetation – 0.33 ha of Very Good vegetation.	Proposed Action adjacent to two locations of the Clay Pans TEC. This TEC has been avoided through design, and the CEMP will include management of dewatering, hygiene (weeds and dieback), erosion and sedimentation and hydrocarbons / chemicals to mitigate indirect impacts.	Loss of: – 1.44 ha of fauna habitat	Loss of: – 1.31 ha of native vegetation within Multiple Use Wetlands	Temporary impacts during construction of the Proposed Action No significant residual impacts are anticipated as a consequence the Proposed Action.

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Revision No. A
Date 05 Nov 2021

Residual Impacts Location

FIGURE 2 - 1

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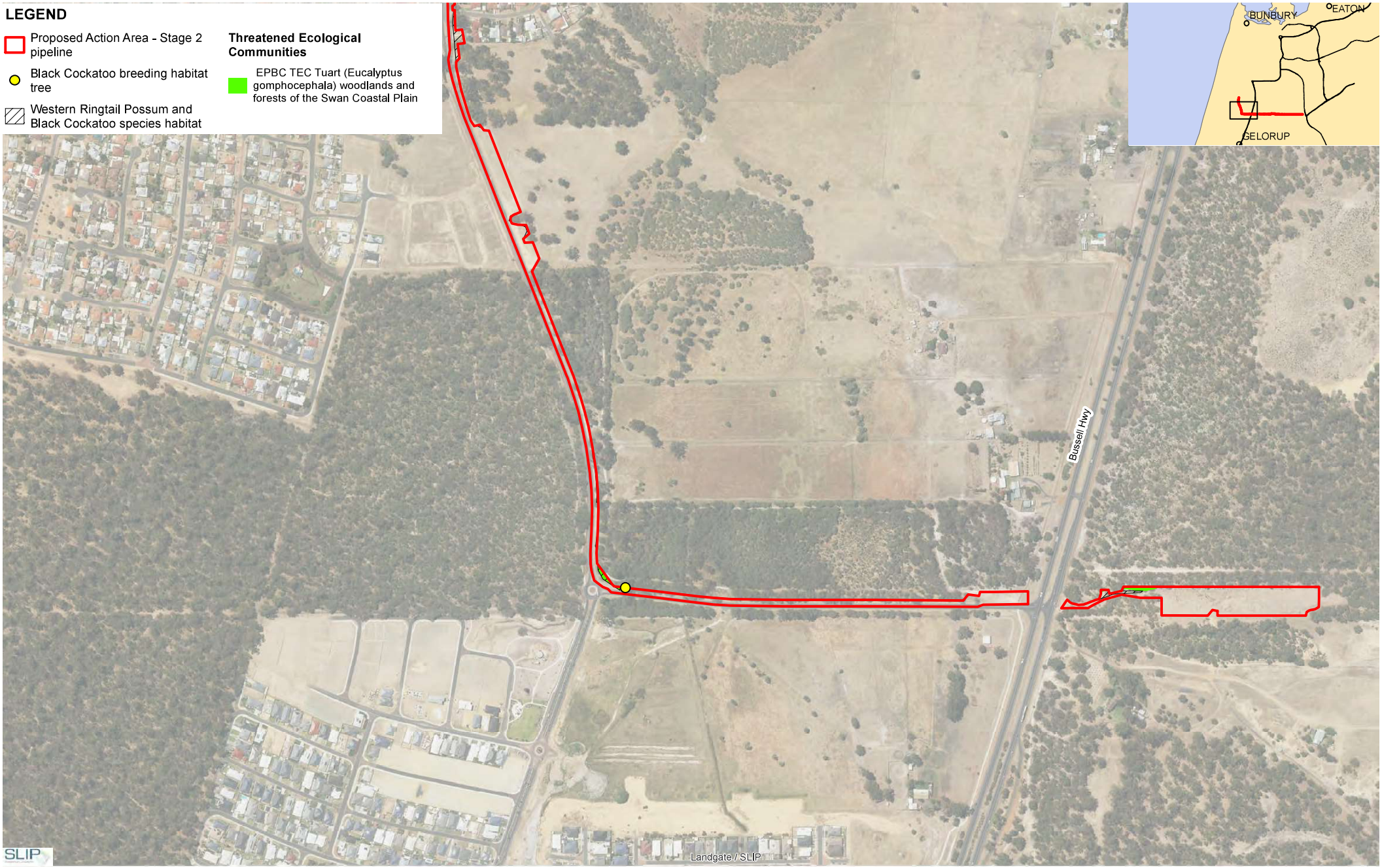

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Residual Impacts Location

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FIGURE 2 - 2

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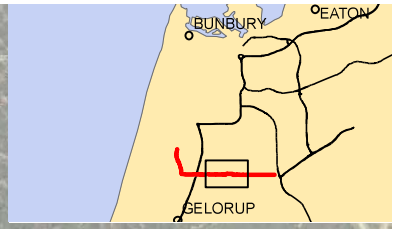
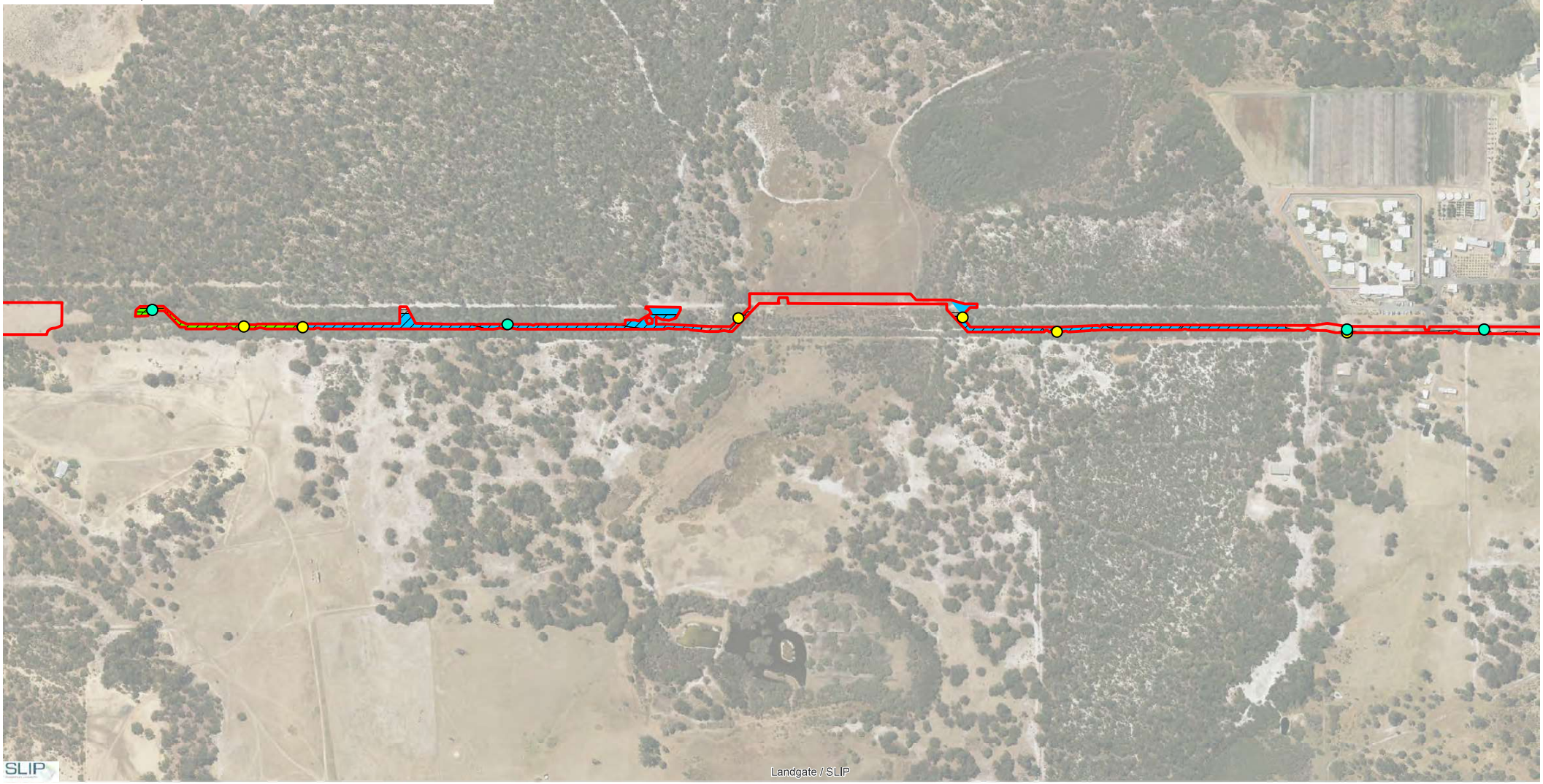
LEGEND

- Proposed Action Area - Stage 2 pipeline
- Western Ringtail Possum observation
- Black Cockatoo breeding habitat tree
- Western Ringtail Possum and Black Cockatoo species habitat

Threatened Ecological Communities

- EPBC TEC Banksia Woodlands of the Swan Coastal Plain, WA PEC Banksia Woodlands of the Swan Coastal Plain
- EPBC TEC Tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain





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Residual Impacts Location

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Revision No. A
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FIGURE 2 - 3

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FIGURE 2 - 4

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4. Proposed offsets

4.1 Proposed offset 1 – Lot 935 Somerville Drive Manea Park

4.1.1 Location information

- Location: Lot 935 Somerville Drive (Lot 935 on Plan 220463) College Grove is located approximately 1.3 km north of the Proposed Action. This Lot intersects Manea Park (Figure 3).
- Tenure: Crown, Reserve No. 36316, Managed by Aqwest
- Ownership: Crown
- Size: 5 ha

4.1.2 Key attributes and values

Ecoedge (2021) completed a reconnaissance flora and vegetation survey in June 2021 (Appendix A). The survey identified nine vegetation units or subunits, two of which were inferred as the Commonwealth Banksia woodlands of the Swan Coastal Plain (Banksia Woodland TEC). GHD also completed a site walk-over to define the fauna habitat values. A summary of the key findings is provided in Table 4 and includes:

- Banksia Woodland TEC: 1.01 ha of Good to Excellent condition Banksia Woodland TEC. An additional 0.46 ha of Banksia community that is Degraded or does not meet the criteria for Banksia species cover / diversity. The total 1.47 ha of Ecoedge (2021) vegetation unit A is likely to form part of the larger Banksia TEC community within Manea Park.
- Western Ringtail Possum: 4.84 ha of habitat (1.01 ha of core habitat and 3.84 ha of supporting habitat – aligning with the categories by Biota (2021) in their assessment of the Proposed Action impact area). Targeted surveys for Western Ringtail Possums have not been completed for the Lot, however Biota (2020) assessed approximately 30% of Manea Park as part of the BORR Project, and this identified Manea Park as medium habitat suitability with 103 individual observations of Western Ringtail Possums (Biota, 2020).
- Black Cockatoo species: approximately nine potential breeding trees (suitable species with a Diameter at Breast Height (DBH) of greater than 50 cm, without suitable hollows), 4.84 ha of habitat (1.01 ha of high quality foraging and 3.83 ha of medium quality foraging habitat).

Table 4 Aqwest Lot 935 through Manea Park – Vegetation types and fauna values

Vegetation Type	Description	Extent (ha)	Extent key attributes
A1	*Eucalyptus marginata* and *Corymbia calophylla* woodland over *Banksia attenuata, B. grandis, B. ilicifolia, Xylomelum occidentale* low woodland over *Kunzea glabrescens*, tall open shrubland over *Melaleuca thymoides* open shrubland over *Calytrix flavescens*, *Hibbertia hypericoides, Stirlingia latifolia, Xanthorrhoea brunonis* low open shrubland over *Dasypogon bromeliifolius* scattered herbs on grey sand. Good or better condition (TEC): 0.9 ha Degraded: 0.11 ha Provides core habitat for Western Ringtail Possum and Black Cockatoo roosting, potential nesting and for the Banksia areas foraging habitat.	1.00	Banksia Woodland TEC: 0.9 ha Western Ringtail Possum: 0.9 ha core habitat Black Cockatoo 0.9 ha high quality foraging
A2	*Corymbia calophylla* woodland over *Agonis flexuosa* low woodland over *Kunzea glabrescens* isolated tall shrubs over *Melaleuca thymoides, Xanthorrhoea brunonis* low open	0.36	Western Ringtail Possum: 0.36 ha supporting habitat

Vegetation Type	Description	Extent (ha)	Extent key attributes
	shrubland over *Dasypogon bromeliifolius, *Hypochaeris glabra* open herbland on grey sand. Dieback is expected in this patch as there is a lack of Banksia species. Good and Very Good: 0.36 ha		Black Cockatoo: 0.36 ha medium quality foraging
A3 Banksia woodland TEC	*Banksia attenuata, B. ilicifolia, Agonis flexuosa* woodland over *Melaleuca thymoides* sparse shrubland over *Hibbertia hypericoides, Calytrix flavescens, Stirlingia latifolia* low open shrubland over **Hypochaeris glabra* scattered herbs on grey sand on low ridge. Very Good condition (TEC): 0.11 ha	0.11	Banksia Woodland TEC: 0.11 ha Western Ringtail Possum: 0.11 ha core habitat Black Cockatoo 0.11 ha of high quality foraging
B1	*Corymbia calophylla, Eucalyptus marginata, Melaleuca preissiana* tall woodland over *Taxandria linearifolia* tall open shrubland over *Xanthorrhoea brunonis* low open shrubland over *Lepidosperma tenue, Baumea juncea* open sedgeland on damp grey sand. Very Good condition: 0.06 ha	0.06	3.47 ha of Western Ringtail Possum supporting habitat and Black Cockatoo medium quality foraging habitat.
B2	*Corymbia calophylla* isolated trees to open woodland over *Agonis flexuosa, Melaleuca preissiana, M. rhaphiophylla, Banksia littoralis* low woodland over *Kunzea glabrescens* tall open shrubland over *Xanthorrhoea brunonis* sparse low shrubland over *Dasypogon bromeliifolius, *Hypochaeris glabra* scattered herbs on damp grey sand. Good condition: 3.11 ha	3.11	
B3	*Corymbia calophylla, Nuytsia floribunda* woodland over *Acacia saligna, Jacksonia furcellata, Kunzea glabrescens* tall shrubland over *Xanthorrhoea brunonis* sparse low shrubland over **Arctotheca calendula, *Ursinia anthemoides* scattered herbs on damp grey sand. Good and Very Good condition: 0.08 ha Degraded: 0.12 ha	0.19	
C	*Melaleuca preissiana, M. rhaphiophylla, Banksia littoralis* woodland over *M. incana subsp. incana* tall shrubland over *Lepidosperma longitudinale, Baumea juncea* sedgeland grading into *Melaleuca preissiana, M. rhaphiophylla* woodland over *Acacia saligna* tall shrubland over Hakea varia sparse shrubland Excellent: 0.11 ha	0.11	
D	*Melaleuca rhaphiophylla, M. preissiana* woodland over *Baumea juncea, Lepyrodia glauca, Juncus pallidus* sedgeland with **Ehrharta longiflora* sparse tussock grassland and **Geranium molle* isolated herbs on damp grey-brown loamy sand Good condition: 0.02 ha	0.02	
E	*Melaleuca rhaphiophylla, Acacia saligna* tall open shrubland over *Lepidosperma longitudinale, Juncus pallidus* open sedgeland with **Anthoxanthum odoratum* tussock grassland and **Lotus subbiflorus* sparse herbland on wet grey-brown clay. Good condition: 0.06 ha	0.06	

4.1.3 Current threats

The Lot has been designated for water infrastructure and there is a high likelihood that future development would be considered. This Lot was initially considered as an alternate alignment for this Proposed Action.

Sections are in Degraded condition with evidence of dieback noted and weeds prominent in the understorey.

Manea Park is currently accessible to the public for recreational activities such as bushwalking.

4.1.4 Proposed offset measures

Aqwest intends to transfer the Lot to DBCA for amalgamation into the adjacent Manea Park. This has been discussed with DBCA, who have provided in-principle support (Appendix A). Further discussions are to be held as part of the next phase of the offset strategy to confirm management actions. This is likely to include on-ground measures such as weed and dieback management.

Plate 1 Proposed offset 1

4.2 Proposed offset 2 – Lot 933 on Plan 220464, College Grove

4.2.1 Location information

- Location: Lot 933 St John Mews (Lot 933 on Plan 220464) College Grove is located approximately 1 km north of the Proposed Action (Figure 3).
- Tenure: Crown, Reserve No. 36316, Managed by Aqwest
- Ownership: Crown
- Size: 4.2 ha

4.2.2 Key attributes and values

GHD (2019) completed a reconnaissance flora and fauna survey of Lot 933 on 2 September 2019. The survey identified three broad vegetation types and habitat for the Western Ringtail Possum and Black Cockatoos (Table 5, Appendix B).

An additional site visit by a GHD senior ecologist was undertaken on 29 August 2021 to assess site suitability as an offset for impacts to Tuart Woodlands, Black Cockatoos and Western Ringtail Possums. This identified that vegetation types Peppermint Tuart woodland and Tuart and Banksia woodland are structurally consistent with the description for Tuart Woodland TEC.

Generally, the vegetation is largely Degraded with some patches of Good condition. The site contains healthy *Banksia* and *Xanthorrhoea* plants in several locations and no areas of obvious die-off of susceptible species were observed, suggesting that the site is not extensively impacted by *phytophthora* dieback.

Based on the site visits it is considered that Lot 933 provides the following offset values:

- Approximately 2.9 ha of Tuart Woodland in Good to Degraded condition
- 1.3 ha of degraded open shrublands over weeds that could be further revegetated with Tuarts / key species to further expand the community present
- 2.9 ha of Western Ringtail Possum core habitat and Black Cockatoo roosting, potential nesting and medium quality foraging habitat.

Further assessment is required to confirm if the Tuart community within Lot 933 meets the criteria for the Tuart Woodland TEC, and to identify the key on-ground management targets.

