COTERRA ENVIRONMENT

Native Vegetation Clearing Permit Application Supporting Information

Carey Baptist College – Forrestdale (Stage 4)

Revision 0 July 2023

CALIBRE | COMMITMENT | COLLABORATION

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1 Introduction

1.1 Background

Carey Baptist College operates a primary school campus at Lot 2 (540) Nicholson Road, Forrestdale. This site is approximately 24 kilometres (km) southeast of Perth, within the City of Armadale (Appendix 1). The site is zoned 'Rural' under the Metropolitan Region Scheme (MRS) and 'General Rural' under the City of Armadale's Town Planning Scheme 4 (TPS4).

Historically, the site was used for agricultural (stock grazing) purposes. Consultation commenced with the City of Armadale, Department of Planning, Department of Environment and Conservation, and other key stakeholders regarding development of a school at this site in 2011. A Masterplan for the school was prepared to outline the full development proposed for the site. A copy of the current Master Plan is provided in Appendix 1. The development footprint of the school once fully constructed will be approximately 50% of the total site area.

The Forrestdale school campus was approved for construction in 2014. Following completion of initial construction works, the first areas of the school were opened in 2016. Since this time, construction and occupation of Stages 1 to 3 have been progressed in accordance with the associated approvals.

1.2 Stage 4 Development Area

The next stage of the development (Stage 4) involves construction of a sports hall. This building is surrounded by a bushfire Asset Protection Zone (APZ) which is sized to address the 'Shelter on site' requirements. The location and extent of the sports hall and APZ are shown on Figure 2 The footprint of this area is 2.015 ha.

1.3 Existing Clearing Permits

The clearing required for Stage 1 of the campus was approved by the Department of Environmental Regulation (DER) in May 2014 (CPS 4860/1). This approval allowed for clearing of 4.26 ha subject to conditions which included:

- management of potential dieback spread and weed control
- implementation of a Revegetation Plan. Revision 1 of the Revegetation Plan, (Coterra Environment, 2014) was approved by DER, which outlined the ultimate revegetation scenario for both Stages 1 and 2 of the site)
- reporting.

The permit was amended to increase the size of the clearing area to 4.45 ha in December 2014 (CPS 4860/2).

Clearing required to facilitate the initial Stage 2 works was approved by the Department of Water and Environmental Regulation (DWER) in July 2020 (CPS 8768/1). This approval allowed for cleaning of 1.21 ha subject to conditions which included amongst other items:

- implementation of offset (revegetation and rehabilitation) works
- vegetation management through fencing
- application of a conservation covenant.

Further to the above works, DWER issued CPS 9928/1 to facilitate the clearing of 0.03 ha of native vegetation within a 0.15 ha footprint, associated with the carpark extension. Conditions associated with this permit include:

- weed and dieback management
- rehabilitation offsets
- a conservation covenant within the site
- record keeping

The following onsite offsets have been provided associated with the above clearing permit approvals:

- 5.4 ha revegetation within the eastern end of the site as part of the CPS 4860/1 approval requirements
- 1.22 ha rehabilitation of Banksia woodland as part of the CPS 8768/1 approval requirements
- 0.30 ha revegetation of Banksia woodland as part of the CPS 8768/1 approval requirements
- 0.51 ha revegetation of mesic woodland vegetation as part of the CPS 8768/1 approval requirements
- 0.073 ha revegetation of Banksia woodland as part of the CPS 9928/1 approval requirements

1.4 *Environmental Protection and Biodiversity Conservation Act 1999* Referral

The full Masterplan was referred to the Federal Department of Sustainability, Environment, Water, Population and Communities (now Department of Climate Change, Energy, the Environment and Water) under the *Environment Protection and Biodiversity Conservation Act 1999* in 2012 (EPBC Ref: 2012/6561).

Following assessment of the proposal, including the proposed onsite revegetation works, the referral decision was issued as 'Not a Controlled Action'. The decision advised is provided in Appendix 2.

1.5 Purpose of report

This environmental report has been prepared to provide supporting information to DWER on the Native Vegetation Clearing Permit (NVCP) application to clear vegetation in order to progress the Stage 4 works at 540 Nicholson Road, Forrestdale.

The report includes the following:

- Size and location of the NVCP application area
- Description of site conditions
- Description of environmental values present within the NVCP application area
- Number and nature of any nearby environmentally sensitive receptors
- Assessment against the Clearing Principles listed in Schedule 5 of the EP Act
- Measures proposed to avoid, mitigate and/or offset environmental impacts
- Description of planning and other relevant matters

2 Proposed Clearing

2.1 Schedule

Initial clearing works are proposed to begin in early 2024 and are anticipated to be completed later that year. Clearing and construction will be governed by the Development Approval issued by the City of Armadale.

2.2 Proposed Works

The proposed Stage 4 works will involve:

- Clearing of native vegetation
- Retention of mulched organic material onsite for use in landscaping and site stabilisation works
- Earthworks for creation of appropriate levels within the development footprint
- Building construction
- Service and access road installation (within the clearing footprint)
- Landscaping
- Management/revegetation of identified offset areas

2.3 Alternatives considered / Actions to Avoid and Minimise Clearing Actions

Construction within the site is limited due to the building restrictions associated with the Bunbury Dampier Natural Gas Pipeline Easement, that extends through the site.

Development has been considerate of the 50 m buffer to the Conservation Category Wetland, which borders the southwest of the site. Proposed development has targeted facilities required by the College.

3 Site Characteristics

3.1 Topography

Topography within the proposed clearing area is flat and is approximately 25 m Australian Height Datum (m AHD) (Figure 3).

3.2 Geology and Soils

The clearing area contains the following geology and soil types, as described by Jordan (1986):

- Thin Bassendean Sand over Guildford Formation (S10): 'very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted of eolian origin'
- Peaty Sands (SP1): 'greyish brown, medium-grained quartz, moderately well sorted, variable organic content, of lacustrine origin.'

The location of these units onsite is shown on Figure 3.

Soils within the majority of the proposed clearing area are mapped as having a High to Moderate Acid Sulfate Soil (ASS) risk, associated with soils mapped within the SP1 unit (Landgate, 2023). Soils in the S10 unit are mapped as being of moderate to low risk of ASS occurring at site (Figure 3).

The Department of Primary Industry and Regional Development (DPIRD) mapped soils within the proposed clearing area are shown in Plate 3-1 and described on Table 3-2.