Table 5 Lot 933 Broad vegetation types and values

Vegetation Type	Description	Extent
Tuart Banksia Woodland	*Eucalyptus gomphocephala, Banksia attenuata* and *Agonis flexuosus* tall /low woodland over *Spyridium globulosum* tall open shrubland over *Daviesia horrida, Macrozamia riedlei* and *Hibbertia hypericoides* low open shrubland over **Lupinus angustifolius, *Oxalis pes-caprae* and **Euphorbia terracina* herbland. Provides core habitat for Western Ringtail Possum and Black Cockatoo roosting, potential nesting and for the Banksia areas foraging habitat.	1.9 ha
Peppermint Tuart Woodland	*Eucalyptus gomphocephala* isolated trees over *Agonis flexuosus* low woodland over *Spyridium globulosum* tall sparse shrubland over *Daviesia horrida* low open shrubland over **Ursinia anthemoides, *Briza maxima* and **Lysimachia arvensis* herb/grassland. Provides core habitat for Western Ringtail Possum and Black Cockatoo roosting, potential nesting and for the Banksia areas foraging habitat.	1 ha
Open shrubland over weeds	*Agonis flexuosus* isolated trees over *Daviesia horrida, Macrozamia riedlei* and *Xanthorrhoea brunonis* tall/mid open shrubland over **Ursinia anthemoides, *Briza maxima,*Avena barbata* and **Ehrharta calycina* closed herb/grassland. Identified as breeding and foraging habitat for Western Ringtail Possum.	1.3 ha

Vegetation Type	Description	Extent
Weed species and density	Two locations of Declared Pest *Zantedeschia aethiopica* (Arum Lily) were recorded within the survey area; no WoNs were recorded during the field survey. Weed dominance and density aligned closely with the vegetation types. Areas shaded by Tuarts were dominated by herbaceous weeds such as *Lupinus angustifolius, *Oxalis pes-caprae, *Lysimachia arvensis* and *Euphorbia terracina* whereas areas that were more open and exposed were dominated by grasses (*Briza maxima, *Avena barbata* and *Ehrharta calycina*) and *Ursinia anthemoides.*	

Plate 2 Proposed offset 2

4.2.3 Current threats

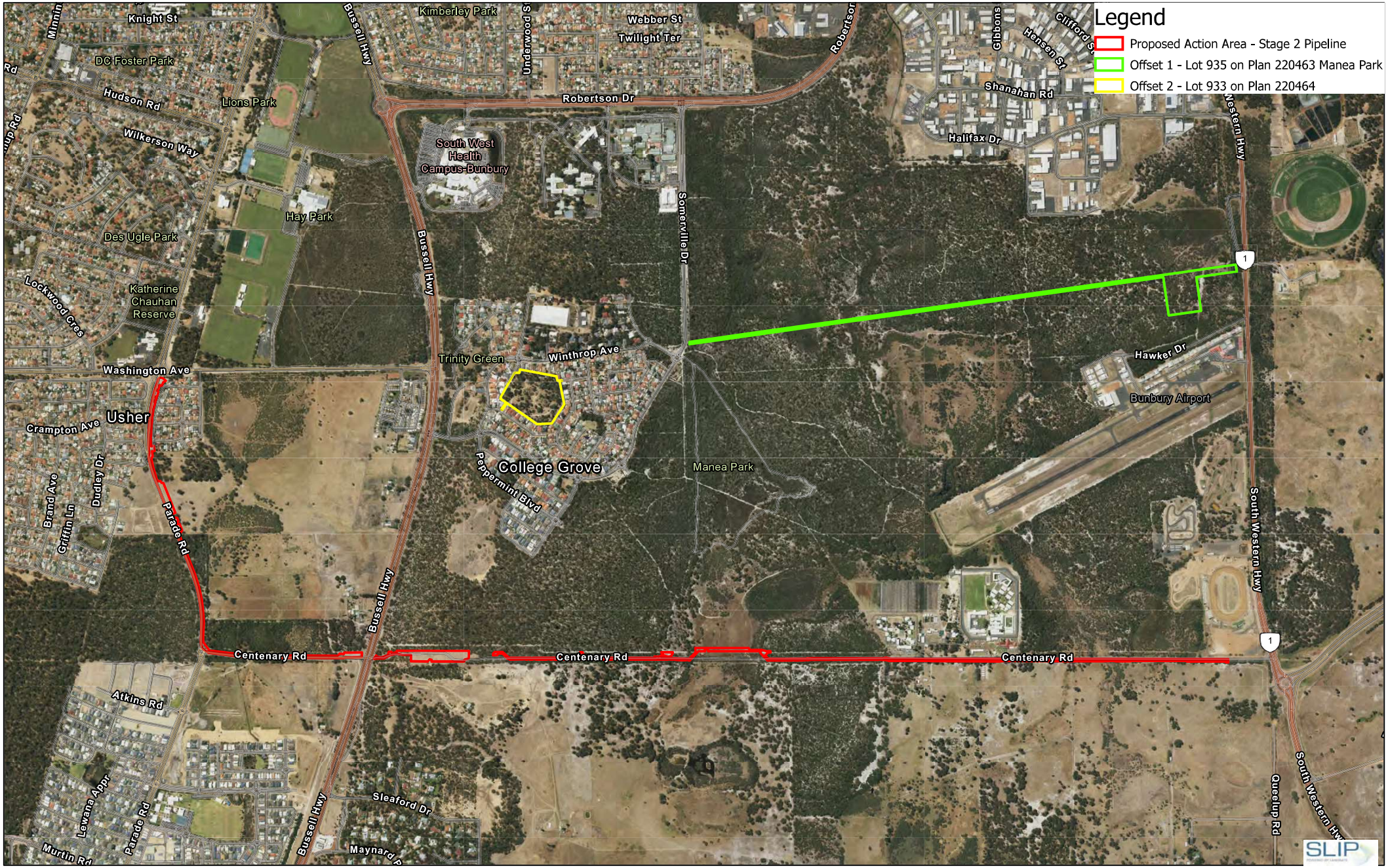
Lot 933 is a Crown Reserve that is under the management of Aqwest,

The Lot is surrounded by residential development. There is potential for this Lot to be developed in the future. Currently there is unrestricted access to the Lot, and it appears that it is utilised by the local community for recreational pursuits. The Lot contains areas that are dominated by introduced species and there is the potential for further weed or dieback spread. The dieback status is currently unknown.

4.2.4 Proposed offset measures

Aqwest would place the Lot or part of the Lot under a conservation covenant. Further assessment is required to finalise the offset measures for this site, however these would include preparing an offset management plan that details:

- Rehabilitation measures such as infill planting and weed management
- Key targets, roles and responsibilities
- Timeline for management actions
- Contingency measures if key targets are not being met
- Monitoring and reporting requirements.



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GHD

Aqwest Bunbury Water Corporation
Bunbury WRRS Stage 2 Pipeline

Project No. 12537061
Revision No. B
Date 5/11/2021

Proposed Offset Sites Locations

FIGURE 3

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Data source: Hybrid Reference Layer: Esri Community Maps Contributors, Esri, HERE, Garmin, METI/NASA, USGS
World Navigation Map: Esri, HERE, Garmin, FAO, NOAA, USGS
WMS. . Created by: vdavies

5. Justification of offsets

The principles of the WA *Environmental Offsets Policy* 2011, as described in the WA *Environmental Offsets Guidelines* 2014, have been applied to the proposed offsets to justify the counterbalances to the Proposed Action's residual impacts to the significant communities and species. Associated calculations have been undertaken using the WA Offsets Template (Appendix C).

5.1 Consistency of the Proposed Action with the principles of the Commonwealth Offsets Policy 2012

Table 6 demonstrates how the Proposed Action and Draft Offset Strategy is consistent with the eight principles identified in the Commonwealth *Environmental Offsets Policy* (DSEWPaC 2012a).

Table 6 ***Consistency of the Proposed Action to the principles of the Commonwealth Environmental Offsets Policy (DSEWPaC 2012a)***

Principle	Justification
1. Deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action	The proposed offsets will deliver an overall conservation outcome with the two proposed offset sites providing conservation outcomes for the conservation significant species and communities impacted. Aqwest proposes to relinquish the Lot through Manea Park, which currently is undeveloped and would lead to fragmentation of this DBCA managed estate if future development occurs. This Lot also contains similar vegetation communities and habitat types as those within the Proposed Action area. This site provides direct like-for-like offsets for Banksia Woodland TEC, Black Cockatoo foraging and potential breeding habitat and Western Ringtail Possum habitat. In converting this to DBCA managed estate, it will protect, maintain / enhance these values and removes the threat of future development, including fragmenting the existing reserve. The second offset site, Lot 933 also provides direct offset for Tuart Woodlands of the Swan Coastal Plain, Black Cockatoos and Western Ringtail Possums. The intent with this offset site is to protect and maintain an existing occurrence of Tuart TEC that is at risk from increasing threatening processes. Aqwest will undertake on-ground management actions aiming to mitigate or reduce the impacts of the threatening processes, predominantly from unrestricted access, dieback and weeds. Aqwest has proposed some revegetation, both within already established occurrences, and in one instance in a highly degraded area. These two sites provide an opportunity to conserve and maintain / enhance existing areas of TECs, Black Cockatoo and Western Ringtail Possum habitat in the long term.
2. Be built around direct offsets but may include other compensatory measures	The offset strategy identifies direct on-ground land management offsets. All proposed offsets target the maintenance of the protected matter by reducing or mitigating the threatening processes. No indirect or other compensatory measures have been included as an offset option in the Draft Offset Strategy. However, revegetation works for Lot 933 are proposed.
3. Be in proportion to the level of statutory protection that applies to the protected matter	The quantum of impacts and offsets has been calculated using the Commonwealth Offsets Assessment Guide, applying the International Union for Conservation of Nature (IUCN) probability of annual extinction for each protected matter.
4. Be of a size and scale proportionate to the residual impacts on the protected matter	In calculating the quantum of impacts / offsets, the following factors were considered: – the level of statutory protection that applies to the protected matter – the vegetation condition and habitat quality – the contextual siting of the protected matter (i.e. proximity to cleared areas or larger fragments) – access to ecological corridors or proximity of similar suitable habitat quality

Principle	Justification
	– permanent impacts and impacts that are temporary (construction) impacts – the level of threat (risk of loss) that each proposed offset site is under and how that risk is mitigated via the protection measure to be implemented – that on-ground management offsets yield a conservation gain within the first five years of management commencing
5. Effectively account for and manage the risks of the offset not succeeding	The two offset sites are currently managed by Aqwest. The risk of loss for the Offset 1 (Lot 935) will be removed by transferring this to DBCA estate. This approach has in-principle agreement with DBCA and this risk of not succeeding is considered low. Offset 2 involves a conservation covenant and on-ground management. In calculating the quantum of impacts a conservative quality score has been selected. The final offset management plan will also include monitoring and corrective actions if key targets are not being met.
6. Be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs (this does not preclude the recognition of state or territory offsets that may be suitable as offsets under the EPBC Act for the same action, see section 7.6)	There are no other requirements for management across either proposed offset site.
7. Be efficient, effective, timely, transparent, scientifically robust and reasonable	The offsets proposed in this Draft Offset Strategy have been selected based on desktop and on-ground assessments. Based on discussion with DBCA it is expected that proposed offset 1 would be accepted into DBCA estate. Lot 933 is Crown Land that is a Reserve for water infrastructure under the management of Aqwest. Aqwest expects to implement the conservation covenant and on-ground management in a timely manner (within 12 months of project commencement).
8. Have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.	The offset management plan will include the governance requirements, these will be transparent and include monitoring and reporting details.

5.2 Consistency of the Proposed Action with the principles of the WA Environmental Offset Policy

Table 7 demonstrates how the Proposal is consistent with the six principles identified in the WA *Environmental Offset Policy* (GoWA 2011).

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

Principle	Assessment
Environmental offsets will only be considered after avoidance and mitigation options have been pursued	The potential impacts from the Proposed Action have been significantly reduced as a result of the efforts applied during design phase. This reduction has been largely achieved through the additional avoidance and mitigation measures that have been developed for the Proposed Action.

Principle	Assessment
Environmental offsets are not appropriate for all projects	The hierarchy of avoid, minimise, reduce, rehabilitate and offset environmental impacts has been applied to this Proposed Action. This hierarchy is achieved primarily through changes in scope and design, implementation of mitigation measures and a CEMP and finally, an offset proposal. Aqwest has proposed offsets to counter-balance significant residual impacts to communities and species.
Environmental offsets will be cost-effective, as well as relevant and proportionate to the significance of the environmental value being impacted	Aqwest has identified two sites as part of the offsets to counterbalance residual impacts that are relevant and appropriate for the locality and quantum of impact. Lot 935 will be transferred to DBCA for inclusion in the Regional Park. This offset site includes like-for-like Banksia Woodland TEC, Western Ringtail Possum and Black Cockatoo habitat. Lot 933, has been assessed as containing Tuart woodlands. On-ground management will be undertaken to improve the quality of this site.
Environmental offsets will be based on sound environmental information and knowledge	The presence, extent and condition of the threatened communities and species has been assessed by a senior ecologist. Additional assessments for Lot 933 will be undertaken to confirm if the site currently meets the Tuart Woodland TEC criteria and identify key on-ground management requirements.
Environmental offsets will be applied within a framework of adaptive management	Offset site 1 will be transferred to DBCA estate. Further discussion on ongoing management will be carried out with DBCA. The final offset strategy for proposed Offset 2 will establish targets for each offset area and include an implementation plan, monitoring and corrective actions.
Environmental offsets will be focussed on longer term strategic outcomes.	Offset site 1 offers a long term strategic outcome by removing the threat of the Lot being developed and fragmenting the Regional Park. Offset site 2 provides the potential to establish a Tuart Woodland TEC in an area that has otherwise been extensively developed (in the immediate area). This potentially provides an important refuge site for local fauna and protects this fragment from future development.

5.3 Application of the WA Environmental Offsets Guidelines to proposed offsets

Table 8 provides a summary as to how the key concepts and requirements of the WA *Environmental Offsets Guidelines* (GoWA, 2014) have been considered in the development of this Draft Offset Strategy, such that the offsets are relevant and proportionate to the significance of the environmental values impacted.

Table 8 Evaluation of offset sites against WA Environmental Offset Guidelines

Concept	Application
Type	On-ground management and revegetation.
In proximity to the area of impact	Both offset sites are within 1.5 km of the area of impact.
Similar or better vegetation condition than the area impacted	Banksia Woodland TEC impact area: 0.89 ha: Very Good (0.31 ha), Good (0.4 ha), Degraded / Completely Degraded (0.18 ha) condition. Tuart Woodland TEC impact area: 0.23 ha: 0.19 Good and Degraded 0.04 ha Banksia Woodland TEC in offset area 1: 1.45 ha : 0.63 ha in Very Good to Excellent, 0.73 ha in Good and 0.11 ha in Degraded condition. Tuart Woodland offset area 2: 2.9 ha of Tuart Woodland in Degraded to Good condition.

Concept		Application
		Banksia woodlands are in similar or better condition than those being impacted. Further assessment is required to confirm the condition of Offset site 2.
Similar habitat structure to undisturbed examples of impacted vegetation type		Offset area 1 contains Banksia Woodland TEC – including areas that are in Good to Excellent condition. These have retained structure to undisturbed areas. Offset area 2 contains 2.9 ha of potential Tuart TEC has some small areas in Good condition that retain natural structure. The intent of rehabilitation is to enhance the quality of this patch through infill planting and weed control to re-establish the Tuart TEC woodland.
Has a better area to perimeter ratio than the area impacted		Offset area 1 is located within Manea Park and is surrounded on both its northern and southern boundary by the Park. The banksia community being impacted is adjacent Manea Park on the northern boundary and agricultural land on the southern. The perimeter ratio is better at offset site 1 than the impact area. Offset area 2 is a patch of remnant bush within a residential development. Its perimeter ratio is greater than the impacted Tuart TEC (approximately 50% of the perimeter is adjacent to agricultural land). Lot 933 is 4.2 ha in size with 2.9 ha of Tuart Woodland and 1.3 ha of open shrubs and weeds. Once rehabilitated there will remain the risk of ongoing edge effects from the surrounding properties, however given the size and of the patch it is expected that edge effects can be managed to retain the core areas of Tuart woodland.
Contains additional rare or otherwise significant species and threatened species or community compared with the impact site		No – the Banksia woodlands are similar between the impact and offset sites. No conservation significant flora were recorded within either the offset or impact sites. Offset site 2 requires further survey but previous reconnaissance surveys have not identified any conservation significant species.
Close to or contiguous with an existing conservation area (e.g. Bush Forever)		Offset site 1 is within Manea Park and meets this concept. Offset site 2 is surrounded by residential development and approximately 400 m to the closest remnant bushland (Manea Park).
Likely to enhance biological corridors or ecological linkages between conservation areas		Offset area 1 – transferring Lot 935 to DBCA estate (forming part of Manea Park) removes the future risk of the Lot being developed and fragmenting the Park. Offset area 2 – is an isolated patch that is surrounded by residential development. There is limited potential to further enhance its connectivity other than street / road verge planting.
It includes actions to address threatening processes		Offset area 1 will be transferred to DBCA, and remove the potential threat of Lot 935 being developed. Further discussions with DBCA will be held to confirm the ongoing management. Offset 2 will be placed in a conservation estate to reduce the risk of future development. It will also undergo rehabilitation including infill planting and weed management.
Allows for secure management arrangements in place that will provide for long term conservation		Offset 1 – will be transferred to DBCA to form part of Manea Park. This will be managed by DBCA. Offset 2 - will be placed under a conservation covenant.
Sound knowledge and adaptive management		The final offset strategy will establish targets for each offset area and include an implementation plan, monitoring and corrective actions.
Likely offset success	Can the values be defined and measured?	The vegetation type, condition and extent are measurable.

Concept		Application
	Operator experience / evidence?	Aqwest will engage suitably qualified contractors to undertake the weed management and rehabilitation works.
Time lag		Offset 1 – has in-principle agreement with DBCA and it is expected that the transfer of the Lot could occur within 12 months of the project commencing. There is no time lag for ecological benefit for Offset 1. Offset 2 – is managed by Aqwest and will be placed under a conservation covenant within 12 months of the Proposed Action being approved. Weed and rehabilitation management will occur within 12 months. It is anticipated that Offset 2 will be rehabilitated over a five-year period.
Long term strategic outcomes		Offset 1 – removes the risk of the Lot being developed and fragmenting Manea Park. Offset 2 – provides a greater level of protection (through the conservation covenant) for a remnant patch of Tuart.
Offset quantification		Each offset site has been quantified using the Commonwealth Offsets Assessment Guide.

5.4 Quantifying the extent of offset provided by the proposed areas

5.4.1 Summary of quantum of impact and offsets

Based on information available on the impact and offset areas and application of the Commonwealth Offsets Guide, 100.5% of Banksia Woodland, 119.1 to 327.3% of Tuart Woodland, more than 150% of Western Ringtail Possum and more than 180% of Black Cockatoo offsets are met. Table 9 provides a summary of the quantum of impacts and percent of offsets met.

Table 9 Summary of quantum of impacts and offsets

Community or species	Impact	Quantum of impact	Proposed offset	% of impact offset
Banksia Woodlands	0.89 ha	0.62	Lot 935 – located in Manea Park	100.5
Tuart Woodlands	0.23 ha	0.16	Lot 933	119.1 to 327.3
Black Cockatoo Species	1.31 ha	1.05	Lot 935 – located in Manea Park	180.7
			Lot 933	35.5 – 102.8
Western Ringtail Possums	1.31 ha	1.05	Lot 935 – located in Manea Park	151.8
			Lot 933	17.3 – 50.3

5.4.2 Banksia Woodlands – Quantum of impact and offsets

Table 10 and Table 11 provide the values and justification for assessment using the Commonwealth Offset Calculator. As shown in these tables, the 0.89 ha of Banksia Woodland TEC within the Proposed Action impact area is offset by 100.5% by Offset Site 1 (transfer of the Aqwest Lot 935 in Manea Park to DBCA). A copy of the calculator is provided at Appendix D.

Table 10 Impact calculator – Banksia TEC

Attribute	Value	Justification
Area of impact	0.89 ha	Ecoedge surveys have confirmed the presence of Banksia TEC within the Proposed Action area.
Quality	7	Medium – High score. The Banksia TEC Proposed Action impact area contains TEC that is 35% Very Good, 45% Good and the remainder in Degraded / Completely Degraded condition. It forms part of the larger area of banksia community within Manea Park but is on the southern boundary of the Park.
Quantum of impact	0.62 ha	

Table 11 Offset calculator – Lot 935 in Manea Park– Banksia TEC

Attribute	Value	Justification
Offset area	1.47 ha	Ecoedge (2021) mapped the vegetation types within the total 5 ha and confirmed the presence of 1.01 ha of Banksia woodlands in Good to Excellent condition that meet the criteria for the TEC. An additional 0.46 ha of the Banksia community is present but lacking key species (Degraded form of the TEC). It is expected that dieback is present in some parts.
Start quality	7	Ecoedge (2021) survey and desktop assessment of context, within the existing DBCA managed Manea Park. High context score due to being located within the broader Bankia community. Condition ranges from Excellent to Degraded.
Future quality without offset	6	Currently forms an water infrastructure reserve, potential for future degradation in particular dieback and weeds if not managed for conservation purposes.
Future quality with offset	8	Aqwest will hand over management to DBCA as part of Manea Park. It is reasonable to expect that the quality will be improved. Placing this Lot into conservation estate also prevents future fragmentation of the adjacent Manea Park, if the Lot was developed. Aqwest and DBCA are to have further discussions on the actions to improve the quality of the vegetation within the Lot.
Risk related time horizon	1	The site will be transferred to DBCA estate and managed as a conservation reserve (maximum of 20 years). DBCA and Aqwest have in-principle agreement for the transfer.
Time until ecological benefit (years)	2	To be converted to conservation estate and managed by DBCA within 12 months of the Proposed Action being approved. Aqwest and DBCA to discuss further management measures to improve quality this may include weed and dieback management.
Risk of loss without offset (%)	60%	There is potential for it to be utilised for its intended purpose i.e. water distribution mains to the Wanju development area.
Risk of loss with offset (%)	10%	Very low risk of loss once the Lot is converted to conservation estate and vested with DBCA.
Confidence in result (%)	90%	High level of confidence that there is a very low risk of loss and that the quality can be improved with management.
% of impact offset	100.5	

5.4.3 Tuart Woodlands – Quantum of impacts and offsets

Table 12 and Table 13 provide the values and justification for assessment using the Commonwealth Offset Calculator. As shown in these tables, the 0.23 ha of Tuart Woodland TEC within the Proposed Action impact area is offset by 327.3 % by Offset Site 2 (conservation covenant and rehabilitation of Lot 933). A copy of the calculator is provided at Appendix D.

Additional surveys are required to confirm if the offset site currently meets Tuart Woodland TEC criteria, further define the quality score and assist in developing the rehabilitation plan. However, this preliminary assessment shows that Lot 933 or part of this Lot could meet and exceed the offset requirements for the impact area.

Further discussions with the Department of Agriculture, Water and the Environment (DAWE) / Department of Water and Environmental Regulations (DWER) / DBCA are required as part of finalising the strategy, to define the final configuration of the offset (over whole or only part of the Lot) and rehabilitation plan. Based on the offset calculator using the values in

Table 13, approximately 1 ha of the Tuart woodland would provide 119.1 % of the offset requirement.

Table 12 Impact calculator – Tuart TEC

Attribute	Value	Justification
Area of impact	0.23 ha	GHD (2021) surveys identified the presence of the Tuart Woodlands TEC within the Proposed Action area.
Quality	7	Medium – High score. The Tuart Woodland TEC Proposed Action impact area contains TEC that in Good (82%) and Degraded (18%) condition. It forms part of the larger area of banksia community within Manea Park to the north but is adjacent to agricultural land along the southern boundary.
Quantum of impact	0.16 ha	

Table 13 Offset calculator – Lot 933 – Tuart TEC

Attribute	Value	Justification
Offset area	1 ha to 2.9 ha	GHD (2019) reconnaissance survey and recent site visit. 4.2 ha Lot with 2.9 ha of Tuart Woodland. Further discussions with DAWE / DWER / DBCA to be held as part of finalising the strategy on the final configuration of the offset (over whole or only part of the Lot). Based on the offset calculator using the values in this table, approximately 1 ha of the Tuart woodland would provide 119.1 % of the offset requirement.
Start quality	5	Site surveys have identified that the vegetation is largely in a Degraded condition with some areas in Good condition. Further mapping and assessment is required to confirm if the criteria for Tuart TEC are met and define the condition. In context terms there is limited connectivity with nearby Manea Park / Trinity Green and coastal vegetation. The patch is separated by residential development and local roads by at least 100 m. The start quality will be further refined once additional surveys are complete.
Future quality without offset	4	The Lot has unrestricted access by the local community. Weeds are prevalent. It is expected that over time, without intervention the quality of this patch would further decline.
Future quality with offset	6	Aqwest will place a conservation covenant over the Lot (or part of the Lot) and undertake rehabilitation, this will focus on weed management and infill planting to improve the structure and species diversity. It is expected that the quality can be improved over a five year period with on-going weed management.

Attribute	Value	Justification
Time of which the loss is averted	1	A conservation covenant will be placed over this portion of the lot within 12 months of the Proposed Action being approved.
Time until ecological benefit (years)	5	A rehabilitation plan will be prepared, this will include infill planting and weed control. It is expected that improvements to quality will be achieved within five years.
Risk of loss without offset (%)	30%	The property is Crown Land, that has been designated a Reserve under Aquest's management. The intended purpose for the Reserve is for water infrastructure. The adjacent area has been developed for residential.
Risk of loss with offset (%)	10%	Very low risk of loss once tuart woodland component of the Lot is placed under a conservation covenant
Confidence in result loss (%)	90%	High level of confidence that there is a very low risk of loss and that the quality can be improved with management.
Confidence in result quality (%)	80 %	
% of impact offset	119.1 to 327.34 %	Depending on whether only 1 ha or the total 2.9 ha of the Tuart woodland within Lot 933 is used as the offset.

5.4.4 Black Cockatoo – Quantum of impacts and offsets

Table 14, Table 15 and Table 16 provide the values and justification for assessment using the Commonwealth Offset Calculator. As shown in these tables, the 1.31 ha of Black Cockatoo habitat loss within the Proposed Action impact area is offset by 180.7 % by Offset Site 1 (transfer of Aqwest Lot 935 in Manea Park to DBCA).

Depending on further assessment of Offset Site 2 (conservation covenant and rehabilitation of Lot 933) and the final configuration of the offset (i.e. whether the whole Lot or only part of the Lot is used as an offset), this site will provide between 1 and 2.9 ha of potential breeding and moderate quality foraging habitat. This would provide an additional 35.5 to 102.8 % of the offset requirement.

A copy of the calculator is provided at Appendix D.

Table 14 Impact calculator – Black Cockatoo Habitat

Attribute	Value	Justification
Area of impact	1.31 ha	Biota (2021) completed a Black Cockatoo assessment. 1.31 ha with 1.09 ha high quality foraging / potential roosting and 0.22 ha Moderate quality foraging. Loss of 18 potential breeding trees (suitable species > 50 cm, none with hollows suitable for breeding).
Quality	8	High score based on the condition, presence of potential breeding and foraging habitat and field observations
Quantum of impact	1.05 ha	

Table 15 Offset calculator – Lot 935 Manea Park– Black Cockatoo

Attribute	Value	Justification
Offset area	4.84 ha	Based on field observations and vegetation mapping (Ecoedge 2021) and habitat values assigned by Biota (2020). It is expected that 4.84 ha will provide foraging habitat for Black Cockatoo species, some areas such as the Banksia community provide higher quality foraging habitat. During the site visit approximately 9 potential breeding trees (trees greater than 50 cm DBH) were noted, none of these trees had hollows considered suitable for current breeding.

Attribute	Value	Justification
Start quality	8	Desktop review and site inspection indicates that the site areas that are high quality foraging and potential breeding (presence of Jarrah and Marri trees that are greater than 50 cm DBH). The site is connected to the adjacent Manea Park, which also provides supporting habitat.
Future quality without offset	7	Currently forms an Reserve for water infrastructure, potential for future degradation in particular dieback and weeds if not managed for conservation purposes. This would further reduce the presence of foraging habitat.
Future quality with offset	8	Aqwest will transfer the Lot to DBCA, with management as part of Manea Park. It is reasonable to expect that the quality will remain the same or be improved. Placing this Lot into conservation estate also prevents future fragmentation of the adjacent Manea Park, if the Lot was developed.
Time of which the loss is averted	1	The site will be transferred to DBCA estate and managed as a conservation reserve (maximum of 20 years).
Time until ecological benefit (years)	1	To be converted to conservation estate and managed by DBCA within 12 months of the Proposed Action being approved.
Risk of loss without offset (%)	60%	The Lot is likely to be developed in the future for water infrastructure.
Risk of loss with offset (%)	10%	Very low risk of loss once the Lot is converted to conservation estate and vested with DBCA.
Confidence in result (%)	90%	High level of confidence that there is a very low risk of loss and that the quality can be maintained (or improved) with management.
% of impact offset	180.7 %	

Table 16 Offset calculator – Lot 933 – Black Cockatoo

Attribute	Value	Justification
Offset area	1 to 2.9 ha	GHD (2019) reconnaissance survey and recent site visit. 4.2 ha Lot with 2.9 ha of the Tuart Woodland providing foraging habitat. It is assumed this would be moderate value. The site visit by GHD in 2021 also identified potential breeding trees. This will be further quantified as the offset strategy develops. Further discussions with DAWE / DWER / DBCA to be held as part of finalising the strategy on the final configuration of the offset (over whole or only part of the Lot).
Start quality	6	Site surveys have identified that the Tuart woodland vegetation (2.9 ha) provides foraging and potential breeding habitat. This is considered to be of moderate value. In context terms there is limited connectivity with nearby Manea Park / Trinity Green and coastal vegetation. The patch is separated by residential development and local roads by at least 100 m. For Black Cockatoo species these gaps would not prevent their ability to utilise the area. The start quality will be further refined once additional surveys are complete.
Future quality without offset	5	The Lot has unrestricted access by the local community. Weeds are prevalent. It is expected that over time, without intervention the quality of this patch would further decline.
Future quality with offset	7	Aqwest will place a conservation covenant over the Lot (or part of the Lot) and undertake rehabilitation, this will focus on weed management and infill planting to improve the structure and species diversity. It is expected that the quality can be improved over a five year period with on-going weed management.
Time of which the loss is averted	1	A conservation covenant will be placed over this portion of the lot within 12 months of the Proposed Action being approved.

Attribute	Value	Justification
Time until ecological benefit (years)	5	A rehabilitation plan will be prepared, this will include infill planting and weed control. It is expected that improvements to quality will be achieved within five years.
Risk of loss without offset (%)	30%	The property is Crown Land, that has been designated a Reserve under Aquest's management. The intended purpose for the Reserve is for water infrastructure. The adjacent area has been developed for residential.
Risk of loss with offset (%)	10%	Very low risk of loss once tuart woodland component of the Lot is placed under a conservation covenant
Confidence in result loss (%)	90%	High level of confidence that there is a very low risk of loss
Confidence in result quality (%)	80%	High level of confidence that the quality can be improved with management.
% of impact offset	35.5 to 102.8%	Depending on whether only 1 ha or the total 2.9 ha of the Tuart woodland within Lot 933 is used as the offset.

5.4.5 Western Ringtail Possum – Quantum of impacts and offsets

Table 17, Table 18 and Table 19 provide the values and justification for assessment using the Commonwealth Offset Calculator. As shown in these tables, the 1.31 ha of Western Ringtail Possum habitat loss within the Proposed Action impact area is offset by 151.8 % by Offset Site 1 (transfer of Aqwest Lot 935 in Manea Park to DBCA).

Depending on further assessment of Offset Site 2 (conservation covenant and rehabilitation of Lot 933) and the final configuration of the offset (i.e. whether the whole Lot or only part of the Lot is used as an offset), this site will provide between 1 and 2.9 ha of potential breeding and moderate quality foraging habitat. This would provide an additional 17.3 to 50.3 % of the offset requirement.

A copy of the calculator is provided at Appendix D.

Table 17 Impact calculator – Western Ringtail Possum Habitat

Attribute	Value	Justification
Area of impact	1.31 ha	Biota (2021) completed a targeted Western Ringtail Possum assessment. This identified 1.31 ha with 1.09 ha Core habitat and 0.22 ha supporting habitat). Five Western Ringtail Possums were observed within the Proposed Action impact area.
Quality	8	High score based on the excellent quality, and connection to larger areas of habitat and confirmed presence of Western Ringtail Possums in the Proposed Action impact area.
Quantum of impact	1.05 ha	

Table 18 Offset calculator – Lot 935 Manea Park– Western Ringtail Possums

Attribute	Value	Justification
Offset area	4.84 ha	Based on field observations and vegetation mapping it is expected that 4.84 ha will provide habitat for the Western Ringtail Possum. The Banksia community (Ecoedge (2021) unit A) align with vegetation identified in Biota (2020) for the Proposed Action area as core habitat (1.01 ha) and the remaining 3.84 ha of vegetation units (except the wetland / riparian area) provide supporting habitat.
Start quality	7	Desktop review and site inspection indicates that the site is in similar condition to the impact area. The context is also similar with it forming part of a larger habitat fragment within Manea Park. The offset has high context and quality scores, however the current

Attribute	Value	Justification
		stocking rate is unknown. Targeted surveys over a portion of Manea Park were completed as part of the BORR Project, and this identified Manea Park as medium habitat suitability with 103 individual observations of Western Ringtail Possums (Biota, 2020b).
Future quality without offset	6	Currently forms a Reserve for water infrastructure, potential for future degradation in particular dieback and weeds if not managed for conservation purposes. This would further reduce the presence of foraging habitat.
Future quality with offset	7	Aqwest will transfer the Lot to DBCA, with management as part of Manea Park. It is reasonable to expect that the quality will remain the same or be improved. Placing this Lot into conservation estate also prevents future fragmentation of the adjacent Manea Park, if the Lot was developed.
Time of which the loss is averted	1	The site will be transferred to DBCA estate and managed as a conservation reserve (maximum of 20 years).
Time until ecological benefit (years)	1	To be converted to conservation estate and managed by DBCA within 12 months of the Proposed Action being approved.
Risk of loss without offset (%)	60%	The Lot is highly likely to be developed in the future for water infrastructure
Risk of loss with offset (%)	10%	Very low risk of loss once the Lot is converted to conservation estate and vested with DBCA.
Confidence in result (%)	90%	High level of confidence that there is a very low risk of loss and that the quality can be maintained (or improved) with management.
% of impact offset	151.8%	

Table 19 Offset calculator – Lot 933 – Western Ringtail Possums

Attribute	Value	Justification
Offset area	1 to 2.9 ha	GHD (2019) mapped the vegetation and fauna habitat types within Lot 933 and identified the three vegetation types as providing foraging and potential breeding habitat for Western Ringtail Possum. Total of 4.2 ha. As part of the offsets for the Tuart Woodland between 1 and 2.9 ha of this will be rehabilitated and this would also provide improved habitat for Western Ringtail Possums.
Start quality	5	Given the condition of the habitat types this is considered to be of moderate value. In context terms there is limited connectivity with nearby Manea Park / Trinity Green and coastal vegetation. The patch is separated by residential development and local roads by at least 100 m. It appears to have limited connectivity to the broader area for Western Ringtail Possum. However, the species has been noted in residential areas and may currently utilise the area.
Future quality without offset	4	The Lot that has unrestricted access by the local community. Weeds are prevalent. It is expected that over time, without intervention the quality of this patch would further decline.
Future quality with offset	6	Aqwest will place a conservation covenant over the Lot (or part of the Lot) and undertake rehabilitation. This will focus on weed management and infill planting to improve the structure and species diversity. It is expected that the quality can be improved over a five year period with on-going weed management.
Time of which the loss is averted	1	A conservation covenant will be placed over this portion of the lot within 12 months of the Proposed Action being approved.
Time until ecological benefit (years)	5	A rehabilitation plan will be prepared, this will include infill planting and weed control. It is expected that improvements to quality will be achieved within five years.
Risk of loss without offset (%)	30%	The property is Crown Land, that has been designated a Reserve under Aquest's management. The intended purpose for the Reserve is for water infrastructure. The adjacent area has been developed for residential.

Attribute	Value	Justification
Risk of loss with offset (%)	10%	Very low risk of loss once tuart woodland component of the Lot is placed under a conservation covenant
Confidence in result Loss (%)	90%	High level of confidence that there is a very low risk of loss
Confidence in result Quality (%)	80%	High level of confidence that the quality can be improved with management.
% of impact offset	17.3 to 50.3%	Depending on whether only 1 ha or the total 2.9 ha of the Tuart woodland within Lot 933 is used as the offset for this impact.

6. Conclusion

Aqwest have developed a Draft Offset Strategy for the Proposed Action to counterbalance significant residual impacts on two threatened ecological communities (Banksia Woodlands TEC and Tuart Woodlands TEC), and habitat for two conservation significant species (Black Cockatoos and Western Ringtail Possums).