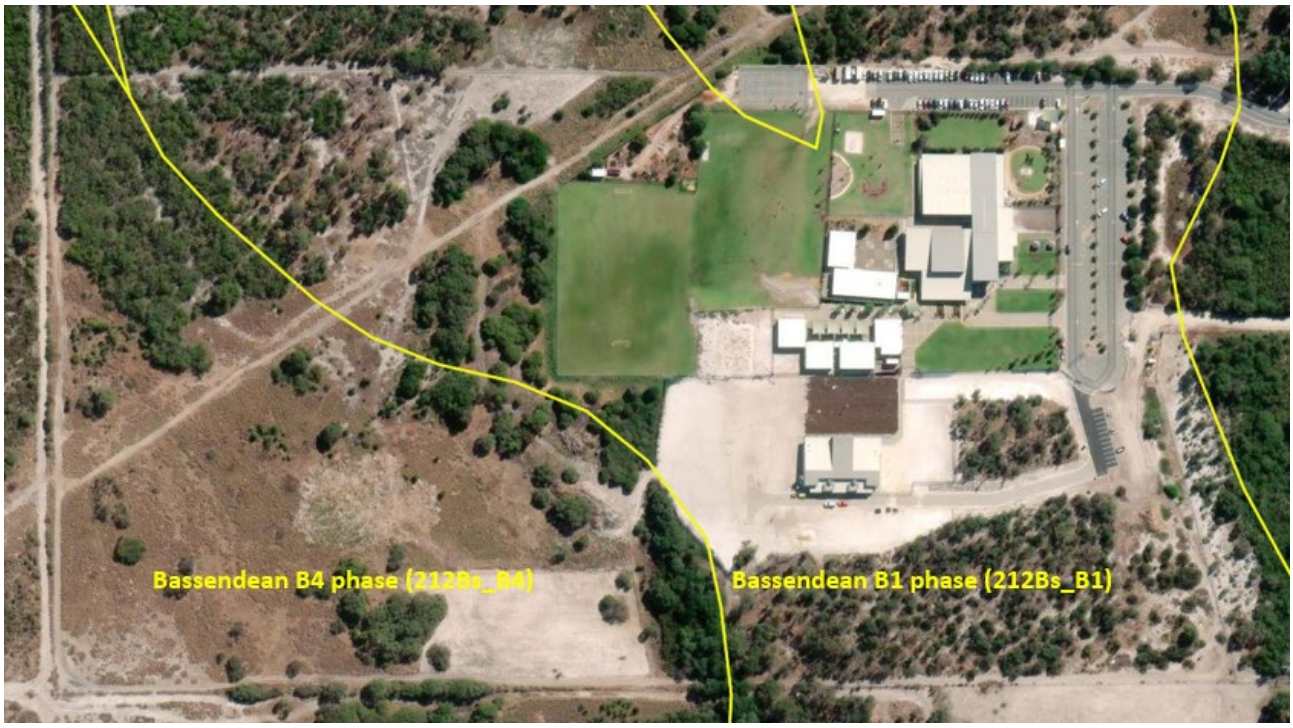


Plate 3-1: Soil Landscape Mapping units

Source: DPIRD, 2023

Table 3-2 lists the land degradation risk categories for each of the above soils.

Table 3-1: Land Systems

Mapping Units	Land System	Description
212Bs_B1	Bassendean B1 Phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant
212Bs_B4	Bassendean B4 Phase	Broad poorly drained sandplain with deep grey siliceous sands or bleached sands, underlain at depths generally greater than 1.5 m by clay or less frequently a strong iron-organic hardpan

Source: DPIRD, 2023

Table 3-2: Land degradation Risk categories

Land Degradation Risk Category	212Bs_B1	212Bs_B4
Water Erosion	0% of map unit has a very high to extreme hazard	0% of map unit has a very high to extreme hazard
Wind Erosion	52% of map unit has a high to extreme hazard	5% of map unit has a high to extreme hazard
Flood Hazard	0% of the map unit has a moderate to high hazard	0% of the map unit has a moderate to high hazard
Salinity Risk	0% of map unit has a moderate hazard	0% of map unit has a moderate hazard
Waterlogging and Inundation	10% of map unit has a moderate to very high risk	95% of map unit has a moderate to very high risk

Source: DPIRD, 2023

3.3 Hydrology

3.3.1 Groundwater

The maximum groundwater level in this location is approximately 24 to 25 mAHD (DWER, 2023), which equates to 1 to 2 m below ground level within the proposed clearing area. Minimum groundwater levels range from 21 to 22mAHD (DWER, 2023).

Groundwater flow direction is easterly toward Forrestdale Lake (located over 1 km east of the proposed clearing area).

3.3.2 Surface Water and Drainage

There are no regionally mapped surface water features and drainage lines within the development footprint.

3.3.3 Wetlands

The Department of Biodiversity, Conservation and Attractions (DBCA) geomorphic wetland dataset for the Swan Coastal Plain maps one Multiple Use Wetland (MUW) within the eastern portion of the site, including part of the proposed clearing area (Figure 4). This is described in Table 3-3. The multiple use wetland management category definition is presented in Table 3-4.

Table 3-3: Wetlands

Wetland Name	Unique Feature ID	Landform	Wetland type	Management Category	Total Area (ha)	Area within proposed clearing footprint (ha)
Unknown	7008	Basin	Dampland	MUW	7.55	1.95

Source: Landgate, 2023

Table 3-4: Multiple Use Wetland Management Category (EPA, 2008)

Management Category	General Description	Management Objective
Multiple Use	Wetlands with few remaining important attributes and functions	Use, development and management should be considered in the context of ecologically sustainable development and best management practice catchment planning through Landcare.

Source: EPA, 2008

3.4 Flora and Vegetation

3.4.1 Pre-European vegetation

Broad scale mapping of pre-European vegetation within the Perth region was undertaken by Beard (1976) which recorded major categories of plants. Shepherd et al. (2002) reassessed Beard's mapping and divided some of the larger vegetation units into smaller units, which then resulted in a total of 819 vegetation units being mapped across the state.

The site is mapped containing the following broad vegetation type (Landgate 2023):

- Bassendean_1001: Jarrah, banksia or casuarina *Eucalyptus marginata, Banksia spp., Allocasuarina* spp. Low Forest, woodland or low woodland with scattered trees

The status of this vegetation system associated at the state, regional and local level is presented in Table 3-5. The remnant native vegetation of the Bassendean 1001 complex within the City of Armadale currently stands at 33.68%, and it is not expected that the minimal clearing to be undertaken on site will alter this number significantly.

Table 3-5: Bassendean_1001 - Vegetation Statistics

Area	Pre-European extent	Current Extent	Current Extent managed in DBCA lands (proportion of Pre-European Extent)	Current Extent Protected for Conservation
Western Australia (1B)	53,283.54 ha	11,394.19 ha (21.38%)	1,790.74 ha (6.68%)	3.01%
Swan Coastal Plain (2B)	53,283.54 ha	11,394.19 ha (21.38%)	1,790.74 (6.68%)	3.01%

Area	Pre-European extent	Current Extent	Current Extent managed in DBCA lands (proportion of Pre-European Extent)	Current Extent Protected for Conservation
City of Armadale (4B)	3,332.90 ha	1.122.54 ha (33.68%)	87.41 ha (3.11%)	2.62%

Source: GoWA, 2019a

3.4.2 Vegetation Complex

Vegetation at the site is identified to be part of the Southern River vegetation complex which is described as 'Open woodland of *Corymbia calophylla- Eucalyptus marginata- Banksia* spp with fringing woodland of *E. rudis – Melaleuca rhaphiophylla* along creek beds' (Heddle et al., 1980).

Approximately 25% of the original extent of the Southern River Complex remains within the City of Armadale (Table 3-6).

Table 3-6: Southern River Vegetation Complex Remaining Extent

Area	Original Extent	Current extent	Extent remaining	Proportion of vegetation complex in LGA	Current extent protected for conservation	Current extent protected for conservation
Swan Coastal Plain	58,781 ha	10,832 ha	18.43 %	-	692 ha	6.39 %
City of Armadale	4,108 ha	1,027 ha	25.01 %	6.99 %		

Source: GoWA, 2019b

3.4.3 Local Context

Spatial data review by DWER as part of the CPS 9928/1 assessment indicates the local area (10-kilometre radius from the centre of the area proposed to be cleared) retains approximately 23.07 per cent of the original native vegetation cover (DWER, 2023).

3.4.4 Vegetation Survey (2011)

3.4.4.1 Vegetation Units

A Level 2 Flora and Vegetation Survey was completed by Bennett Environmental Consulting (2011) for the entire site in October 2011 in accordance with EPA Guidance Statement No 51 (EPA, 2004). A full copy of the report is provided in Appendix 3 and submitted to DWER through the IBSA portal with a reference number of IBSA-2023-0334.

During the survey, a total of eight different vegetation units were identified which consisted of upland and wetland vegetation (Table 3-7, Figure 5).

Table 3-7: Vegetation units

Vegetation Type	Vegetation Unit	Description
Upland Vegetation	Ba	Low Woodland A of *Banksia attenuata, Banksia menziesii, Nuytsia floribunda* and Eu*calyptus todtiana* over Heath B dominated by *Acacia pulchella* var. *glaberrima* over Tall Grass dominated by **Ehrharta calycina* in grey sand
	Bi	Low Forest A of *Banksia attenuata* and *Banksia ilicifolia* over Tall Grass dominated by **Ehrharta calycina* and **Ehrharta longiflora* in grey sand
	Et	Low Woodland A of *Eucalyptus todtiana* with occasional *Banksia ilicifolia* over Open Dense Tall Grass dominated by **Eragrostis curvula* over Herbs dominated by **Carpobrotus edulis, *Erodium botrys, *Lotus subbiflorus* and **Hypochaeris glabra* in pale grey sand
Wetland Vegetation	Mp	Open Low Woodland B of *Melaleuca preissiana* over Dense Thicket of *Kunzea glabrescens* over Open Herbs dominated by *Patersonia occidentalis* and *Drosera glanduligera* in damp dark grey sand
	Mr	Low Forest A of *Melaleuca rhaphiophylla* over Dense Herbs dominated by **Zantedeschia aethiopicum* and **Lotus subbiflorus* in very damp grey sand
	EM	Open Low Woodland A of *Eucalyptus todtiana* and *Melaleuca preissiana* over Low Scrub A or Scrub of *Kunzea glabrescens* and *Pultenaea reticulata* over Herbs dominated by **Carpobrotus edulis* and **Lotus subbiflorus* in grey sand
	Er	Low Forest A of *Eucalyptus species (possibly **Eucalyptus robusta*), *Melaleuca preissiana* and **Populus nigra* over Dense Tall Grass dominated by **Eragrostis curvula* in grey sandy loam
	Ec	Dense Tall Grass of **Eragrostis curvula*, **Paspalum urvillei,* and/or **Pennisetum clandestinum* or Tall Sedges of *Juncus pallidus* or Herbs dominated by **Lotus subbiflorus, *Moraea flaccida* and **Euphorbia terracina* in damp grey sand

Source: BEC, 2011

The vegetation units and areas present within the proposed clearing area from the 2011 survey are as follows:

- Ba –0.033 ha (1.6% of clearing footprint)
- Ec – 1.08 ha (53.5% of clearing footprint)
- Mr – 0.90 ha (44.9 % of clearing footprint)

In addition, 0.03 ha (1.5%) of the footprint did not contain any vegetation.

3.4.4.2 Vegetation Condition

According to the Keighery scale of vegetation condition, remnant vegetation within Lot 2 varied from 'Very Good – Good' to 'Completely Degraded', with over half of the site (12.5ha, 56%) being 'Degraded to Completely Degraded' (Figure 6).

The Ec vegetation unit within the proposed clearing area is generally mapped as 'Degraded-Completely Degraded' and 'Completely Degraded' condition, the Ba unit is mapped as 'Very Good-Good' condition, and the Mr unit is mapped as 'Good' and 'Degraded-Completely Degraded' condition (Bennett, 2011). The condition category extents within the proposed clearing footprint are as follows:

- Very Good-Good – 0.33 ha (1.64% of clearing footprint)
- Good – 0.67 ha (33.2% of clearing footprint)
- Degraded-Completely Degraded- 1.21 ha (60.2% of clearing footprint)
- Completely Degraded – 0.1 ha (4.96% of clearing footprint)

As noted above, 0.03 ha (1.5%) of the footprint did not contain any vegetation.

3.4.4.3 Declared Rare and Priority Flora

No Declared Rare Flora species were found at the site (BEC, 2011).

One Priority 2 flora annual sedge species *Schoenus pennisetis* was identified at one site in the north western corner (CS01) of the site. *Jacksonia gracillima* a Priority 3 Flora is a shrub was also identified at two locations on site (Figure 5) (BEC, 2011). These priority flora species are not located within the proposed clearing area.

3.4.5 Updated Banksia Extent and Condition Survey (2021)

In March 2021, Focused Vision Consulting (FVC) undertook an assessment of a targeted area of Banksia woodland vegetation within the site associated to update the condition mapping and identify if this was likely to represent the Banksia Woodland of the Swan Coastal Plain Priority Ecological Community (PEC).This survey did not encompass the area proposed to be cleared under this application but does include the connected Banksia Woodland area to the east. This survey has previously been submitted to DWER as part of the CPS 9928/1 permit assessment with an IBSA reference number of IBSA-2022-0355.

This survey identified that the condition of the banksia woodland patch to the east of the site was predominately in degraded condition (FVC, 2021).

3.4.6 Dieback

In September 2014, NPC Consulting undertook a Dieback Assessment for the site which included:

- Site inspection to undertake dieback assessment
- Collection of 3 samples for soil and root testing of dieback
- Preparation of an interpretation map
- Preparation of a report outlining the findings of the assessment (Appendix 5)

Two out of three sample results returned positive, confirming field investigations which indicated that *Phytophthora cinnamomi* is present in the remnant Banksia Woodland area situated in the centre of the site.

NPC Consulting (2014) discussed that there was a poor to average expression of the disease observed and grasses and weeds were present throughout the site. The impact of the disease was considered variable with significant changes in biomass and biodiversity and the greater presence of non-susceptible species particularly within the resource enhancement wetland (REW) area on the eastern site boundary and areas with little or no vegetation (i.e. paddocks/cleared areas).

3.4.7 Weeds

A total of 66 weed species were recorded onsite during the Level 2 flora and vegetation survey (Bennett Environmental Consulting, 2011). The weed species found onsite in areas relevant to this clearing proposal and their rating for ecological impacts, impact attributes and invasiveness are shown detailed in Appendix 4.

The common weeds, which were identified as those occurring at a coverage of 5% within survey quadrats from the Mr and Ec units are as follows (BEC, 2011):

- *Carpobrotus edulis*
- *Cyperus tenellus*
- *Eragrostis curvula*
- *Isolepis marginata*
- *Juncus bufonius*
- *Lotus subbiflorus*
- *Moraea flaccida*
- *Romulea rosea*
- *Vulpia bromoides*
- *Zantedeschia aethiopicum*

3.5 Fauna and Habitat

3.5.1 Fauna habitat

A fauna survey was undertaken on 10 August 2012 by Coterra Environment. The survey identified several waterbird and bushland bird species utilising and / or occurring within the site, though no conservation significant species were identified. Mammals identified at the site included the western grey kangaroo (*Macropus fuliginosus*) and the European rabbit (*Oryctolagus cuniculus*), which appears to have colonised many of the drier areas of the site. One reptile, a tiger snake (*Notechis ater*), was identified during the site visit.

3.5.2 Black Cockatoo Habitat Assessment

A black cockatoo habitat assessment was undertaken as part of the fauna survey. Results are summarised as follows:

- The Level 2 Flora and Vegetation Survey (BEC, 2011), identified four vegetation types (Ba, Bi, Et, EM) within the site containing plant species that provide potential black cockatoo foraging habitat
- Two black cockatoo species were identified through database searches as potentially occurring within the site, or having been previously recorded in the vicinity:
  - Carnaby's Black Cockatoo (*Zanda latirostris*)
  - Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*)
- No potential breeding habitat trees were found within the site
- No potential roosting habitat trees were found within the site (no trees were considered sufficiently tall or structurally complex enough to provide core roosting habitat)
- Three types of foraging habitat were identified within the site as follows
  - Good quality *Eucalyptus todtiana* foraging habitat
  - Good quality *Banksia sp*. foraging habitat
  - Poor quality *Banksia sp*. foraging habitat
- A thorough search was undertaken for cockatoo feeding signs, though there was no evidence of cockatoos utilising the area for feeding across the entire site

No signs of black cockatoos were noted during the field survey.