Aqwest have applied Commonwealth and State offset policies in the development of this strategy. Two offset sites have been identified, Lot 935 which intersects Manea Park and Lot 933 in College Grove. These two Lots are Crown Land Reserves managed by Aqwest with the intention of being utilised for future water infrastructure. The offsets involve transferring Lot 935 to DBCA for it to form part of Manea Park and a conservation covenant and on-ground rehabilitation of Lot 933.

Offset extents have been determined using the Commonwealth Offset Assessment Guide and/or State-based policies and demonstrate that the offset requirements can be met.

7. References

Biota. (2020). Bunbury Outer Ring Road Southern Section Targeted Fauna Assessment, BORR IPT, Available at: https://www.epa.wa.gov.au/sites/ BORR Southern Section_EPA Updated Referral Spprtng Doc_v3

Biota. (2021). Bunbury Water Resources Scheme Fauna Assessment, unpublished report. Aqwest

DEC (2008). Forest Black Cockatoo (Baudin's Cockatoo *Calyptorhynchus baudinii* and Forest Redtailed Black Cockatoo *Calyptorhynchus banksii naso*) Recovery Plan. [online] Unknown: Australian Government.

DEWHA (2009). Approved Conservation Advice for *Calyptorhynchus banksii naso* (Forest Redtailed Black Cockatoo). [online] Canberra: Australian Government. Available at: http://www.environment.gov.au/biodiversity/threatened/species/pubs/67034-conservationadvice.

DotEE (2017). Revised draft referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo. [online] Unknown: Australian Government. Available at: https://www.environment.gov.au/system/files/consultations/1a21997c-5542-4cd6-ace9-561865bbff29/files/draft-revised-referral-guideline-black-cockatoos.pdf [Accessed 1 Jan 2021].

DPaW (2013). Carnaby's Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan. Western Australian Wildlife Management Program No. 52. Perth, Western Australia: Government of Western Australia.

DSEWPAC (2012). EPBC Act referral guidelines for three threatened black cockatoo species. [online] Commonwealth of Australia: Australian Government. Available at: https://www.environment.gov.au/system/files/resources/895d4094-af63-4dd3-8dffad2b9b943312/ files/referral-guidelines-wa-black-cockatoo.pdf [Accessed 1 Jan 2021].

DSEWPaC (2012a). EPBC Act Environmental Offsets Policy. Commonwealth of Australia: Australian Government.

DSEWPaC (2012b). Offsets assessment guide. [online] Unknown: Australian Government. Available at: https://www.environment.gov.au/epbc/publications/epbc-act-environmental-offsetspolicy [Accessed 01 Dec 2020].

DSEWPaC (2012c). How to use the Offsets assessment guide. [online] Unknown: Australian Government. Available at: https://www.environment.gov.au/system/files/resources/12630bb4-2c10- 4c8e-815f-2d7862bf87e7/files/offsets-how-use.pdf [Accessed 1 Oct 2021].

Ecoedge. (2021). Memorandum Manea Park Offset Investigation Report. Unpublished report for Aqwest.

EPA (2014). WA environmental offsets template. [online] Perth, Western Australia.: Government of Western Australia. Available at: https://www.epa.wa.gov.au/policies-guidance/wa-environmentaloffsets-policy-2011-and-guidelines [Accessed 1 Oct 2021].

GHD. (2019). Memorandum Aqwest Broad vegetation, fauna habitat and weed density, unpublished report Aqwest.

GHD. (2021). Bunbury Water Resources Recovery Scheme: Flora and Vegetation Survey, unpublished report. Aqwest.

GoWA (2004). Environmental Protection (Clearing of Native Vegetation) Regulations 2004. [online]. Version 02-e0-00. Government of Western Australia. Unknown: Available at: https://www.legislation.wa.gov.au/legislation/statutes.nsf/main_mrtitle_1384_homepage.html

GoWA (2011). Application of the WA Environmental Offsets Policy. Unknown: Unknown.

GoWA (2014). WA Environmental Offsets Guidelines. Unknown: Government of Western Australia.

GoWA (2020). Environmental Protection Act 1986. [online] Version 09-g0-00. Unknown: DWER. Available at: https://www.legislation.wa.gov.au/legislation/prod/filestore.nsf/FileURL/mrdoc_43548.pdf/$FILE/Environmental%20Protection%20Act%201986%20-%20%5B09-g0-00%5D.pdf?OpenElement [Accessed 1 Oct 2021].

TSSC (2012). Conservation Advice *Clay Pans of the Swan Coastal Plain*. [online] Unknown: Australian Government. Available at: http://www.environment.gov.au/biodiversity/communities//pubs/121-conservation-advice-

TSSC (2018). Conservation Advice *Calyptorhynchus baudinii* Baudin's cockatoo. [online] Unknown: Australian Government. Available at: http://www.environment.gov.au/biodiversity/threatened/species/pubs/769-conservation-advice-

Appendices

Appendix A

Lot 935 Manea Park background information

A-1 Ecoedge (2021) Flora and Vegetation assessment

A-2 DBCA letter of support

Memorandum R128

Client:	**GHD**
Attention:	[redacted]
From:	
Date:	23 July 2021
Subject:	Manea Park Offset Investigation Report

Introduction

Ecoedge were engaged in 2021 by GHD on behalf of Aqwest to undertake a reconnaissance flora and vegetation survey over approximately five hectares of land within Manea Park, in part of the Kalgulup Regional Park in Bunbury (the 'survey area'). The survey area stretches east to west for about 2.4 kilometres (km) and is for the most part a narrow corridor about 10 metres (m) in width, with a larger parcel in the south of the corridor at the east end (**Figure 1**).

The purpose of the survey was to broadly map vegetation types and condition and identify the presence of Threatened and Priority ecological communities (TEC and PEC) occurring within the survey area, with a view to these areas potentially being used to offset environmental impacts associated with Aqwest's wastewater infrastructure projects in the local area.

Scope

The scope for the reconnaissance survey is itemised below:

- Undertake a reconnaissance level survey, relevés only, map and describe vegetation types.
- Only common, dominant, or characteristic flora species were required to be recorded at relevés.
- Map and describe the location and extent of TECs and PECs.
- Map vegetation condition.
- Mark any conservation significant species observed. Due to the time of year the survey was conducted, a specific targeted search was not undertaken.
- Provide a memo report with methods, vegetation type descriptions, flora lists, TEC PEC occurrence and descriptions, and maps of survey results.
- Provide spatial data in IBSA format.

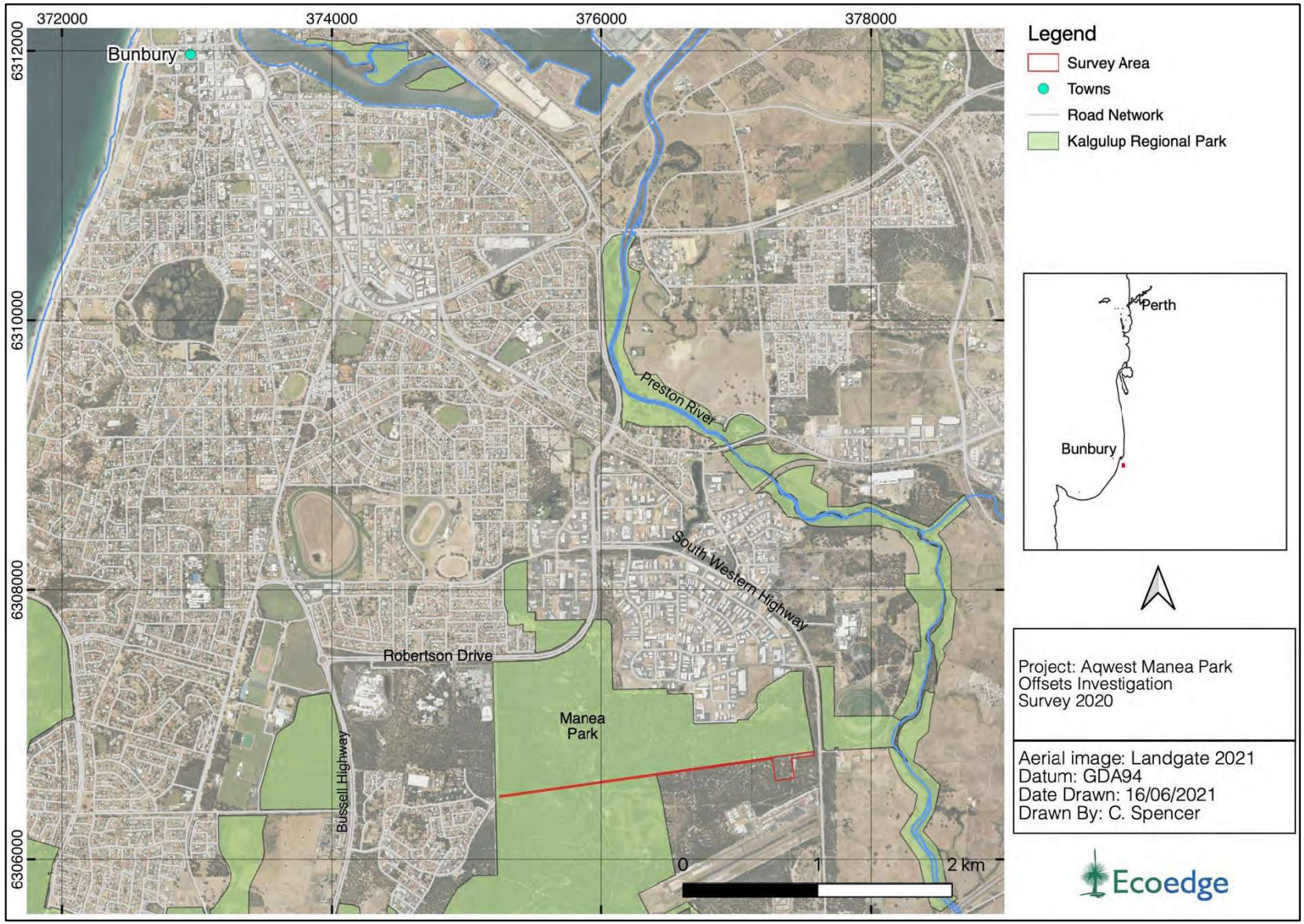


Figure 1. Location of the survey area.

Survey limitations

Potential limitations regarding the survey are addressed in **Table 1.**

Table 1. Limitations of the field survey regarding assessment adequacy and accuracy.

Aspect	Constraint	Comment
Scope	Not a constraint	The survey scope was prepared in consultation with the Client and was designed to comply with EPA requirements.
Proportion of flora identified	Not a constraint	The survey was carried out in winter, which is outside the optimal survey time for the high-rainfall southwest. Consequently, some annual or annually regenerating species were not visible or not identifiable. A comprehensive flora inventory was not required under the scope of works
Climatic and seasonal effects	Not a constraint	Rainfall recorded at Bunbury was about average at the time of survey.
Availability of contextual information	Not a constraint	Regional surveys of remnant vegetation, and more localised surveys, have been carried out in the southern Swan Coastal Plain.
Completeness of the survey	Not a constraint	All the survey area was accessible.
Skill and knowledge of the botanists	Not a constraint	The senior botanist has 30 years' experience in flora surveys in the south-west of W.A., with many years working in the Swan IBRA region.
Disturbance (fire, grazing, clearing etc.)	Minor	Much of the survey area has been affected by dieback disease and heavy kangaroo grazing.

Field survey methods

The field survey was undertaken by botanists Russell Smith (SL flora permit FT61000473) and Ben Eckermann (flora permit FB62000262) on 22 June 2021.

Information on species present, vegetation structure and condition were collected at 16 comprehensive relevés[1], 14 other vegetation recording sites and 56 vegetation condition recording sites.

Flora species that were not identified in the field were collected or photographed for later identification. Taxonomy and conservation status of flora species was checked against Parks and Wildlife Service databases. The time of survey (winter) meant some annual or annually regenerating species could not be identified.

The total area of native vegetation in the survey area was approximately 5 ha.

Vegetation condition was assessed using the method of the EPA (2016) (**Appendix 1**).

Vegetation units were derived mapped using the 16 full relevés, supplemented by the other vegetation recording sites and recent aerial photography.

[1] At 'comprehensive' relevés common, dominant, or characteristic flora species were recorded along with details of vegetation structure and soil.

Results

Flora

One hundred and six species of vascular flora were identified during the survey, 19 of which are non-native taxa (**Appendix 2).** No Threatened or Priority flora, or other flora of conservation significance were found within the survey area.

Vegetation units

Nine vegetation units or sub-units[2] were recognized within the survey area these are described in **Table 2**. Vegetation units in the survey area are shown in **Figure 2** to **Figure 5**. Pictures of these units together with their descriptions are provided in **Appendix 3.**

The most extensive vegetation unit is B3, covering about two-thirds of the survey area. Sub-unit A1 was the second most extensive vegetation type, covering about 20% of the survey area.

Table 2. Vegetation units and sub-units within the survey area.

Unit/Sub-unit	Description
A1	*Eucalyptus marginata* and *Corymbia calophylla* woodland over *Banksia attenuata*, *B. grandis*, *B. ilicifolia*, *Xylomelum occidentale* low woodland over *Kunzea glabrescens*, tall open shrubland over *Melaleuca thymoides* open shrubland over *Calytrix flavescens*, *Hibbertia hypericoides*, *Stirlingia latifolia*, *Xanthorrhoea brunonis* low open shrubland over *Dasypogon bromeliifolius* scattered herbs on grey sand.
A2	*Corymbia calophylla* woodland over *Agonis flexuosa* low woodland over *Kunzea glabrescens* isolated tall shrubs over *Melaleuca thymoides*, *Xanthorrhoea brunonis* low open shrubland over *Dasypogon bromeliifolius*, **Hypochaeris glabra* open herbland on grey sand.
A3	*Banksia attenuata*, *B. ilicifolia*, *Agonis flexuosa* woodland over *Melaleuca thymoides* sparse shrubland over *Hibbertia hypericoides*, *Calytrix flavescens*, *Stirlingia latifolia* low open shrubland over **Hypochaeris glabra* scattered herbs on grey sand on low ridge.
B1	*Corymbia calophylla*, *Eucalyptus marginata*, *Melaleuca preissiana* tall woodland over *Taxandria linearifolia* tall open shrubland over *Xanthorrhoea brunonis* low open shrubland over *Lepidosperma tenue*, *Baumea juncea* open sedgeland on damp grey sand.

[2] Sub-units are related to other sub-units with the same initial letter but differ in either species composition, degree of disturbance or both.

B2	*Corymbia calophylla* isolated trees to open woodland over *Agonis flexuosa*, *Melaleuca preissiana*, *M. rhaphiophylla*, *Banksia littoralis* low woodland over *Kunzea glabrescens* tall open shrubland over *Xanthorrhoea brunonis* sparse low shrubland over *Dasypogon bromeliifolius*, **Hypochaeris glabra* scattered herbs on damp grey sand.
B3	*Corymbia calophylla*, *Nuytsia floribunda* woodland over *Acacia saligna*, *Jacksonia furcellata*, *Kunzea glabrescens* tall shrubland over *Xanthorrhoea brunonis* sparse low shrubland over **Arctotheca calendula*, **Ursinia anthemoides* scattered herbs on damp grey sand.
C	*Melaleuca preissiana*, *M. rhaphiophylla*, *Banksia littoralis* woodland over *M. incana* subsp. *incana* tall shrubland over *Lepidosperma longitudinale*, *Baumea juncea* sedgeland grading into *Melaleuca preissiana*, *M. rhaphiophylla* woodland over *Acacia saligna* tall shrubland over *Hakea varia* sparse shrubland over
D	*Melaleuca rhaphiophylla*, *M. preissiana* woodland over *Baumea juncea*, *Lepyrodia glauca*, *Juncus pallidus* sedgeland with **Ehrharta longiflora* sparse tussock grassland and **Geranium molle* isolated herbs on damp grey-brown loamy sand
E	*Melaleuca rhaphiophylla*, *Acacia saligna* tall open shrubland over *Lepidosperma longitudinale*, *Juncus pallidus* open sedgeland with **Anthoxanthum odoratum* tussock grassland and **Lotus subbiflorus* sparse herbland on wet grey-brown clay.

Two of the sub-units, A1 and A3, have *Banksia attenuata* and *B. ilicifolia* as co-dominant species and where they are in Good, or better, condition are inferred to belong to the Commonwealth-listed TEC "Banksia woodlands of the Swan Coastal Plain".

In the absence of a multivariate analysis of floristic data (MVA) it is uncertain whether sub-units A1 and A3 belong to the SCP21a or SCP21b floristic community type (FCT) (Gibson *et al*., 1994). Quadrats assigned to both these FCTs were placed near the survey area during the Floristic Survey of the southern Swan Coastal Plain (Gibson *et al*., 1994) and in areas where they adjoin these FCTs can be difficult to distinguish from each other. The virtual absence of *E. marginata* (Jarrah) in sub-unit A3 means it is more likely to be SCP21b. However, the installation of floristic quadrats in spring followed by an MVA would be necessary for be categorical about which (or which parts) of sub-units A1 and A3 were SCP 21a or SCP21b.

Vegetation sub-unit A2 represents areas formerly sub-units A1 or A3 which have been degraded by *Phytophthora cinnamomi* root-rot disease. The characteristic small trees *B. attenuata* and *B. ilicifolia* have been eliminated by the disease, as well as many of the susceptible understorey taxa. Consequently, vegetation sub-unit A2 is not considered to be the TEC, nor are the parts mapped as A1 that were in Degraded condition (TSSC 2016).

None of the other vegetation units or sub-units is inferred to be a TEC or PEC, though vegetation unit D has some characteristics of a claypan TEC community (in that it occurs on clay), although it is now too degraded to be inferred as such. The wetland comprising vegetation unit C probably falls within SCP12, a poorly-defined floristic community type with the name "Wet Forests and Woodlands" which is considered to be "well-reserved".