3.6 Conservation Areas

Bush Forever (BF) Site 344 'Denis de young Reserve and Gibbs Road Swamp Bushland, Banjup/Forrestdale' is located to the immediate west and south of the site. This BF site extends over 289.8 ha.

The site also contains a number of conservation areas as noted in Section 1.3 as follows:

- 5.4 ha revegetation within the eastern end of the site as part of the CPS 4860/1 approval requirements
- 1.22 ha rehabilitation of Banksia woodland as part of the CPS 8768/1 approval requirements
- 0.30 ha revegetation of Banksia woodland as part of the CPS 8768/1 approval requirements
- 0.51 ha revegetation of mesic woodland vegetation as part of the CPS 8768/1 approval requirements
- 0.073 ha revegetation of Banksia woodland as part of the CPS 9928/1 approval requirements

The site is located within the Perth Regional Ecological Linkage (nr 52) mapped by WA Local Government Association's (WALGA) biodiversity project (DWER, 2023).

The site and surrounds are mapped within an Environmentally Sensitive Area (ESA) (ID 1900) associated with surrounding wetlands (DWER, 2023).

3.7 Heritage

3.7.1 Indigenous heritage

A search of the Aboriginal Cultural Heritage (ACH) Enquiry System on 3 July 2023 Identifies that the site does not contain any sites listed under the following databases (DPLH, 2023):

- ACH Directory
- ACH Pending
- ACH Holistic

A search of the survey register identified that the site falls within the boundaries of 7 regional scale surveys (DPLH, 2023)

The closest Aboriginal Heritage Place is located adjacent to Forestdale Lake and is a lodged heritage value associated with Artefacts/Scatter (ID #4149) (Landgate, 2023). Forrestdale Lake is also of significance as a Hunting Place, Camp or of Mythological value (Registered Site #3713). Neither of these places will impinge on the development.

3.7.2 Non-indigenous heritage

A search of the Heritage Council InHerit database (State Heritage Council, 2023) and the City of Armadale's Heritage List (CoA, 2023) indicates the closest European heritage value to the site is Forrestdale Lake, over 1 km from the site.

4 Assessment Against Clearing Principles

An assessment of the proposed vegetation clearing against the ten native vegetation Clearing Principles contained in Schedule 5 of the EP Act is provided in Sections 4.1 to 4.10. Based on the assessment of the environmental value so the clearing area, it is deemed that the development is unlikely to be at variance with one of the ten Clearing Principles. However, the development could be considered potentially at variance for *Principle (f).*

4.1 Comprises high level of biological diversity

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

The botanical assessment conducted by Bennett Environmental Consulting (2011) over Lot 2, including the application area recorded a total of 148 plant taxa including 82 native species and 66 introduced species within the survey area.

During the botanical assessment no threatened or priority flora species were found within the proposed clearing extent. *Schoenus pennisetis* (Priority 2) and *Jacksonia gracillima* (Priority 3) flora species were found within Lot 2, however this is outside the boundary of the application area.

Proposed clearing incorporates approximately 0.02 ha of Banksia Woodland upland vegetation (Ba) (Figure 5) originally mapped in 'Good-Very-Good' condition (Figure 6) (BEC, 2011). More recent mapping of this banksia patch to the east of the proposed clearing extent indicates that the condition of the patch was mostly 'Degraded'.

The remaining portion of the proposed clearing area contains two vegetation units Melaleuca Forest (Mr) (0.90 ha) and Dense Tall Grass (Ec) (1.06 ha) (Figure 5) in 'Good', 'Degraded-Completely Degraded' and 'Completely Degraded' condition (BEC, 2011) (Figure 6).

The Banksia Woodland vegetation within the Ba unit, has previously been confirmed to have dieback present (NPC, 2014), which may contribute to a reduction in condition and values of this area over time (Appendix 5).

Given the above, the proposed clearing is not considered to be at variance with this principle.

4.2 Potential impact to any significant habitat

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

A portion of the application area (approximately 0.033 ha associated with the Ba vegetation unit) has been identified to provide potential foraging habitat opportunities for black cockatoos.

The project was referred to the Federal government under the Environment Protection and Biodiversity Conservation Act 1999 in 2012, who deemed the referral to be 'Not a Controlled Action' (EPBC Ref: 2012/6561).

Given the above, the proposed clearing may be at variance with this principle.

In order to address the potential minor loss of black cockatoo foraging habitat, revegetation onsite of a further 0.08 ha is proposed to offset clearing of the application area. This will enhance the condition and fauna habitat opportunities presented by the remaining revegetation onsite.

4.3 Potential impacts to any rare flora

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

No flora species listed as Threatened flora under the *Biodiversity Conservation Act 2016* (BC Act) were recorded on Site.

The proposed clearing is not considered to be at variance with this Principle.

4.4 Presence of any threatened ecological communities

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

The Ba unit vegetation has the potential to represent the Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community (TEC) as listed under the Federal *Environment Protection and Biodiversity Conservation Act 1999*. The Banksia Woodlands of the Swan Coastal Plain ecological community is also listed as a Priority 3(iii) ecological community under the Western Australian BC Act. Priority 3(iii) communities are defined as (DBCA, 2023):

> ***P3 Priority 3: Poorly known ecological communities – inadequately surveyed or not well defined***
>
> *Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them. This category includes three sub-categories:*
>
> *(iii) Communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, inappropriate fire regimes, clearing, hydrological change, etc*

Based on the 2021 vegetation survey of the adjoining banksia patch, the Ba unit vegetation within the clearing area is likely to be lower than assessed in 2011 and may fall below the TEC minimum patch size thresholds of:

- 1 ha for 'Very Good' condition patches
- 2 ha for 'Good' condition patches
- Patches below 'Good' condition do not form part of this TEC

Given the above, the proposed clearing may be at variance with this principle, but it is noted that based on small extent of clearing proposed and the degraded nature of adjoining areas of Banksia vegetation, the proposed clearing appears unlikely to have a significant impact on the occurrence of the Banksia Woodland TEC in the local area.

4.5 Significance of remnant native vegetation

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

DBCA 2018 vegetation complex statistics indicate that approximately 25% of the Southern River vegetation complex is remaining within the City of Armadale and approximately 18% is remaining within the Swan Coastal Plain (Government of Western Australia, 2019).

The application area is classified as a constrained area on the Swan Coastal Plain, where the threshold for representation of the pre-clearing of native vegetation is 10%. The proposed clearing will not reduce the extent below this target.

The City of Armadale Local Biodiversity Strategy states that 76% of the original extent of remnant vegetation remains with the City of Armadale (CoA, 2009). As such, the vegetation onsite would not be considered an isolated remnant.

Given the above, the proposed clearing is not considered to be at variance with this principle.

4.6 Potential impact on watercourses and/or wetlands

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

No watercourses are present within or adjacent to the site.

A Multiple Use Wetland (MUW) (UFI 7008) is located within the proposed clearing area (1.950 ha). The EPA advised that MUW areas are generally considered suitable for use and development in the context of ecologically sustainable development and best management practice catchment planning through land care (EPA, 2008). Other areas of this MUW are proposed for revegetation as part of this clearing application, which will enhance both the condition of this MUW, and also strengthen the buffer to the wetlands south and west of the site (UFI 14835).

Two conservation category wetlands (CCW) (UFI 15304 and UFI 14835) are located to the south and west of the proposed clearing area, external to the site. A minimum buffer of 50 m between school facilities and these CCWs has been provided along the site boundary. Portions of the boundary are also included in the onsite revegetation programs associated with the previous clearing permits, which assists to sustain the long-term viability of this wetland area.

Given the above, the proposed clearing may be at variance with this principle, but revegetation of wetland areas onsite and provision of buffers to adjacent CCW is likely to result in the proposed clearing being unlikely to have a significant impact on wetlands in the local area.

4.7 Potential to cause appreciable land degradation

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

As noted in in Table 3-2 wind erosion and waterlogging are identified as having the highest land degradation risks associated with the soil types onsite.

Following clearing, soils onsite will be stabilised through construction of buildings, landscaping and sporting ovals. It is also proposed to use mulched organic material created onsite in the future landscape areas which will assist in soil erosion control and stabilisation.

Waterlogging risk will be managed through onsite drainage actions and management of wetland areas as part of vegetation management and revegetation works.

Given the above, the proposed clearing is not considered to be at variance with this principle.

4.8 Potential impact on adjacent or nearby conservation areas

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

Lot 2 lies to the immediate east of the Bush Forever Site 344 'Denis de Young Reserve and Gibbs Road Swamp Bushland, Banjup/Forrestdale' which is within the Jandakot Regional Park (Government of Western Australia, 2000). The Concept Plan design provides for the campus facilities to remain at least 50 m away from the site's boundary to provide a buffer to the Bush Forever sites. No clearing is proposed within the 50 m buffer. It is also proposed to provide some revegetation planting within this zone to enhance the buffer values.

Given the above, the proposed clearing is not considered to be at variance with this principle.

4.9 Potential deterioration in the quality of surface or underground water

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

No *Rights in Water and Irrigation Act 1914* (RIWI Act) rivers, surface water areas or irrigation districts occur within the vicinity of the proposed clearing area. The site is located in the Jandakot Groundwater Area but is not located within any Public Drinking Water Source Areas (Government of Western Australia, 2021).

A MUW Dampland is mapped within the proposed clearing area (Landgate, 2023).

Stormwater and drainage management forms a part of the development design and construction. The site is also connected to the Water Corporation reticulated sewer network.

Given there is no significant surface water flow from the proposed application area, the proposed clearing is unlikely to impacts surface water.

Given the size of the proposed clearing, the distance to CCW and Resource Enhancement wetland areas and unlikely impacts to groundwater the proposed clearing is not likely to cause deterioration in the quality of surface or underground water.

Given the above, the proposed clearing is not considered to be at variance with this principle.

4.10 Potential for clearing to cause or exacerbate the incidence of flooding

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

The site is predominantly Thin Bassendean Sand (S10) which is characterised as white to pale grey at the surface, yellow at depth, fine to medium-grained, moderately sorted, sub-angular to sub-rounded, minor heavy minerals of eolian origin, relatively thin veneer over strong, blocky, brown silts and (Jordan, 1986). The remainder of the site is mapped as Peaty Sands (SP1), described as 'greyish brown, medium-grained quartz, moderately well sorted, variable organic content, of lacustrine origin' (Figure 3).

The soils onsite comprise B1 and B4 Bassendean phases. The B4 phase has a higher risk of waterlogging, therefore has the potential for short-term waterlogging. This can be managed through appropriate design, and the proposed clearing is not likely to cause, or exacerbate, the incidence or intensity of flooding.

Given the above, the proposed clearing is not considered to be at variance with this principle.

5 Revegetation Plan Summary

The Revegetation Plan has been designed on the basis of previous plans prepared for other stages in the Carey Baptist College development. A summary of revegetation methodology is detailed below, with the entire Revegetation Plan attached as Appendix 6.

5.1 Revegetation Areas

Revegetation areas comprise wetland management areas and mesic vegetation areas.

5.1.1 Clearing

Clearing will comprise of 0.033 ha of Banksia Woodland (Ba vegetation unit) and 1.98 ha of vegetation (Mr and Ec vegetation units) associated with wetland/mesic vegetation areas on site (Table 5-1).

Table 5-1: Extent of clearing

Vegetation type	Vegetation unit	Clearing extents
Dryland vegetation	Banksia Woodland (Ba vegetation unit)	Area: 0.033 ha Existing condition: 'Good-Very-Good' (BEC, 2011)
Wetland/Mesic vegetation	Melaleuca Woodland (Mr vegetation unit)	Area: 0.904 ha Existing condition: 'Good' and 'Completely Degraded-Degraded' (BEC, 2011)
	Dense Tall Grass dominated by weed species (Ec vegetation unit)	Area: 1.08 ha Existing condition: 'Completely Degraded-Degraded' and 'Completely Degraded' (BEC, 2011)

5.1.2 Proposed Revegetation Extent

5.1.2.1 Clearing of Mr and Ec vegetation units

The clearing of 1.98 ha of wetland/mesic vegetation (Mr and Ec vegetation units) will be compensated through the undertaking of wetland management including weed control activities within 1.25 ha of retained wetland areas onsite. This is consistent with the approach approved for previous clearing permits for the site (e.g. CPS 8768/1).

5.1.2.2 Clearing of Ba vegetation unit

The DWER Environmental Offset Calculator has been used to identify the offset areas for the clearing of 0.033 ha of Ba vegetation to address potential loss of habitat for black cockatoos, including Carnaby's Black Cockatoo. Based on the calculator the revegetation area required to address the Ba vegetation unit offset requirements is 0.08 ha (Table 5-2).

It is proposed to undertake revegetation works incorporating key foraging species for Carnaby's Black Cockatoos, within mesic vegetation areas as shown in Figure 7.

Table 5-2: Offset calculation results

Revegetation Area (ha)	Percentage contribution to offset requirements	Description
0.08 ha	100%	Revegetation and protection of completely degraded landscape from condition 1 (Completely Degraded to Degraded) to condition 5 (Good to Very Good). The revegetation planting will include species which provide Carnaby's Black Cockatoo foraging opportunities.

A copy of the offset calculator identifying the parameters used to provide the revegetation area sizing is presented in Appendix 7.

The location of the proposed onsite revegetation area is shown on Figure 7.

5.1.3 Suitability to address Clearing Impacts

The clearing proposal will result in removal of 0.033 ha of 'Good' to 'Very Good;' condition Banksia woodland which may provide foraging opportunities for black cockatoos. The revegetation proposed will create/protect 0.08 ha of additional good to very good quality vegetation including species which provide both foraging and roosting opportunities.

Based on the banksia cover within the onsite Ba vegetation unit (15%) this would equate to a potential habitat extent of 0.0049 ha (i.e. 15% of 0.033 ha) which is to be removed. In order to ensure no net loss of potential habitat the revegetation area would need to ensure a minimum of 0.0049 ha cover for potential foraging species which equates to approximately 6% cover within this area (i.e. 0.0049 ha out of 0.08 ha).

It is proposed to increase the cover to 10% (0.008 ha) of black cockatoo foraging species within the revegetation area rather than just replacing what will be removed. In addition, the species proposed will also provide roosting opportunities once mature which the Banksia woodland does not currently provide.

5.2 Revegetation Methodology

Similar to approved revegetation plans for previous stages of the Carey Baptist College development, the following methodology summarises works to be undertaken for the Stage 4 development.

The full Revegetation Plan is provided in Appendix 6.

5.2.1 Access Management

Targeted fencing will be installed to prevent unauthorised or inadvertent access.

5.2.2 Weed Control

Weeds are prevalent across much of the degraded areas of the site (Appendix 3). African Lovegrass (**Eragrostis curvula*) is one of the main weeds present within the revegetation areas.

Targeted weed control will be undertaken within the rehabilitation areas via spot-spraying with a grass selective herbicide such as fusillade, or other method as suitable to the target species identified at the site (Appendix 6).