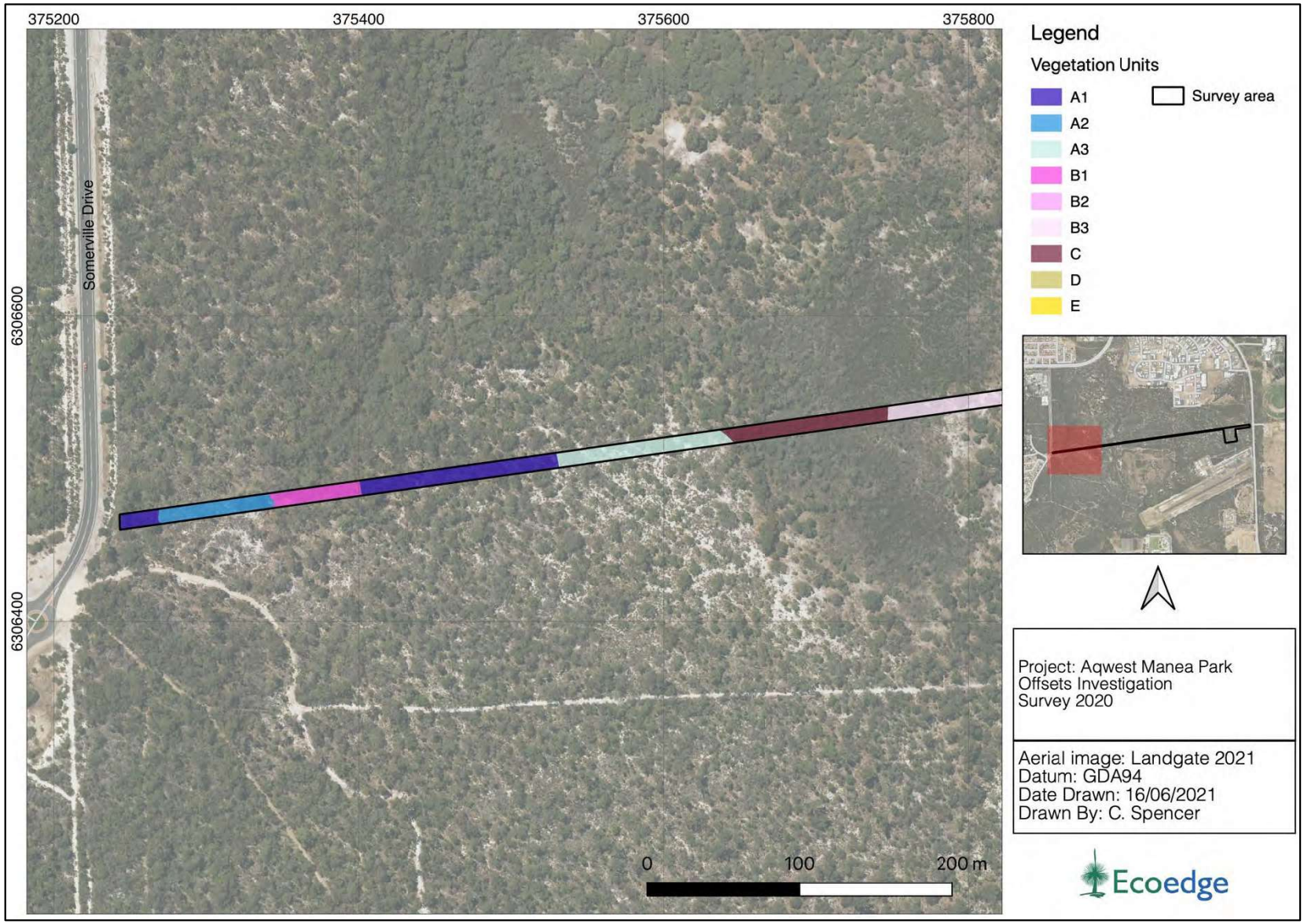


Figure 2. Vegetation units in the survey area.

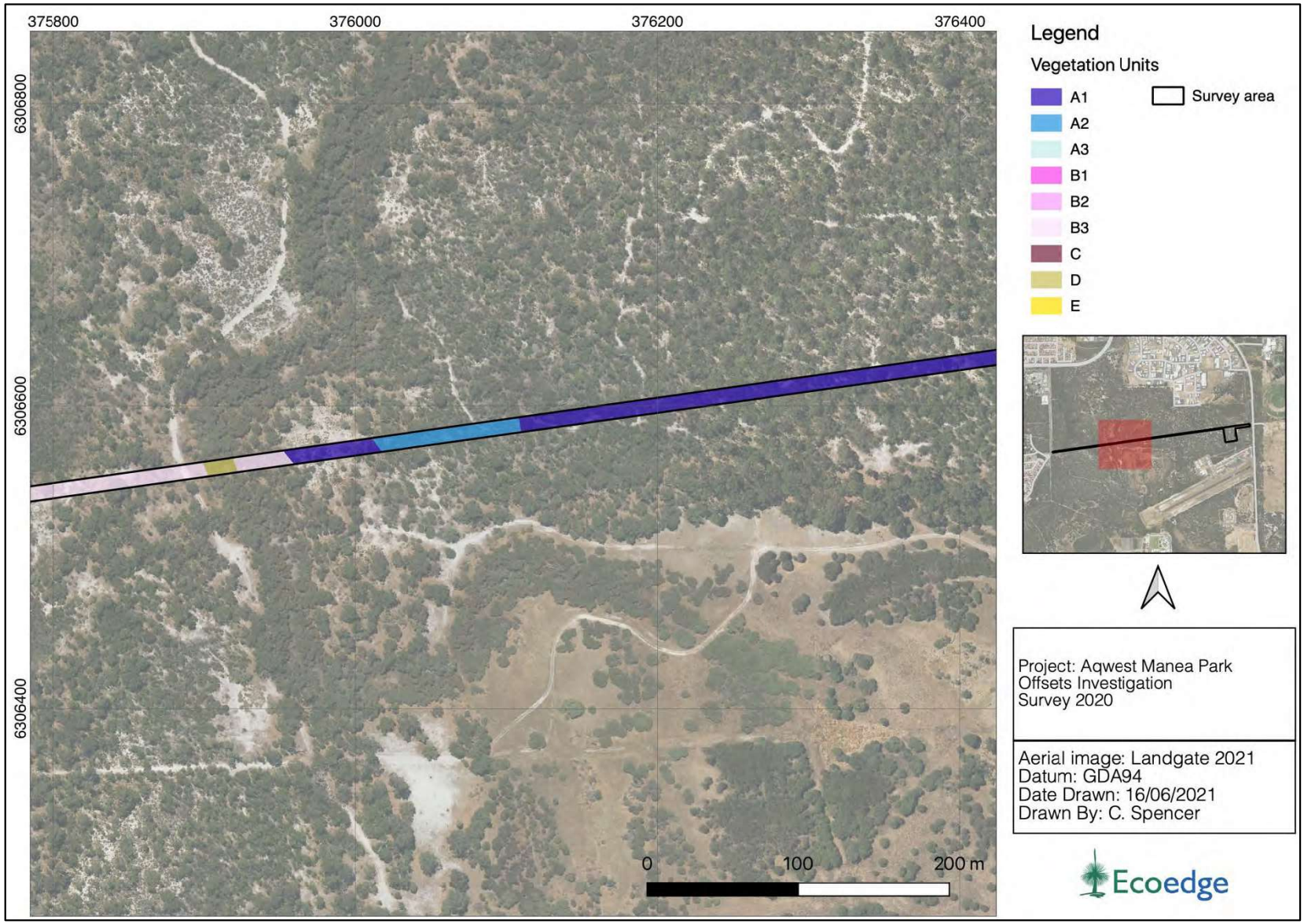


Figure 3. Vegetation units in the survey area.

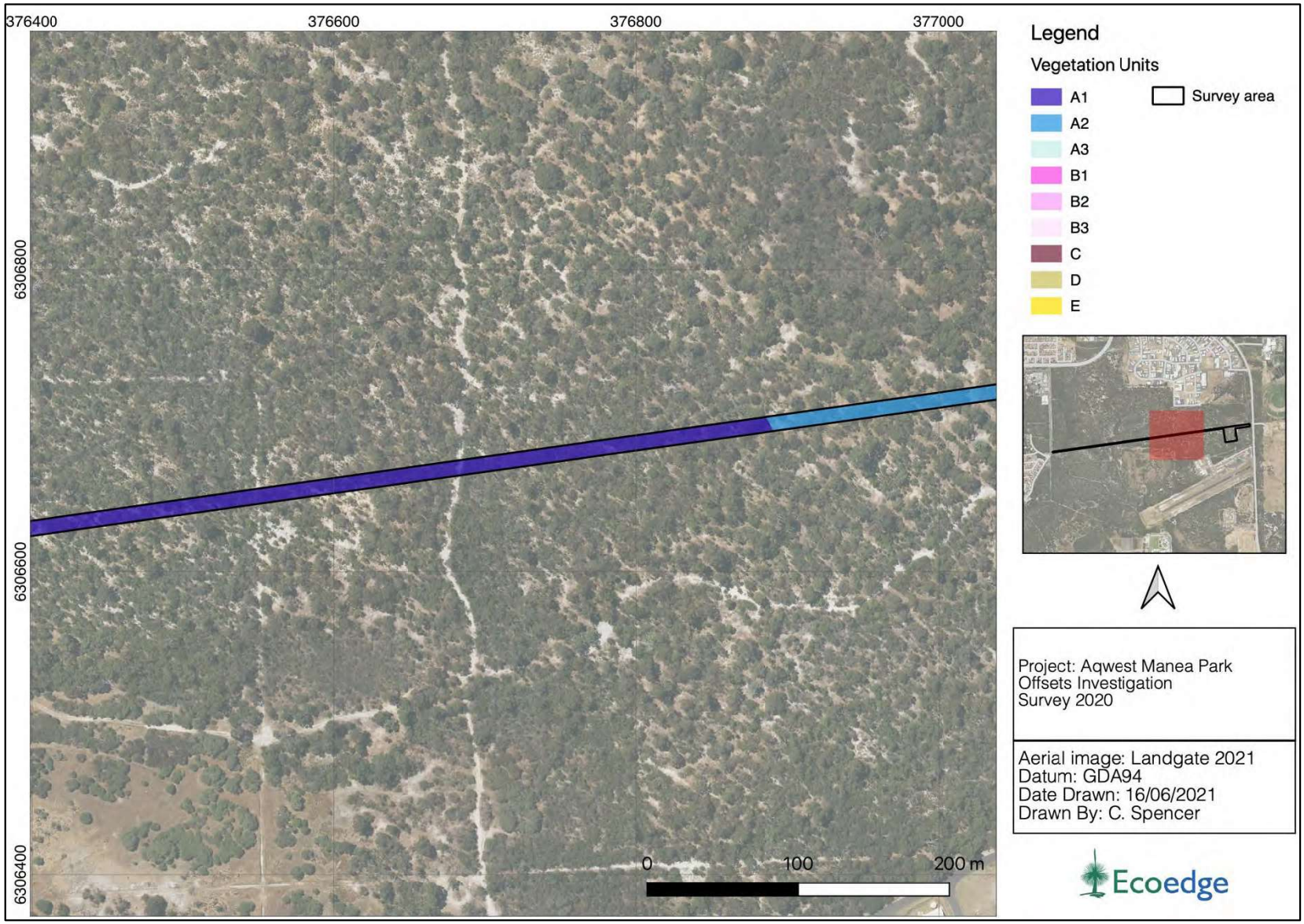


Figure 4. Vegetation units in the survey area.

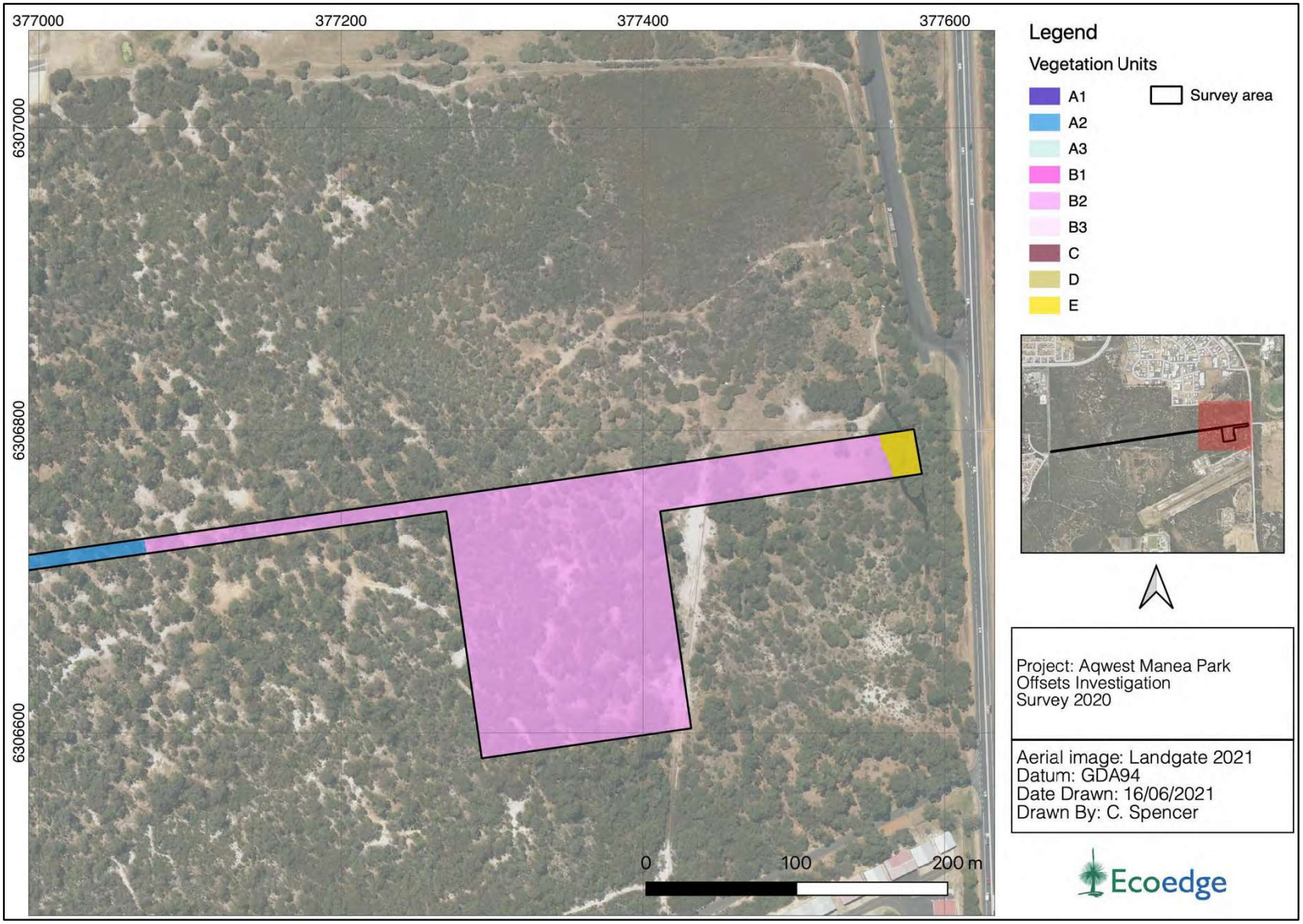


Figure 5. Vegetation units in the survey area.

Vegetation condition

Much of the vegetation has been affected by dieback disease caused by the pathogen *Phytophthora cinnamomi* in the past which had caused loss of species and opening-up of the canopy (**Figure 6**). In particular, the dieback-susceptible small tree *Banksia attenuata*, which would have been a characteristic species of unit A2 and probably of B3, has been largely removed by the disease. Recent deaths of susceptible species were evident in the western part of the survey area.

A breakdown of the vegetation condition over the survey area is provided in **Table 3** and shown in **Figure 7** to **Figure 10.**

In addition, past livestock grazing had probably had an effect in degrading the vegetation and current heavy kangaroo grazing was evident in some areas, also.

Table 4 provides a breakdown of the vegetation condition and TEC status for all vegetation units and subunits. The combined area for this TEC occurrence is 1.01 ha.

Figure 6. Part of the survey area affected by dieback disease, grazing and weed invasion.

Table 3. Vegetation condition within the survey area.

Condition	Area (ha)	%
Excellent	0.13	2.6
Very Good	0.69	13.8
Good	3.97	79.1
Degraded	0.22	4.5
Total	**5.01**	**100.0**

Table 4. Breakdown of vegetation units by vegetation condition and TEC occurrence.

Vegetation Unit	Condition	Area (ha)	%	TEC
A1	Excellent	0.03	2.6	0.03
	Very Good	0.40	39.4	0.40
	Good	0.47	47.3	0.47
	Degraded	0.11	10.7	
Total		**1.00**	**100.0**	
A2	Very Good	0.09	25.9	
	Good	0.26	74.1	
Total		**0.36**	**100.0**	
A3	Very Good	0.11	100.0	0.11
Total		**0.11**	**100.0**	
B1	Very Good	0.06	100.0	
Total		**0.06**	**100.0**	
B2	Good	3.11	100.0	
Total		**3.11**	**100.0**	
B3	Very Good	0.04	19.5	
	Good	0.04	18.4	
	Degraded	0.12	62.10	
Total		**0.19**	**100.00**	
C	Excellent	0.11	100.0	
Total		**0.11**	**100.0**	
D	Good	0.02	100.0	
Total		**0.02**	**100.0**	
E	Good	0.06	100.0	
Total		**0.06**	**100.0**	
Grand Total		**5.01**		**1.01**

Figure 11 and **Figure 12** show the extent of Banksia woodland TEC in good or better condition.

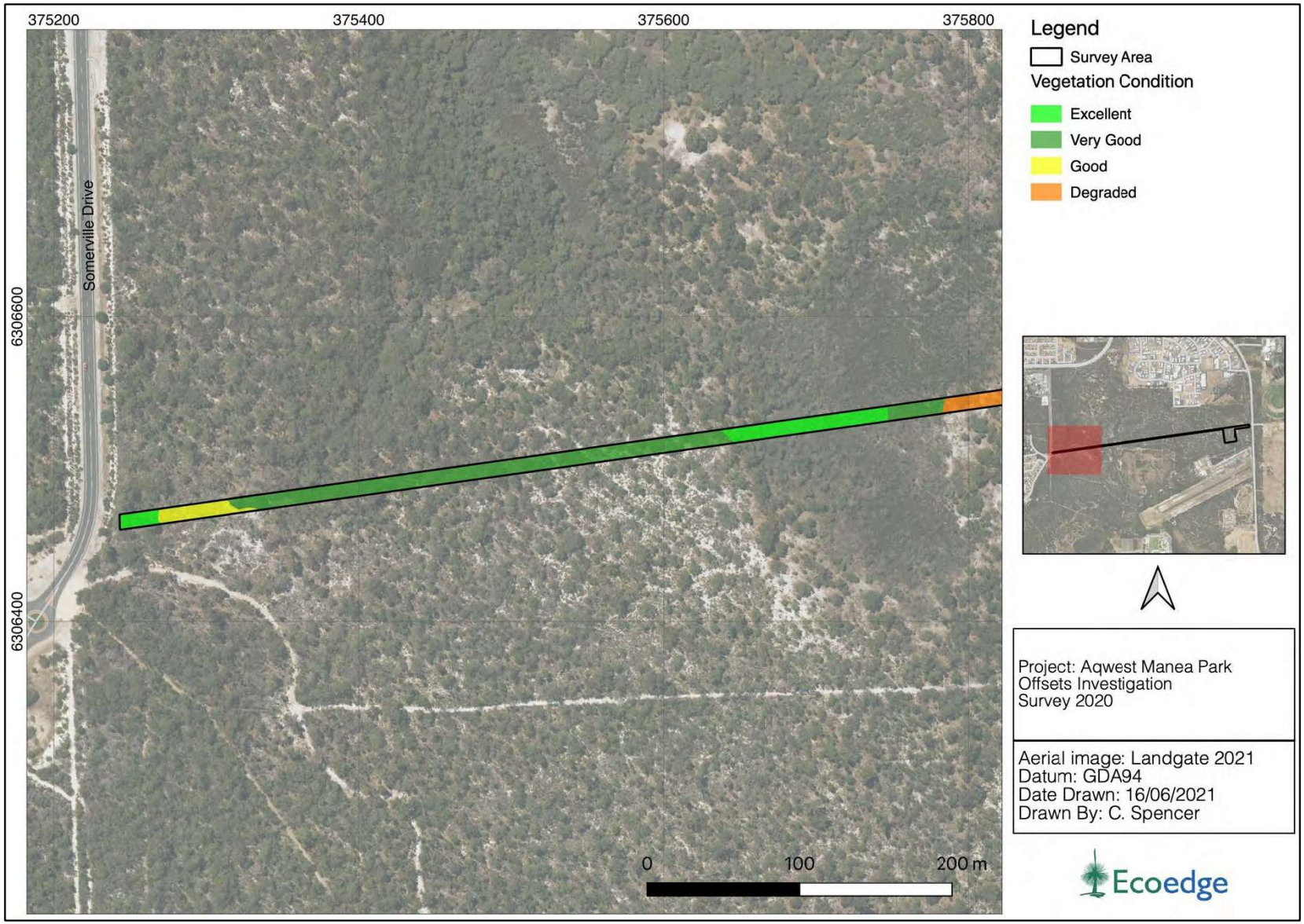


Figure 7. Vegetation condition in the survey area.

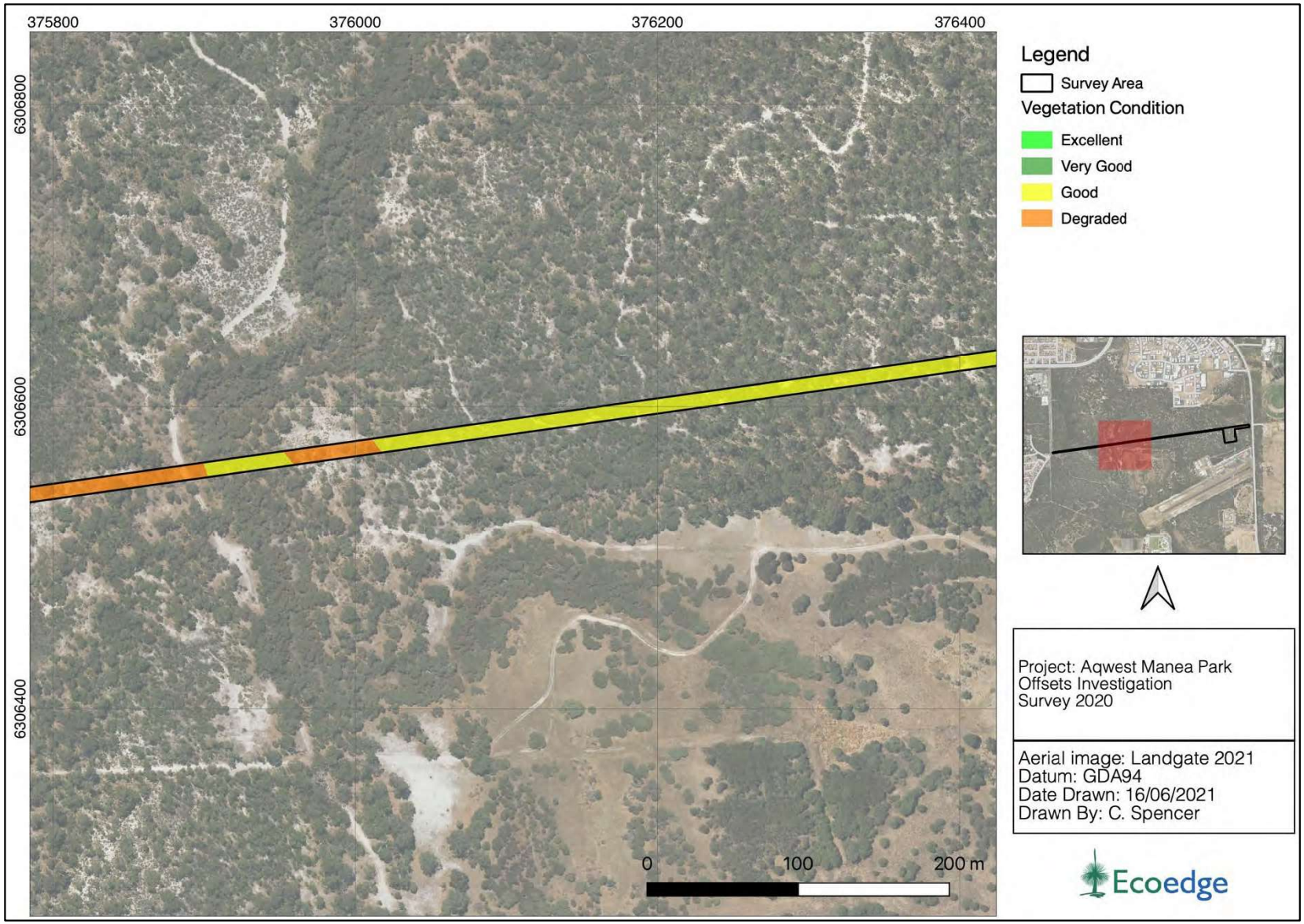


Figure 8. Vegetation condition in the survey area.

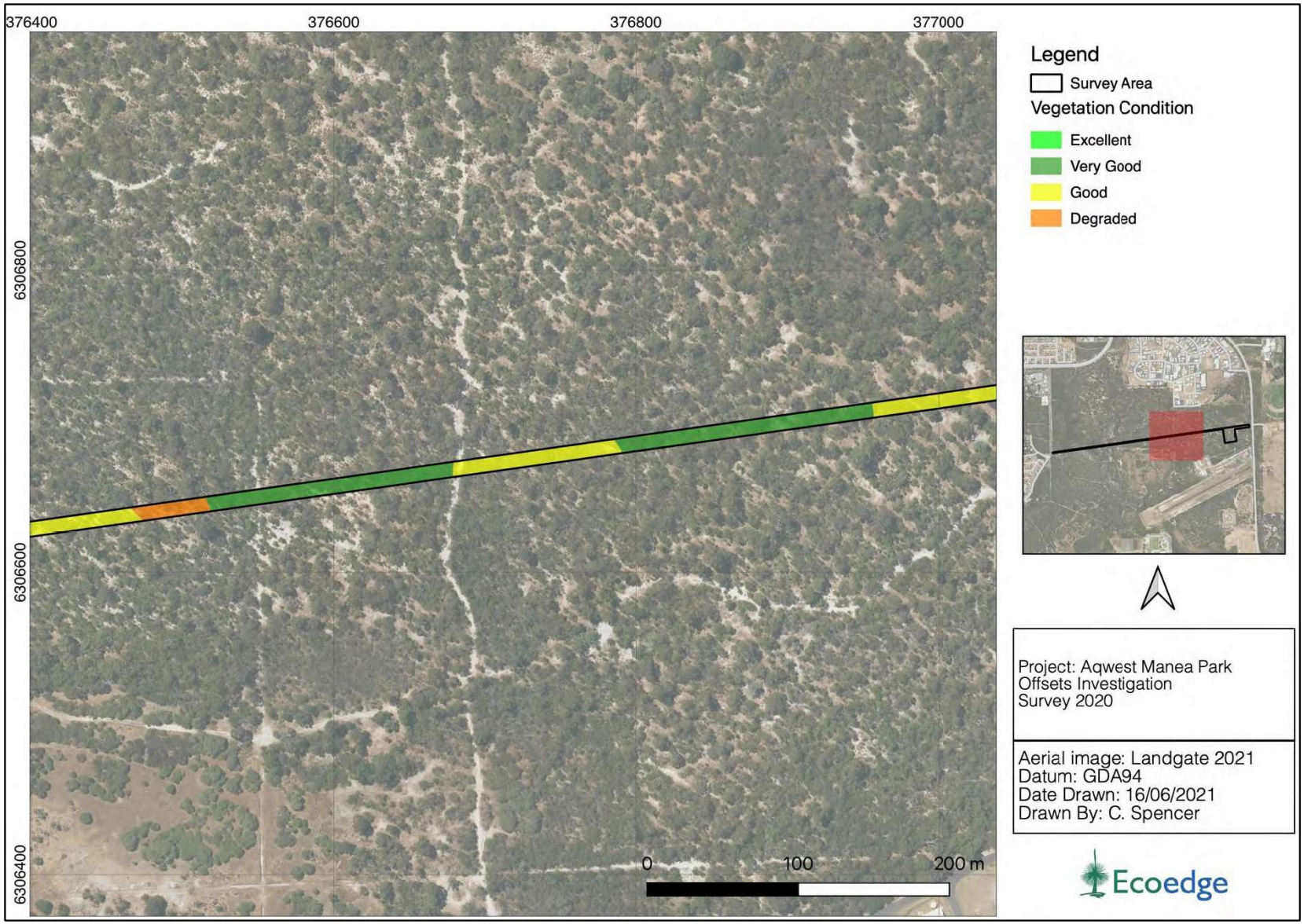


Figure 9. Vegetation condition in the survey area.

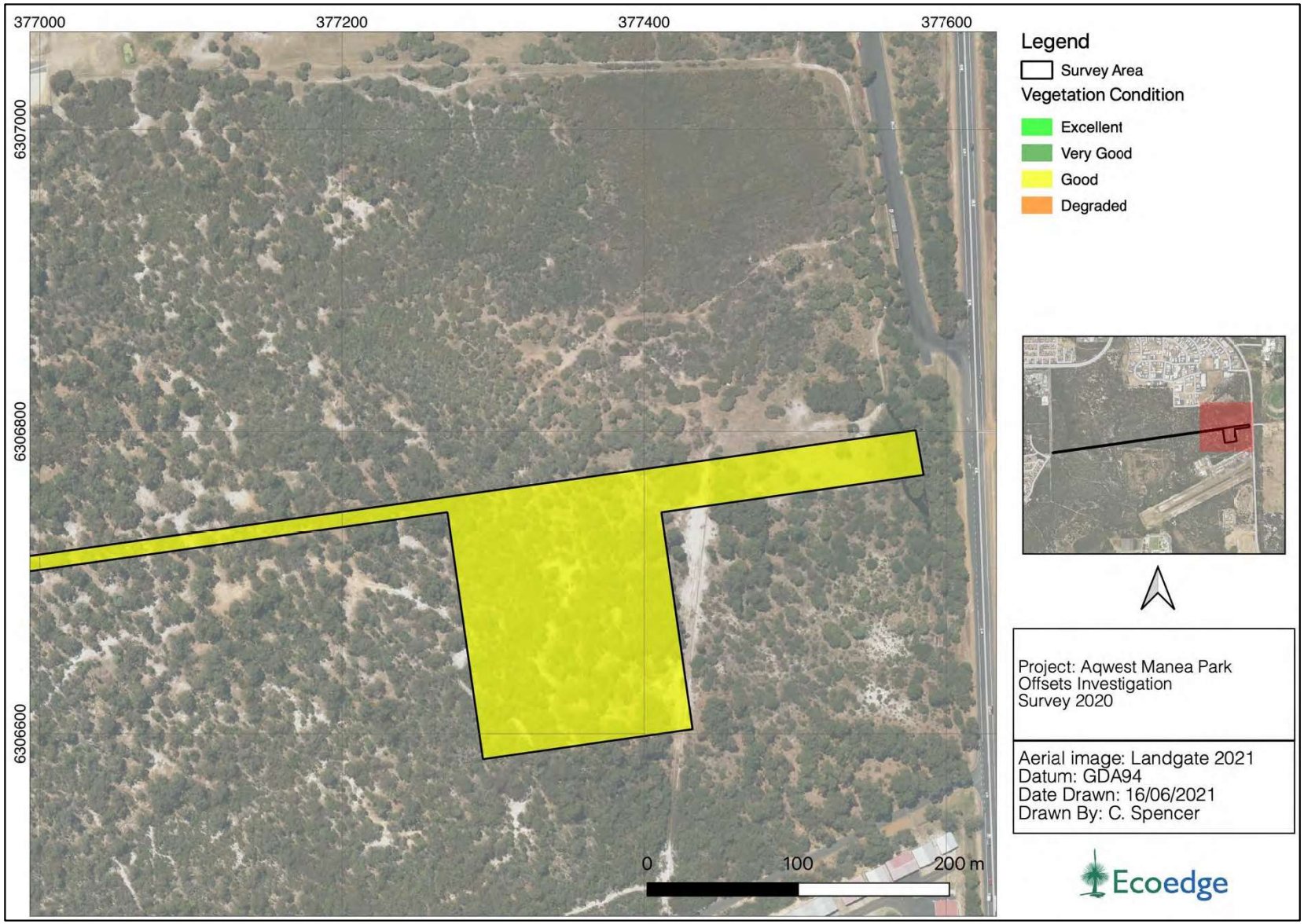


Figure 10. Vegetation condition in the survey area.

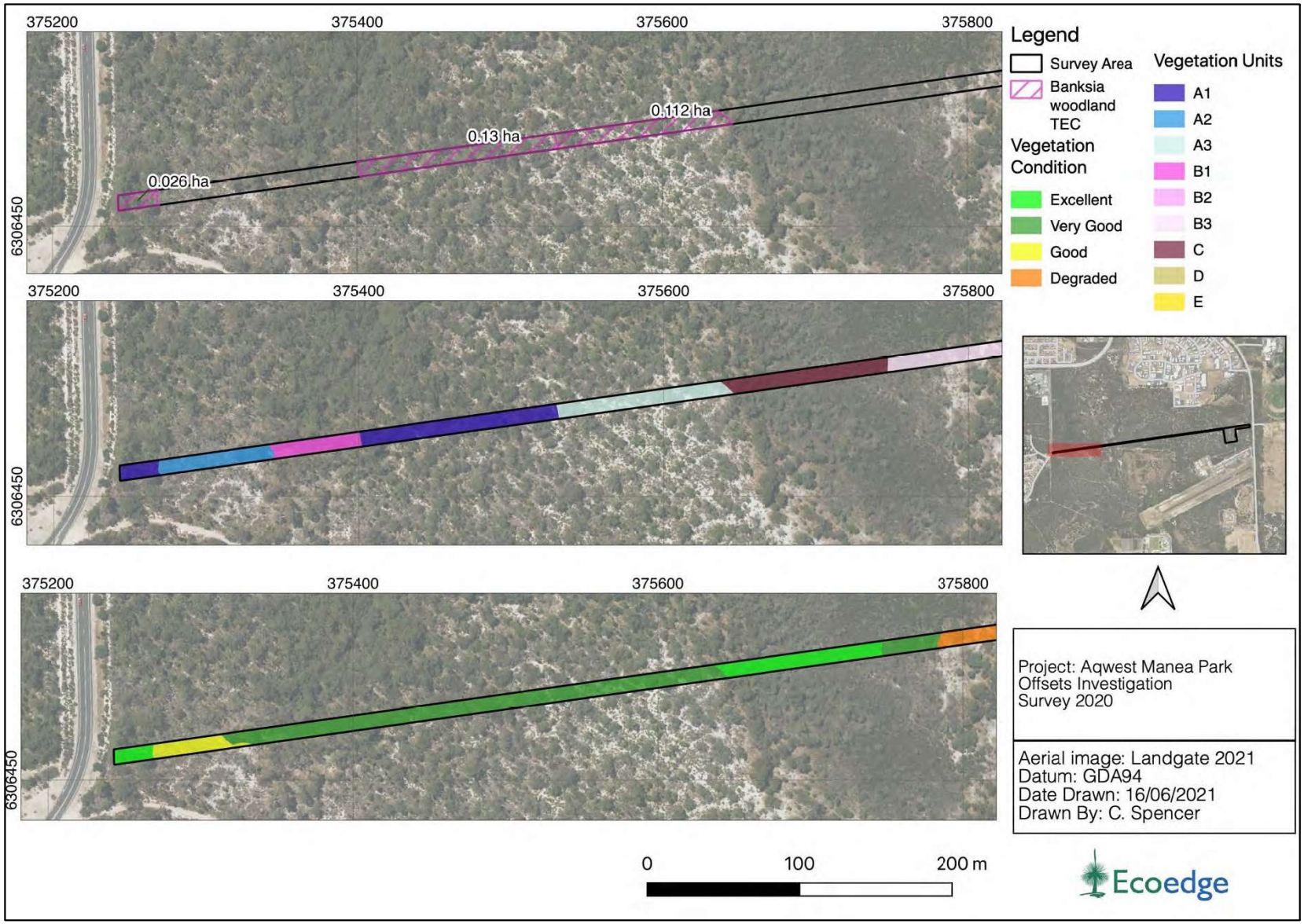


Figure 11. TEC occurrences and associated vegetation unit and vegetation condition in the survey area.