5.2.3 Species Selection and Sourcing

Revegetation species will include a selection of species that occur naturally on site and/or species that provide use for Carnaby's Black Cockatoo (Appendix 6).

5.2.4 Plant Densities and Establishment

Planting will be undertaken using tubestock at a rate of 1 to 2 stems/m^2. Planting is proposed to commence in the winter/spring 2025 planting season which will allow for stock to be order prior to September in the preceding year (Appendix 6).

5.3 Retained Wetland Management

Weed control is proposed within the identified Mp and Mr vegetation units onsite as shown on Figure 7. The weed control will be undertaken for three years which is the same duration as the revegetation works management proposed in this plan.

5.4 Performance Targets

The program will achieve a 'Good-Very Good' (DWER Level 5) condition level within the rehabilitation areas.

Quantitative completion criteria developed for Stage 4 as outlined within Appendix 6 are consistent with performance targets approved for revegetation areas in other parts of the site.

Achievement of these performance targets will result in:

- Creation/protection of a further 0.08 ha of onsite native vegetation.
- Improvement in condition and therefore ecological value of the rehabilitation sites from 'Completely Degraded to Degraded' to 'Good to Very Good'.
- Increase in the extent of Carnaby's Cockatoo habitat currently in the clearing and rehabilitation areas from approximately 0.0033 ha to approximately 0.008 ha (increase by 55%).

Further details in relation to performance targets are provided in Appendix 6.

5.5 Monitoring and Reporting

Assessments into weed control and planting success will be undertaken for three years in spring, summer and autumn after planting (Appendix 6).

Monitoring methodology will utilise establishment of permanent monitoring quadrats (5 m x 5 m) within each revegetation state, as well as establishment of photo point monitoring locations.

Monitoring locations will be selected to best reflect the works areas.

A monitoring report will be produced annually and submitted to DWER by 30 June, which outlines the findings of the Revegetation Plan. Each report will cover the previous 1 June to 31 May period.

5.6 Contingency Actions

Should performance targets not be met in revegetation works areas, further works may be implemented, including:

- additional revegetation works to increase plant densities and species representation
- further weed management
- rubbish removal
- fauna control
- continuing/maintaining plant protection measures (e.g. tree guards) and removing when no longer required.

Performance targets would then be re-checked for these areas in next annual monitoring event.

5.7 Implementation

5.7.1 Actions and Timing

Works on site will commence in the 12 months following commencement of clearing (Table 5-3)

Table 5-3: Implementation Schedule

Issue	Action	Timing
Fencing	Install targeted fencing to prevent inadvertent damage to the revegetation areas.	Prior to planting.
	Inspect fencing and repair as needed	As required.
Site preparation	Pre-planting weed control within the revegetation area	Autumn 2025
Weed Control	Undertake targeted weed control in the revegetation and rehabilitation areas	Spring 2025 Autumn and Spring 2026 Autumn and Spring 2027 Autumn 2028
	Undertake weed control within the Mp vegetation unit	
Planting	Install additional planting via direct seeding or tubestock installation within the revegetation zone to meet the plant density target.	Autumn to Spring 2025
Monitoring and Reporting	Advise DWER and CoA of specific monitoring locations	First annual report
	Undertake monitoring of weed presence and planting success until three years post planting.	Spring 2025 Autumn and Spring 2026 Autumn and Spring 2027 Autumn 2028
	Annual summary report to be provided to DWER and CoA. The annual report is to cover the previous 1 June to 31 May period.	Annually by 30th June in the following years: • 2026 • 2027 • 2028
Contingency Actions	Assess need for remedial actions annually. Implement if required.	As required.

6 References

Bennett Environmental Consulting (2011). *Botanical Assessment of Lot 2 Nicholson Road, Forrestdale*. Unpublished report prepared for Coterra Environment, Perth, Western Australia.

Coterra Environment (2012). *Cockatoo Habitat Assessment – Lot 2 Nicholson Road, Forrestdale.* Unpublished report prepared for Carey Baptist College, Perth, Western Australia.

Coterra Environment (2014). *Stage 1 Revegetation Plan – Lot 2 Nicholson Road, Forrestdale (Revision 1)*. Unpublished report prepared for Carey Baptist College, Perth, Western Australia.

Coterra Environment (2019). *Native Vegetation Clearing Permit Application Supporting Information – Carey Baptist College, Forrestdale (Stage 2).* Unpublished report prepared for Carey Baptist College, Perth, Western Australia [in support of CPS 8768/1].

Coterra Environment (2020). *Revegetation Plan Addendum (Stage 2) – Carey Baptist College, Forrestdale (Revision 2)*. Unpublished report prepared for Carey Baptist College, Perth, Western Australia.

Department of Biodiversity, Conservation and Attractions (2023). *Threatened Ecological Communities.* Government of Western Australia, Perth, Western Australia. Available at: https://www.dbca.wa.gov.au/wildlife-and-ecosystems/threatened-ecological-communities

Department of Biodiversity, Conservation and Attractions (2019). *2018 South West Vegetation Complex Statistics Report*, Government of Western Australia, Perth, Western Australia.

Department of Primary Industries and Regional Development (2023). Natural Resource Information (NRM). [Online]. Available at https://dpird.maps.arcgis.com/apps/webappviewer/index.html?id=662e8cbf2def492381fc915aaf3c6a0f

Department of Water and Environmental Regulation (2023). Perth Groundwater Map. [Online]. Available at: https://maps.water.wa.gov.au/Groundwater/. Government of Western Australia, Perth, Western Australia.

Environmental Protection Authority (2004). *Guidance Statement No. 51: Guidance for the Assessment of Environmental Factors – Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia.* Government of Western Australia, Perth, Western Australia.

Environmental Protection Authority (2008). *Guidance Statement No. 33: Environmental Guidance for Planning and Development.* Government of Western Australia, Perth, Western Australia.

Environmental Protection Authority (2016). *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*. Government of Western Australia, Perth, Western Australia.

Focused Vision Consulting (2021). *Memorandum – Lot 2 Nicholson Road, Forrestdale: Banksia Woodland condition and extent*. Unpublished memorandum prepared for Coterra Environment, Perth, Western Australia.

Government of Western Australia (2000). *Bush Forever: Keeping the Bush in the City volume 2 'Directory of Bush Forever Sites'*, Government of Western Australia (Department of Environmental Protection), Perth, Western Australia.

Government of Western Australia (2019). *2018 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report). Current as of March 209.* Government of Western Australia (Department of Biodiversity, Conservation and Attractions), Perth, Western Australia. https://catalogue.data.wa.gov.au/dataset/dbca-statewide-vegetation-statistics

Government of Western Australia (2021). 'RIWI Act, Groundwater Areas' In: *Shared Land Information Platform: Locate V5*. Government of Western Australia, Perth, Western Australia. Available at: https://maps.slip.wa.gov.au/landgate/locate/.

Heddle E.M., Loneragan O.W. and Havel J.J. (1980). Vegetation of the Darling System. In: DCE 1980 *Atlas of Natural Resources, Darling System, Western Australia*. Department of Conservation and Environment, Perth, Western Australia.