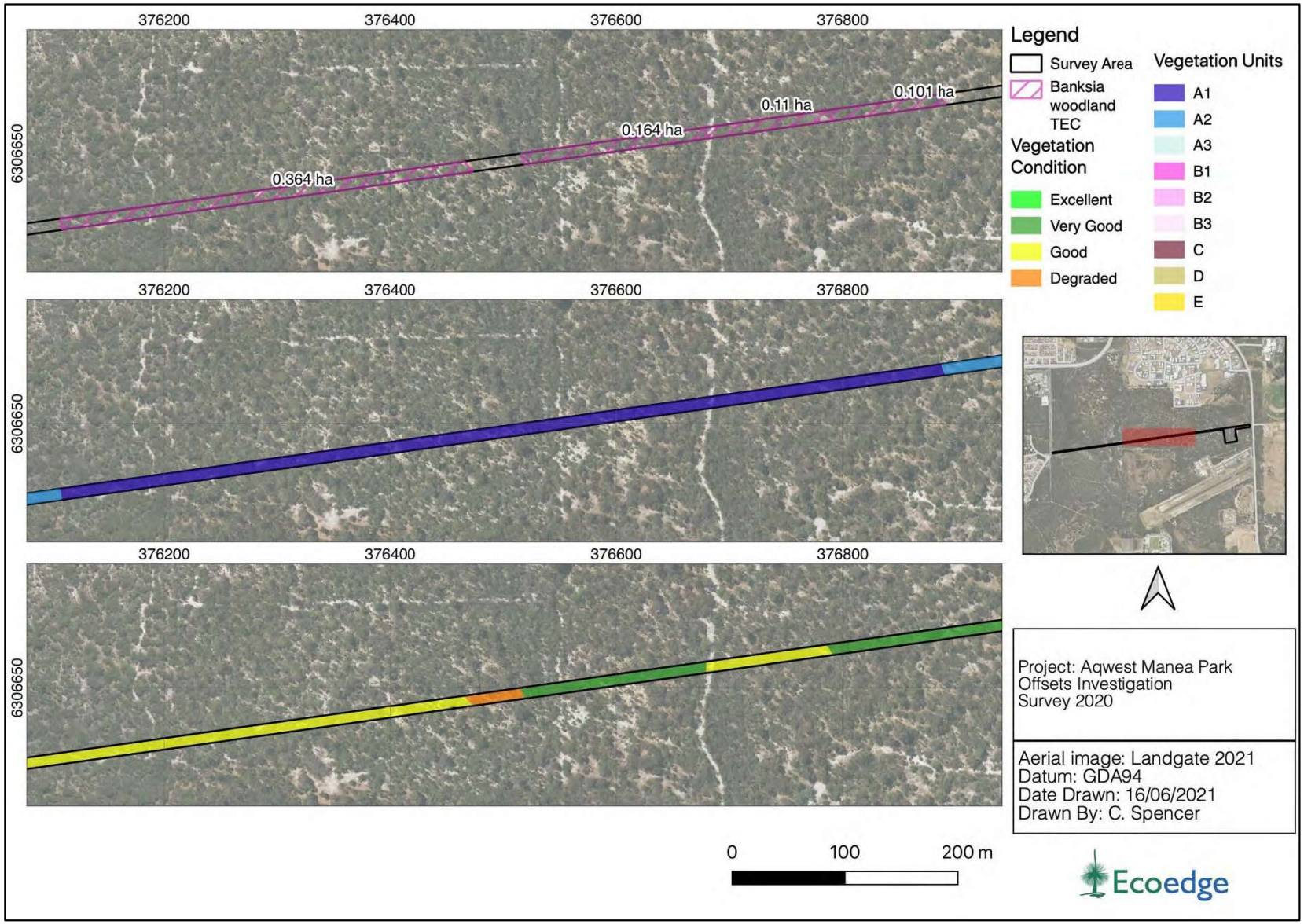


Figure 12. TEC occurrences and associated vegetation unit and vegetation condition in the survey area.

Conclusions

A reconnaissance flora and vegetation survey was conducted over approximately 5 ha of vegetation within Manea Park in part of the Kalgulup Regional Park in June 2021. Because the survey was conducted outside of the main flowering season only a partial species list could be made because many annual or annually-regenerating species were not identifiable.

No Threatened or Priority-listed flora, or flora otherwise of conservation significance were seen within the survey area.

Nine vegetation units or sub-units were recognized within the survey area. Two of the sub-units, A1 (0.90 ha) and A3 (0.11 ha) have *Banksia attenuata* and *B. ilicifolia* as co-dominant species and where they are in Good, or better, condition are inferred to belong to the Commonwealth-listed TEC "Banksia woodlands of the Swan Coastal Plain" according to the key diagnostic, condition and area thresholds of the approved conservation advice for this TEC (TSSC 2016).

None of the other vegetation units or sub-units resembled a TEC or PEC.

About 16% of the survey area was in Very Good or Excellent condition, with most of the remainder rated as Good condition. Disease caused by *P. cinnamomi*, along with past livestock grazing and current heavy grazing by kangaroos has caused degradation of much of the vegetation within the survey area.

References

Threatened Species and Scientific Committee (2016). Approved Conservation Advice (incorporating listing advice) for the *Banksia* Woodlands of the Swan Coastal Plain ecological community. Canberra.

Gibson, N., Keighery, B.J., Keighery, G.J., Burbidge, A.H. and Lyons, M.N. (1994). A floristic survey of the southern Swan Coastal Plain: report to Heritage Council of W.A. and Australian Heritage Commission. Department of Conservation and Land Management, Western Australia.

Appendix 1. Vegetation condition scale EPA (2016)

Vegetation Condition	South West and Interzone Botanical Provinces
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees and shrubs.

Appendix 2. List of vascular flora found within the survey area.

No.	Family Name	Species Name	Naturalised
1	Araceae	*Zantedeschia aethiopicum*	*
2	Anarthriaceae	*Lyginia imberbis*	
3	Apiaceae	*Platysace filiformis*	
4	Apiaceae	*Xanthosia huegelii*	
5	Apocynaceae	*Gomphocarpus fruticosus*	*
6	Araliaceae	*Erigeron bonariensis*	
7	Araliaceae	*Trachymene sp.*	
8	Asparagaceae	*Asparagus asparagoides*	*
9	Asparagaceae	*Chamaescilla corymbosa var. corymbosa*	
10	Asparagaceae	*Lomandra nigricans*	
11	Asparagaceae	*Lomandra suaveolens*	
12	Asteraceae	*Arctotheca calendula*	*
13	Asteraceae	*Asteridea pulverulenta*	
14	Asteraceae	*Cotula coronopifolia*	*
15	Asteraceae	*Craspedia variabilis*	
16	Asteraceae	*Hypochaeris glabra*	*
17	Asteraceae	*Podolepis gracilis*	
18	Asteraceae	*Sonchus oleraceus*	*
19	Asteraceae	*Ursinia anthemoides*	*
20	Asteraceae	*Vellereophyton dealbatum*	*
21	Cyperaceae	*Baumea juncea*	
22	Cyperaceae	*Cyathochaeta avenacea*	
23	Cyperaceae	*Gahnia trifida*	
24	Cyperaceae	*Isolepis cernua*	
25	Cyperaceae	*Lepidosperma longitudinale*	
26	Cyperaceae	*Lepidosperma tenue*	
27	Cyperaceae	*Schoenus sp.*	
28	Dasypogonaceae	*Dasypogon bromeliifolius*	
29	Dilleniaceae	*Hibbertia cunninghamii*	
30	Dilleniaceae	*Hibbertia hypericoides*	
31	Dilleniaceae	*Hibbertia racemosa*	
32	Dilleniaceae	*Hibbertia vaginata*	
33	Droseraceae	*Drosera erythrorhiza*	
34	Droseraceae	*Drosera pallida*	
35	Droseraceae	*Drosera sp.*	
36	Elaeocarpaceae	*Platytheca galioides*	
37	Ericaceae	*Leucopogon australis*	
38	Ericaceae	*Styphelia racemulosa*	

39	Fabaceae	*Acacia longifolia subsp. longifolia*	*
40	Fabaceae	*Acacia pulchella*	
41	Fabaceae	*Acacia saligna*	
42	Fabaceae	*Aotus gracillima*	
43	Fabaceae	*Bossiaea eriocarpa*	
44	Fabaceae	*Daviesia physodes*	
45	Fabaceae	*Hardenbergia comptoniana*	
46	Fabaceae	*Jacksonia furcellata*	
47	Fabaceae	*Jacksonia horrida*	
48	Fabaceae	*Lotus subbiflorus*	*
49	Geraniaceae	*Geranium molle*	*
50	Goodeniaceae	*Scaevola calliptera*	
51	Haemodoraceae	*Haemodorum spicatum*	
52	Haemodoraceae	*Phlebocarya ciliata*	
53	Iridaceae	*Romulea rosea var. australis*	*
54	Juncaceae	*Juncus pallidus*	
55	Lauraceae	*Cassytha racemosa*	
56	Loranthaceae	*Nuytsia floribunda*	
57	Menyanthaceae	*Liparophyllum capitatum*	
58	Myrtaceae	*Agonis flexuosa*	
59	Myrtaceae	*Astartea scoparia*	
60	Myrtaceae	*Calytrix flavescens*	
61	Myrtaceae	*Corymbia calophylla*	
62	Myrtaceae	*Eucalyptus marginata*	
63	Myrtaceae	*Eucalyptus rudis*	
64	Myrtaceae	*Eucalyptus rudis*	
65	Myrtaceae	*Hypocalymma angustifolium*	
66	Myrtaceae	*Kunzea glabrescens*	
67	Myrtaceae	*Kunzea ciliata*	
68	Myrtaceae	*Melaleuca incana subsp. incana*	
69	Myrtaceae	*Melaleuca preissiana*	
70	Myrtaceae	*Melaleuca rhaphiophylla*	
71	Myrtaceae	*Melaleuca thymoides*	
72	Myrtaceae	*Taxandria linearifolia*	
73	Orchidaceae	*Caladenia flava*	
74	Orchidaceae	*Cryptostylis ovata*	
75	Orchidaceae	*Leporella fimbriata*	
76	Orchidaceae	*Pterostylis vittata*	
77	Orchidaceae	*Pyrorchis nigricans*	
78	Oxalidaceae	*Oxalis corniculata*	*

79	Oxalidaceae	*Oxalis purpurea*	*
80	Phyllanthaceae	*Phyllanthus calycinus*	
81	Poaceae	*Anthoxanthum odoratum*	*
82	Poaceae	*Briza maxima*	*
83	Poaceae	*Deyeuxia quadriseta*	
84	Poaceae	*Ehrharta longiflora*	*
85	Proteaceae	*Banksia attenuata*	
86	Proteaceae	*Banksia grandis*	
87	Proteaceae	*Banksia ilicifolia*	
88	Proteaceae	*Banksia littoralis*	
89	Proteaceae	*Hakea prostrata*	
90	Proteaceae	*Hakea varia*	
91	Proteaceae	*Petrophile linearis*	
92	Proteaceae	*Stirlingia latifolia*	
93	Proteaceae	*Xylomelum occidentale*	
94	Restionaceae	*Desmocladus fasciculatus*	
95	Restionaceae	*Leptocarpus coangustatus*	
96	Restionaceae	*Lepyrodia glauca*	
97	Rhamnaceae	*Spyridium globulosum*	
98	Rubiaceae	*Opercularia vaginata*	
99	Rutaceae	*Boronia spathulata*	
100	Solanaceae	*Solanum nigrum*	*
101	Stylidiaceae	*Stylidium brunonianum*	
102	Stylidiaceae	*Stylidium crassifolium*	
103	Thymelaeaceae	*Pimelea sp.*	
104	Violaceae	*Hybanthus floribundus*	
105	Xanthorrhoeaceae	*Xanthorrhoea brunonis*	
106	Zamiaceae	*Macrozamia riedlei*	

Appendix 3. Vegetation description and photo.

Unit A1: *Eucalyptus marginata* and *Corymbia calophylla* woodland over *Banksia attenuata*, *B. grandis*, *B. ilicifolia*, *Xylomelum occidentale* low woodland over *Kunzea glabrescens*, tall open shrubland over *Melaleuca thymoides* open shrubland over *Calytrix flavescens*, *Hibbertia hypericoides*, *Stirlingia latifolia*, *Xanthorrhoea brunonis* low open shrubland over *Dasypogon bromeliifolius* scattered herbs on grey sand. [Relevés MP01, MP03, MP04, MP10, MP12, MP13].

Unit A2: *Corymbia calophylla* woodland over *Agonis flexuosa* low woodland over *Kunzea glabrescens* isolated tall shrubs over *Melaleuca thymoides*, *Xanthorrhoea brunonis* low open shrubland over *Dasypogon bromeliifolius*, **Hypochaeris glabra* open herbland on grey sand. [Relevé MP13].

Unit A3: *Banksia attenuata*, *B. ilicifolia*, *Agonis flexuosa* woodland over *Melaleuca thymoides* sparse shrubland over *Hibbertia hypericoides*, *Calytrix flavescens*, *Stirlingia latifolia* low open shrubland over **Hypochaeris glabra* scattered herbs on grey sand on low ridge. [Relevé MP05, MP11].

Unit B1: *Corymbia calophylla*, *Eucalyptus marginata*, *Melaleuca preissiana* tall woodland over *Taxandria linearifolia* tall open shrubland over *Xanthorrhoea brunonis* low open shrubland over *Lepidosperma tenue*, *Baumea juncea* open sedgeland on damp grey sand. [Relevé MP02].

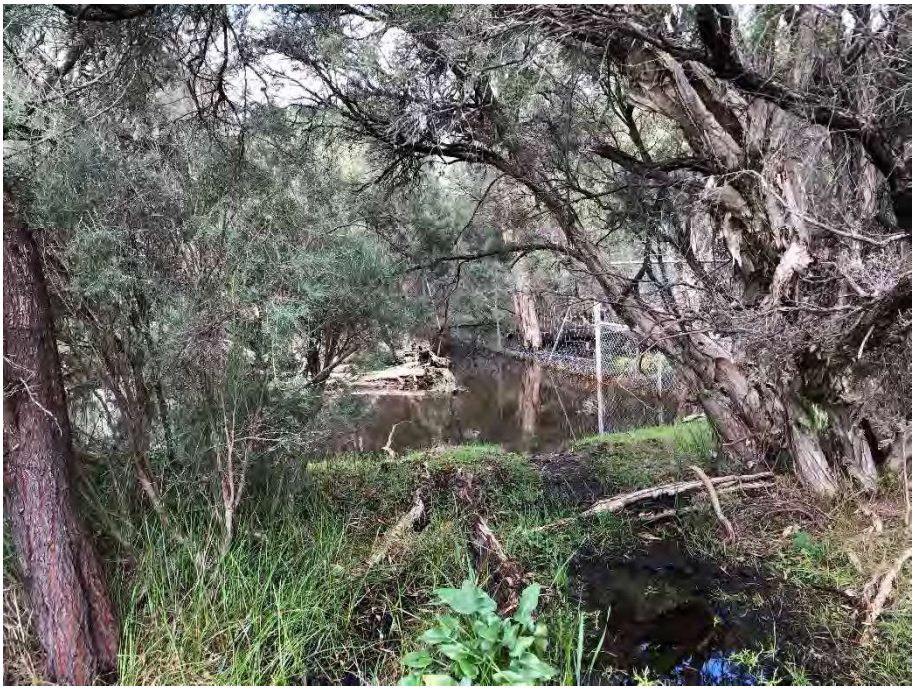
Unit B2: *Corymbia calophylla* isolated trees to open woodland over *Agonis flexuosa*, *Melaleuca preissiana*, *M. rhaphiophylla*, *Banksia littoralis* low woodland over *Kunzea glabrescens* tall open shrubland over *Xanthorrhoea brunonis* sparse low shrubland over *Dasypogon bromeliifolius*, **Hypochaeris glabra* scattered herbs on damp grey sand. [Relevés MP08, MP15]

Unit B3: *Corymbia calophylla*, *Nuytsia floribunda* woodland over *Acacia saligna*, *Jacksonia furcellata*, *Kunzea glabrescens* tall shrubland over *Xanthorrhoea brunonis* sparse low shrubland over **Arctotheca calendula*, **Ursinia anthemoides* scattered herbs on damp grey sand. [Relevés MP08, MP13].

Unit C: *Melaleuca preissiana*, *M. rhaphiophylla*, *Banksia littoralis* woodland over *M. incana* subsp. *incana* tall shrubland over *Lepidosperma longitudinale*, *Baumea juncea* sedgeland grading into *Melaleuca preissiana*, *M. rhaphiophylla* woodland over *Acacia saligna* tall shrubland over *Hakea varia* sparse shrubland over *Baumea juncea* sedgeland with *Lomandra suaveolens*, *Craspedia variabilis* sparse herbland on damp grey sand. [Relevés MP06, MP07].

Unit D: *Melaleuca rhaphiophylla*, *M. preissiana* woodland over *Baumea juncea*, *Lepyrodia glauca*, *Juncus pallidus* sedgeland with **Ehrharta longiflora* sparse tussock grassland and **Geranium molle* isolated herbs on damp grey-brown loamy sand along a creekline. [Relevé MP09].

Unit E. *Melaleuca rhaphiophylla*, *Acacia saligna* tall open shrubland over *Lepidosperma longitudinale*, *Juncus pallidus* open sedgeland with **Anthoxanthum odoratum* tussock grassland and **Lotus subbiflorus* sparse herbland on wet grey-brown clay. [Relevé MP16].



Your ref:
Our ref: 2017/005137 PRS46689
Enquiries: [redacted]
Phone: [redacted]
Email: [redacted]

[redacted]

Dear [redacted]

Addition of pipeline Reserve C36316 to R32963 within the Kalgulup Regional Park

I refer to the email of 31 August 2021 from [redacted] of [redacted] on your behalf seeking confirmation of support from the Department of Biodiversity, Conservation and Attractions (DBCA) for inclusion of the undeveloped pipeline reserve 36316 into the Kalgulup Regional Park reserve 32963 that has been identified for vesting in the Conservation and Parks Commission for management as a conservation reserve.

Addition of the pipeline reserve 36316 to the Kalgulup Regional Park proposed conservation reserve is supported by DBCA. This is consistent with the approach made to Aqwest during preparation of the Kalgulup Regional Park Management Plan about having the reserve added to DBCA-managed lands within the Regional Park.

Inclusion of the reserve would remove the likelihood that at some future time a pipeline would be installed within the reserve resulting in potentially significant impacts upon the high conservation values contained in the regional park during installation, and subsequent maintenance, repair, or replacement work.

The affected area of the regional park contains many values including threatened flora, threatened fauna, threatened ecological communities and high value wetlands, which could be impacted by water pipe installation. As the pipeline reserve bisects the middle of the park, any disturbance could also enhance risks of introductions and spread of weeds, disease and feral animals.

The anticipated process for the change of reserve vesting is outlined below.

The pipeline reserve 36316 will be included in the schedule of reserves to be amended for future vesting and management of the many land parcels making up the regional park.