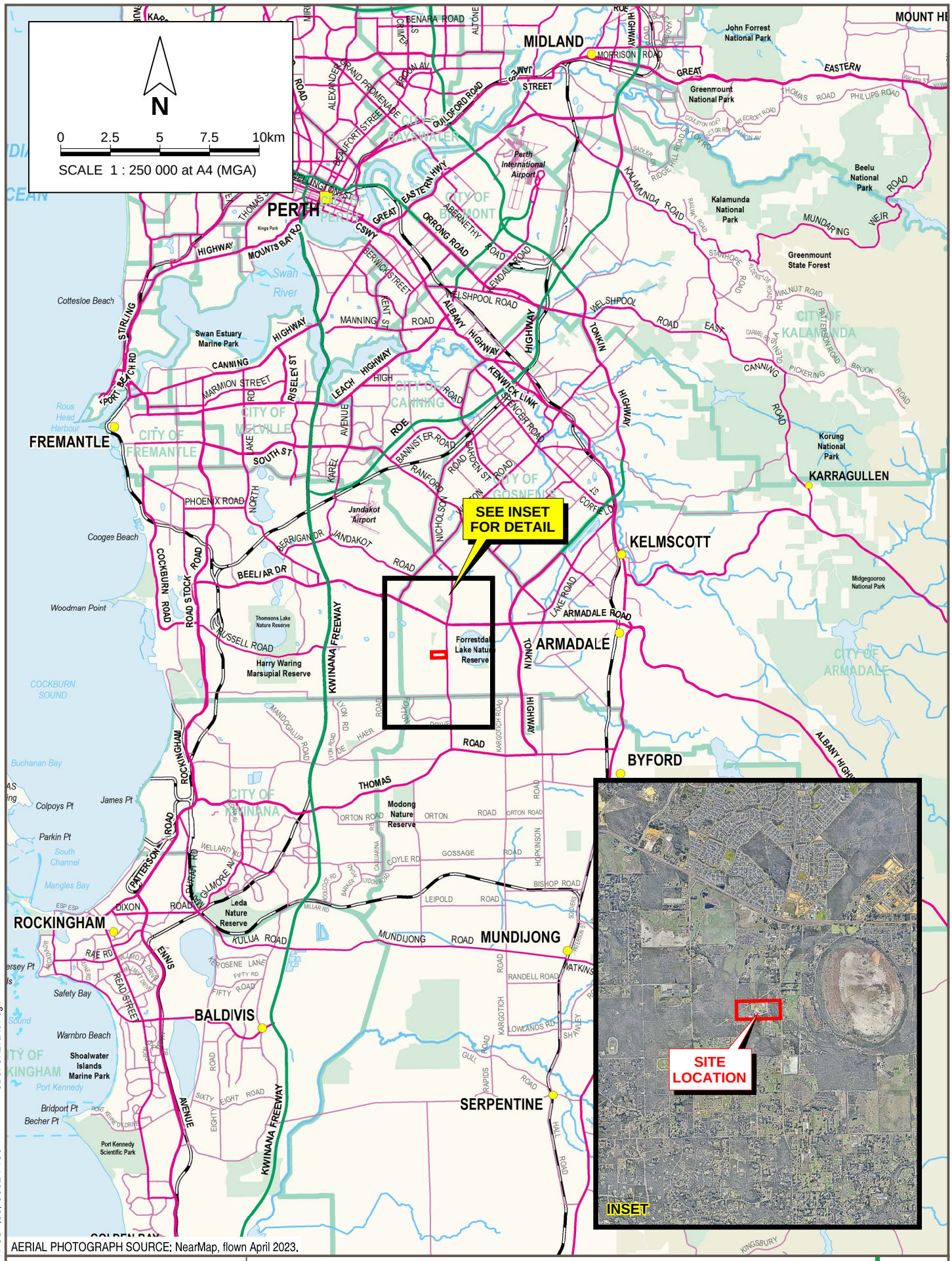
Jordan J.E (1986). *Armadale Part Sheets 2033 1 and 2133 IV, Perth Metropolitan Region, 1:50 000 Environmental Geology Series*. Geological Survey of Western Australia. Perth, Western Australia.

Keighery, B. (1994). *Bushland Plant Survey: A Guide to Plant Community Survey for the Community*. Wildflower Society of Western Australia (Inc.), Perth, Western Australia.

Landgate (2023) *Shared Land Information Platform (SLIP) – Locate V5*. [Online]. Available at: https://maps.slip.wa.gov.au/landgate/locate/. Government of Western Australia, Perth, Western Australia.

NPC Consulting (2014). *Phytophthora Dieback Interpretation Report: Lot 2 Nicholson Road, Forrestdale*. Unpublished report prepared for Coterra Environment, Perth, Western Australia.

Figures



AERIAL PHOTOGRAPH SOURCE: NearMap, flown April 2023.

COTERRA ENVIRONMENT

Carey Baptist College
STAGE 4 NATIVE VEGETATION CLEARING PERMIT APPLICATION
LOT 2 NICHOLSON ROAD, FORRESTDALE

Drawn: K. Watts	Date: 14 Jun 2023
Job: CBCFOR27a	Revision: A

SITE LOCATION

Figure 1

PINPOINT CARTOGRAPHICS (08) 9562 7136 CBCFOR27a-f01.dgn

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary
- Existing Asset Protection Zone
- Existing Infrastructure
- Proposed Concept Plan
- Proposed Clearing Area

N

0 25 50 75 100m

SCALE 1 : 2 500 at A3 (MGA)

398 000mE

398 250mE

6 441 250mN

6 441 000mN

NICHOLSON ROAD

Lot 2

PLAYING COURTS
EXISTING STAFF CAR PARKING
FUTURE FIRE TANKS & PUMPS
EXISTING ACCESS ROAD
EXISTING LANDSCAPED PLAY AREA
EXIST. GRASSED AREA
EXIST. PLAYING FIELD
EXISTING K/PP
OSHC CENTRE
EXIST. TRANSPORTABLES
EXISTING YEAR 1/2
EXIST PICK UP DROP OFF PARKING
EXISTING ACCESS DFES ROAD
FUTURE SOCCER
FUTURE FOOTBALL OVAL
TEACHING BLOCK
EXIST. TRANSPORTABLES
FUTURE ADMIN
FUTURE CHILD CARE
FUTURE STEM
EXISTING STEM CENTRE
FUTURE ARTS & CENTRE FOOD TECHNOLOGY & GLA'S
FUTURE CENTRE FOR THE COMMUNITY
NEW CAR PARKING
FUTURE BRIDGE LINK
PROPOSED SPORTS HALL
FUTURE GLA'S
EXTENDED FIRE SERVICE ACCESS ROAD
EXISTING SERVICE / FIRE SERVICE ACCESS ROAD
FUTURE AUDITORIUM
FUTURE PLAYING COURTS
FUTURE STAFF PARKING
FUTURE BRIDGE LINK
FUTURE CARPARKING

30
303
800
801
270
271
272
163

CADASTRAL SOURCE: Landgate, October 2019.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown April 2023.
CONCEPT PLAN SOURCE: Brad Quatermaine, Dwg No. 23.01-SK01-B, 01-06-23.

COTERRA ENVIRONMENT

Carey Baptist College
STAGE 4 NATIVE VEGETATION CLEARING PERMIT APPLICATION
LOT 2 NICHOLSON ROAD, FORRESTDALE

Drawn: K. Watts	Date: 14 Jun 2023
Job: CBCFOR27a	Revision: A

PROPOSED CLEARING AREA

Figure 2

CBCFOR27a-f02.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary
- Topographic Contour
- Existing Asset Protection Zone
- Existing Infrastructure
- Proposed Concept Plan
- Proposed Clearing Area

Geology

- S8 — SAND - very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted of eolian origin
- S10 — SAND - as S8 as relatively thin veneer over strong, blocky, brown silts and clays
- SP1 — PEATY SAND - grey to black, fine to medium-grained, moderately sorted quartz sand, slightly peaty, of lacustrine origin

Acid Sulfate Soils Risk

- High to moderate risk of ASS occurring within 3m of natural soil surface
- Moderate to low risk of ASS occurring within 3m of natural soil surface but high to moderate risk of ASS beyond 3m of natural soil surface

N

0 25 50 75 100m

SCALE 1 : 2 500 at A3 (MGA)

398 000mE

398 250mE

6 441 250mN

6 441 000mN

ASS SOURCE: DWER, 2019.
CADASTRAL SOURCE: Landgate, October 2019.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown April 2023.
GEOLOGY SOURCE: Geological Survey of WA, 1:50 000 Environmental Geology.
CONCEPT PLAN SOURCE: Brad Quatermaine, Dwg No. 23,01-SK01-B, 01-06-23.