AqWest should advise the Department of Planning Lands and Heritage that it chooses to give up (revoke) the management order for reserve 36316 for it to be added to adjoining reserve 32963 currently vested with the City of Bunbury and intended to be vested with the Conservation and Parks Commission in accordance with the Kalgulup Regional Park Management Plan.

[redacted]

The key contact involved in the processing of the land tenure matters is [redacted] in the DBCA Land Unit [redacted] and otherwise you may contact [redacted] if you need more information.

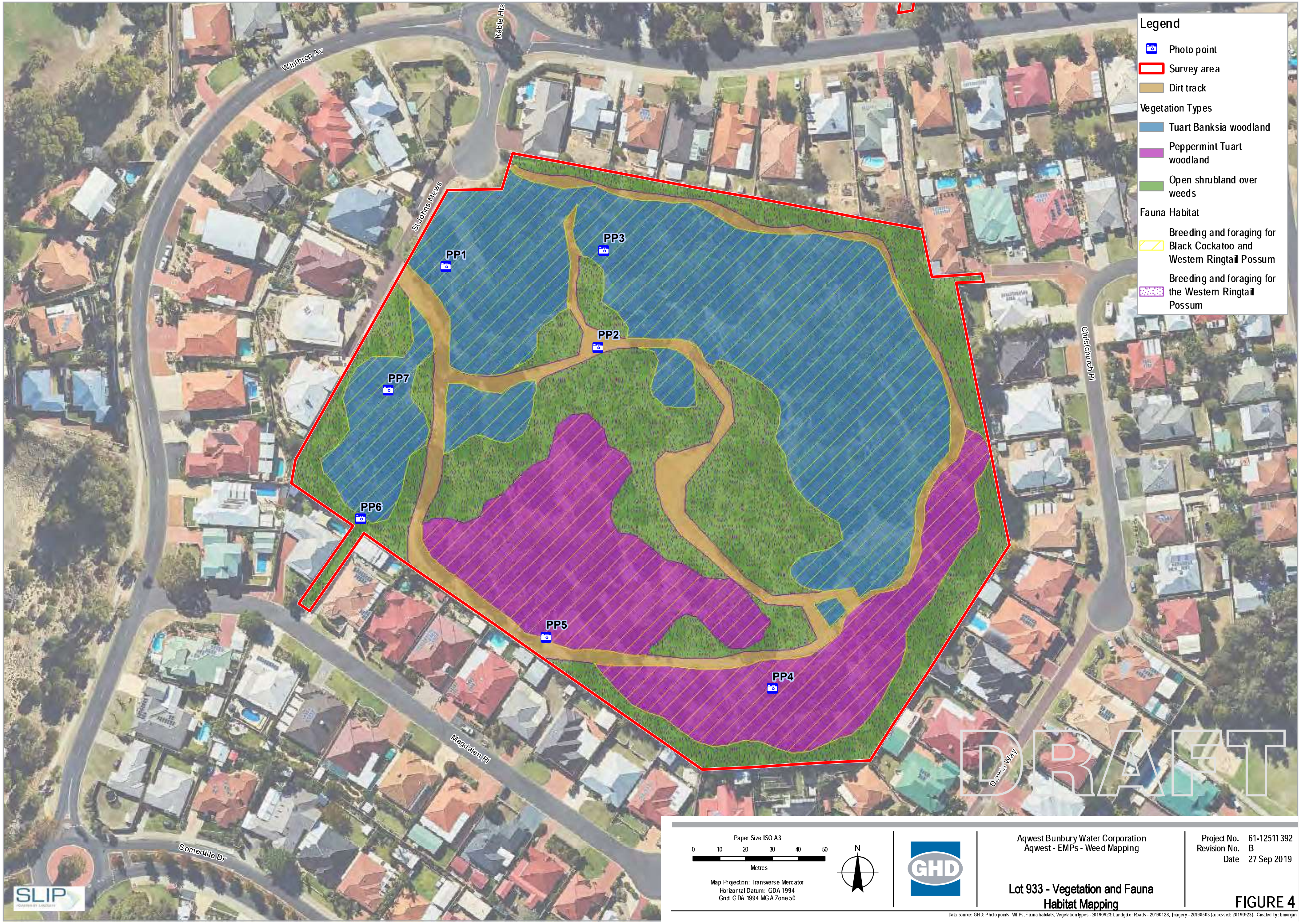
Yours sincerely

[redacted]

21 September 2021

Appendix B

Lot 933 - Vegetation and Fauna habitat mapping



Aqwest Bunbury Water Corporation
Aqwest - EMPs - Weed Mapping

Project No. 61-12511392
Revision No. B
Date 27 Sep 2019

Lot 933 - Vegetation and Fauna Habitat Mapping

FIGURE 4

Data source: GHD: Photo points, WRPs, Fauna habitats, Vegetation types - 20190923; Landgate: Roads - 20190128, Imagery - 20190503 (accessed: 20190923). Created by: bmorgan

Appendix C

WA Offset Template

WA OFFSET TEMPLATE – Aqwest: Bunbury Recycled Water Scheme: Stage 2 Pipeline

Existing environment/ Impact	Avoid and minimise	Rehabilitation Type	Likely Rehabilitation Success	Significant Residual Impact	Type	Risk	Likely offset success	Time Lag	Offset Quantification
The Proposal may result in a loss of up to: - 0.89 ha of Banksia Woodland TEC - 0.23 ha of Tuart Woodland TEC - 1.31 ha of suitable Black Cockatoo habitat - 1.31 ha of suitable Western Ringtail Possum habitat.	Initial route selection compared and selected the option with the least impact on the environment. Further alignment refinement placed the alignment along the boundary (where possible) of remnant vegetation (avoiding fragmentation), selected an alignment with an existing disturbance (along an old track), or within cleared areas such as cleared road reserve. The alignment has been designed to avoid individual trees in road reserves and uses trenchless technologies to avoid / minimise impacts to the root zone of retained trees. The Proposal will be managed through a CEMP. This will include vegetation, hygiene (weed and dieback), dewatering and fauna management.	On-site: with the exception of a single vehicle access track the pipeline alignment will be naturally regenerated by placing of topsoil (seed bank) and mulched vegetation over temporarily cleared areas. Offset Site 2 will undergo rehabilitation and weed management to improve the quality / diversity.	Proposal area: previous gas pipelines adjacent to the area have naturally regenerated and it is expected that the temporarily cleared areas will regenerate. Offset Site 2 will be actively managed, monitored and corrective actions implemented if key targets are not being met.	- 0.89 ha of Banksia Woodland TEC (0.31 ha Very Good, 0.40 ha Good and 0.18 ha Degraded to Completely Degraded) - 0.23 ha of Tuart Woodland TEC (0.19 ha Good and 0.04 ha Degraded condition) - 1.31 ha of Black Cockatoo habitat (1.09 ha high quality foraging / potential roosting and 0.22 Moderate quality foraging. Loss of 18 potential breeding trees (suitable species > 50 cm, none with hollows suitable for breeding). - 1.31 ha of suitable Western Ringtail Possum habitat (1.09 ha Core Habitat and 0.22 ha Supporting habitat)	On-ground management, revegetation and environmental offsets including Manea Park Lot 935 being converted to DBCA estate and Lot 933 undergoing rehabilitation. Offset includes: Lot 935 Manea Park: 4.84 ha of foraging habitat approximately 9 potential breeding trees Lot 933: Tuart woodland vegetation (2.9 ha) provides foraging and potential breeding habitat. This is considered to be of moderate value.	Low – Lot 935 Manea Park to be transferred to DBCA Estate. Lot 933, College Grove (whole or part of Lot) be preserved under a conservation covenant.	<u>Can the values be defined and measured?</u> Yes, the proposed offset sites have been surveyed / will be surveyed. <u>Operator experience/Evidence?</u> Aqwest will manage the land (Lot 933) and engage suitably qualified and experienced contractors. Manea Park Lot 935 will be transferred to DBCA Estate. <u>What is the type of vegetation being revegetated?</u> Revegetation within the offset site will include key species for the two TECs and habitat species for the WRP and Black Cockatoos. These will be similar to those within the Proposal area. <u>Is there evidence the environmental values can be re-created (evidence of demonstrated success)?</u> This reflects the approach for similar offset revegetation works by major infrastructure organisations such as Main Roads in the region.	Lot 935 and Lot 933 will be secured within 12 months (transfer to DBCA and conservation covenant, respectively). Revegetation within Lot 933 is proposed to be undertaken for five years to establish ecological benefits for foraging.	The DAWE offset calculator has been used to qualify environmental offsets. This demonstrates that the two proposed offset sites can meet the requirements of the Proposal.
Clay Pans of the Swan Coastal Plain TEC	Stage 2 pipeline alignment has been designed to avoid all clearing of Clay Pans TEC vegetation.	Not applicable – no rehabilitation required	Not applicable – no rehabilitation required	No residual impact	Not applicable – no rehabilitation required	Not applicable	Not applicable	Not applicable	Not applicable

Appendix D

DAWE Offset Calculators

D-1 Banksia Woodland TEC – Manea Park

D-2 Tuart Woodland TEC – Lot 933

D-3 Black Cockatoo Habitat – Manea Park

D-4 Black Cockatoo Habitat – Lot 933

D-5 Western Ringtail Possum Habitat – Manea Park

D-6 Western Ringtail Possum habitat – Lot 933

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Matter of National Environmental Significance	
Name	Banksia TEC
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	yes	0.89 ha of Banksia TEC that is 35% Very Good, 45 % Good and the remaining in Degraded / Completely Degraded condition. It forms part of the larger area of banksia community within Manea Park	**Area**	0.89	Hectares	
			Quality	7	Scale 0-10	
			Total quantum of impact	0.62	Adjusted hectares	
Threatened species habitat						
Area of habitat	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	Yes	0.62	Adjusted hectares	Manea Park Lot 935: 1.01 ha of Banksia woodlands in Good to Excellent condition that meet the criteria for the TEC. 0.46 ha lacking key species (Degraded form of the TEC). Forms part of the larger patch within Manea Park	**Risk-related time horizon (max. 20 years)**	1	**Start area (hectares)**	1.47	**Risk of loss (%) without offset**	60%	**Risk of loss (%) with offset**	10%	0.74	90%	0.66	0.65	100.52%	Yes		GHD (2021) and Ecoedge (2021)
									Future area without offset (adjusted hectares)	0.6	**Future area with offset (adjusted hectares)**	1.3				0.63				
					Time until ecological benefit	2	**Start quality (scale of 0-10)**	7	**Future quality without offset (scale of 0-10)**	6	**Future quality with offset (scale of 0-10)**	8	2.00	90%	1.80	1.76				
Threatened species habitat																				
Area of habitat	No				**Time over which loss is averted (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	0				$0.00		$0.00
Area of community	0.623	0.63	100.52%	**Yes**	$0.00	N/A	$0.00
					$0.00	**$0.00**	**$0.00**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Tuart Woodland TEC
EPBC Act status	Critically Endangered
Annual probability of extinction Based on IUCN category definitions	**6.8%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	yes	Tuart TEC	**Area**	0.23	Hectares	GHD (2021) Vegetation and Flora survey
			Quality	7	Scale 0-10	
			Total quantum of impact	0.16	Adjusted hectares	
Threatened species habitat						
Area of habitat	YeS		**Area**		Hectares	
			Quality		Scale 0-10	
			Total quantum of impact	0.00	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	Yes	0.16	Adjusted hectares	Lot 933, College Grove	**Risk-related time horizon (max. 20 years)**	1	**Start area (hectares)**	2.9	**Risk of loss (%) without offset**	30%	**Risk of loss (%) with offset**	10%	0.58	90%	0.52	0.49	327.34%	Yes		GHD (2019) and GHD site visit 2021
									Future area without offset (adjusted hectares)	2.0	**Future area with offset (adjusted hectares)**	2.6				0.53				
					Time until ecological benefit	5	**Start quality (scale of 0-10)**	5	**Future quality without offset (scale of 0-10)**	4	**Future quality with offset (scale of 0-10)**	6	2.00	80%	1.60	1.15				
Threatened species habitat																				
Area of habitat	No				**Time over which loss is averted (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	0				$0.00		$0.00
Area of community	0.161	0.53	327.34%	**Yes**	$0.00	N/A	$0.00
					$0.00	**$0.00**	**$0.00**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Matter of National Environmental Significance	
Name	Black Cockatoo Species
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes	Black Cockatoo habitat: 1.31 ha with 1.09 ha high quality foraging / potential roosting; 0.22 Moderate foraging. 18 potential breeding trees (suitable species > 50 cm, no suitable hollows).	**Area**	1.31	Hectares	Biota (2021)
			Quality	**8**	Scale 0-10	
			Total quantum of impact	1.05	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset** **Future area without offset (adjusted hectares)**	0.0	**Risk of loss (%) with offset** **Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	1.05	Adjusted hectares	Lot 935 4.84 ha: of foraging habitat (1.01 ha of high and 3.83 ha of moderate). Approximately 9 potential breeding trees (trees > 50 cm DBH) (no suitable hollows)	**Time over which loss is averted (max. 20 years)**	1	**Start area (hectares)**	4.84	**Risk of loss (%) without offset** **Future area without offset (adjusted hectares)**	60% 1.9	**Risk of loss (%) with offset** **Future area with offset (adjusted hectares)**	10% 4.4	2.42	90%	2.18	2.15	1.89	180.72%	Yes		
					Time until ecological benefit	1	**Start quality (scale of 0-10)**	**8**	**Future quality without offset (scale of 0-10)**	**7**	**Future quality with offset (scale of 0-10)**	**8**	1.00	90%	0.90	0.89				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	1.048	1.89	180.72%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**$0.00**	**$0.00**

Offsets Assessment Guide

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2 October 2012

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Matter of National Environmental Significance	
Name	Black Cockatoo Species
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	1.2%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		Area			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	YeS	Black Cockatoo habitat: 1.31 ha with 1.09 ha high quality foraging / potential roosting; 0.22 Moderate foraging. 18 potential breeding trees (suitable species > 50 cm, no suitable hollows).	Area	1.31	Hectares	Biota (2021)
			Quality	8	Scale 0-10	
			Total quantum of impact	1.05	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				Risk-related time horizon (max. 20 years)		Start area (hectares)		Risk of loss (%) without offset Future area without offset (adjusted hectares)	0.0	Risk of loss (%) with offset Future area with offset (adjusted hectares)	0.0								
					Time until ecological benefit		Start quality (scale of 0-10)		Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)									
Threatened species habitat																				
Area of habitat	Yes	1.05	Adjusted hectares	1 to 2.9 ha: GHD (2019) and recent site visit. 2.9 ha of the Tuart Woodland providing foraging habitat. It is assumed this would be moderate value. Lot 933	Time over which loss is averted (max. 20 years)	1	Start area (hectares)	2.9	Risk of loss (%) without offset Future area without offset (adjusted hectares)	60% 1.2	Risk of loss (%) with offset Future area with offset (adjusted hectares)	10% 2.6	1.45	90%	1.31	1.29	1.08	102.82%	Yes		
					Time until ecological benefit	5	Start quality (scale of 0-10)	6	Future quality without offset (scale of 0-10)	5	Future quality with offset (scale of 0-10)	7	2.00	80%	1.60	1.51				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	1.048	1.08	102.82%	Yes	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**$0.00**	**$0.00**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

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Matter of National Environmental Significance	
Name	Western Ringtail Possum
EPBC Act status	Critically Endangered
Annual probability of extinction Based on IUCN category definitions	6.8%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		Area			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes	1.31 ha with 1.09 ha Core habitat and 0.22 ha supporting habitat). Five Western Ringtail Possums were observed within the Proposed impact area	Area	1.31	Hectares	Biota 2021
			Quality	8	Scale 0-10	
			Total quantum of impact	1.05	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				Risk-related time horizon (max. 20 years)		Start area (hectares)		Risk of loss (%) without offset Future area without offset (adjusted hectares)	0.0	Risk of loss (%) with offset Future area with offset (adjusted hectares)	0.0								
					Time until ecological benefit		Start quality (scale of 0-10)		Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)									
Threatened species habitat																				
Area of habitat	Yes	1.05	Adjusted hectares	Manea Park Lot 935: 4.84 ha of Western Ringtail Possum, with core habitat (1.01 ha) and 3.84 ha of supporting habitat	Time over which loss is averted (max. 20 years)	1	Start area (hectares)	4.84	Risk of loss (%) without offset Future area without offset (adjusted hectares)	60% 1.9	Risk of loss (%) with offset Future area with offset (adjusted hectares)	10% 4.4	2.42	90%	2.18	2.04	1.59	151.78%	Yes	
					Time until ecological benefit	1	Start quality (scale of 0-10)	7	Future quality without offset (scale of 0-10)	6	Future quality with offset (scale of 0-10)	7	1.00	90%	0.90	0.84				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	1.048	1.59	151.78%	Yes	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**$0.00**	**$0.00**

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Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Matter of National Environmental Significance	
Name	Western Ringtail Possum
EPBC Act status	Critically Endangered
Annual probability of extinction Based on IUCN category definitions	6.8%

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		Area			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes	1.31 ha with 1.09 ha Core habitat and 0.22 ha supporting habitat). Five Western Ringtail Possums were observed within the Proposed impact area	Area	1.31	Hectares	Biota 2021
			Quality	8	Scale 0-10	
			Total quantum of impact	1.05	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				Risk-related time horizon (max. 20 years)		Start area (hectares)		Risk of loss (%) without offset		Risk of loss (%) with offset									
									Future area without offset (adjusted hectares)	0.0	Future area with offset (adjusted hectares)	0.0								
					Time until ecological benefit		Start quality (scale of 0-10)		Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)									
Threatened species habitat																				
Area of habitat	Yes	1.05	Adjusted hectares	Lot 933: 4.2 ha identified by GHD (2019) as potential breeding / foraging. Between 1 and 2.9 ha to be used as an offset.	Time over which loss is averted (max. 20 years)	1	Start area (hectares)	2.9	Risk of loss (%) without offset	30%	Risk of loss (%) with offset	10%	0.58	90%	0.52	0.49	50.29%	No		
									Future area without offset (adjusted hectares)	2.0	Future area with offset (adjusted hectares)	2.6				0.53				
					Time until ecological benefit	5	Start quality (scale of 0-10)	5	Future quality without offset (scale of 0-10)	4	Future quality with offset (scale of 0-10)	6	2.00	80%	1.60	1.15				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	1.048	0.53	50.29%	No	$0.00	#DIV/0!	#DIV/0!
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

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The Power of Commitment