CBCFOR27a-f03.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

COTERRA ENVIRONMENT

Carey Baptist College
STAGE 4 NATIVE VEGETATION CLEARING PERMIT APPLICATION
LOT 2 NICHOLSON ROAD, FORRESTDALE

Drawn: K. Watts | Date: 5 Jul 2023
Job: CBCFOR27a | Revision: A

TOPOGRAPHY AND SOILS

Figure 3

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary
- Existing Asset Protection Zone
- Minimum Groundwater Contour
- Existing Infrastructure
- Proposed Concept Plan
- Proposed Clearing Area

Geomorphic Wetlands

- Conservation Category
- Resource Enhancement
- Multiple Use
- **7088** Wetland UFI Number

7328 1 7088 7090 14835 15304 15820 7233 303 800 801 30 163 270 271 NICHOLSON ROAD 6 441 250mN 6 441 000mN 398 000mE 398 250mE 22 23 Lot 2 PLAYING COURTS EXISTING STAFF CAR PARKING FUTURE FIRE TANKS & PUMPS EXISTING ACCESS ROAD EXISTING LANDSCAPED PLAY AREA EXIST GRASSED AREA EXIST PLAYING FIELD EXISTING K/PP OSHC CENTRE EXIST TRANSPORTABLES EXISTING YEAR 1/2 EXIST PICK UP DROP OFF PARKING EXISTING ACCESS/DFES ROAD TEACHING BLOCK EXIST TRANSPORTABLES FUTURE ADMIN FUTURE CHILD CARE FUTURE SOCCER FUTURE FOOTBALL OVAL PROPOSED SPORTS HALL FUTURE GLA'S EXISTING STEM CENTRE FUTURE STEM FUTURE ARTS & CENTRE FOOD TECHNOLOGY & GLA'S FUTURE CENTRE FOR THE COMMUNITY EXISTING SERVICE / FIRE SERVICE ACCESS ROAD EXTENDED FIRE SERVICE ACCESS ROAD FUTURE PLAYING COURTS FUTURE AUDITORIUM FUTURE STAFF PARKING NEW CAR PARKING FUTURE BYPASS LANE PICK UP/DROP OFF PARKING

N

0 25 50 75 100m

SCALE 1 : 2 500 at A3 (MGA)

WETLANDS SOURCE: DWER, August 2022.
CADASTRAL SOURCE: Landgate, October 2019.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown April 2023.
GROUNDWATER CONTOUR SOURCE: DWER, 2019 Minimum.
CONCEPT PLAN SOURCE: Brad Quatermaine, Dwg No. 23.01-SK01-B, 01-06-23.

COTERRA ENVIRONMENT		Carey Baptist College STAGE 4 NATIVE VEGETATION CLEARING PERMIT APPLICATION LOT 2 NICHOLSON ROAD, FORRESTDALE	Figure 4
Drawn: K. Watts	Date: 5 Jul 2023	**HYDROGEOLOGICAL FEATURES**	
Job: CBCFOR27a	Revision: A		

CBCFOR27a-f04.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary
- Existing Asset Protection Zone
- Existing Infrastructure
- Proposed Concept Plan
- Proposed Clearing
- Mp — Vegetation Unit
- Vegetation Unit Boundary

Priority Flora Species

- *Jacksonia gracillima*
- *Schoenus pennisetis*

N

0 25 50 75 100m

SCALE 1 : 2 500 at A3 (MGA)

398 000mE

398 250mE

6 441 250mN

6 441 000mN

Ba Bi Mr Mp Ec Er Et EM Deg

Ec with scattered Mp over **Paspalum urvillei* and other weeds

PLAYING COURTS
EXISTING STAFF CAR PARKING
FUTURE FIRE TANKS & PUMPS
EXISTING ACCESS ROAD
EXISTING LANDSCAPED PLAY AREA
EXIST GRASSED AREA
EXIST PLAYING FIELD
EXISTING K/PP
OSHC CENTRE
EXIST TRANSPORTABLES
EXISTING YEAR 1/2
EXIST PICK UP DROP OFF PARKING
EXISTING ACCESS DFES ROAD
FUTURE SOCCER
FUTURE FOOTBALL OVAL
TEACHING BLOCK
EXIST TRANSPORTABLES
FUTURE ADMIN
FUTURE CHILD CARE
Lot 2
FUTURE STEM
EXISTING STEM CENTRE
FUTURE ARTS & CENTRE FOOD TECHNOLOGY & GLA'S
FUTURE CENTRE FOR THE COMMUNITY
PROPOSED SPORTS HALL
FUTURE GLA'S
EXISTING SERVICE / FIRE SERVICE ACCESS ROAD
EXTENDED FIRE SERVICE ACCESS ROAD
FUTURE PLAYING COURTS
FUTURE AUDITORIUM
FUTURE STAFF PARKING
FUTURE PURPOSE DRIVE
PROPOSED CARPARK
NICHOLSON ROAD

30 303 801 163 270 271 272

Vegetation Units

Ba	Low Woodland A of *Banksia attenuata*, *Banksia menziesii*, *Nuytsia floribunda* and *Eucalyptus todtiana* over Heath B dominated by *Acacia pulchella* var. *glaberrima* over Tall Grass dominated by * *Ehrharta calycina*
Bi	Low Forest A of *Banksia attenuata* and *Banksia ilicifolia* over Tall Grass dominated by **Ehrharta calycina* and **Ehrharta longiflora*
Et	Low Woodland A of *Eucalyptus todtiana* with occasional *Banksia ilicifolia* over Open to Dense Tall Grass dominated by * *Eragrostis curvula* over Herbs dominated by **Carpobrotus edulis, *Erodium botrys, *Lotus subbiflorus* and **Hypochaeris glabra*
Mp	Open Low Woodland B of *Melaleuca preissiana* over Dense Thicket of *Kunzea glabrescens* over Open Herbs dominated by *Patersonia occidentalis* and *Drosera glanduligera*
Mr	Low Forest A of *Melaleuca rhaphiophylla* over Dense Herbs dominated by **Zantedeschia aethiopicum* and **Lotus subbiflorus*
EM	Open Low Woodland A of *Eucalyptus todtiana* and *Melaleuca preissiana* over Low Scrub A or Scrub of *Kunzea glabrescens* and *Pultenaea reticulata* over Herbs dominated by * *Carpobrotus edulis* and **Lotus subbiflorus*
Er	Low Forest A of * *Eucalyptus* species, possibly (* *Eucalyptus robusta*), *Melaleuca preissiana* and * *Populus nigra* over Dense Tall Grass dominated by * *Eragrostis curvula*
Ec	Dense Tall Grass of * *Eragrostis curvula, *Paspalum urvillei* and/or * *Pennisetum clandestinum* or Tall Sedges of *Juncus pallidus* or Herbs dominated by * *Lotus subbiflorus*, **Moraea flaccida* and **Euphorbia terracina*

CADASTRAL SOURCE: Landgate, October 2019.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown April 2023.
VEGETATION UNIT SOURCE: Bennett Environmental Consulting, 2011.
CONCEPT PLAN SOURCE: Brad Quatermaine, Dwg No. 23.01-SK01-B, 01-06-23.

CBCFOR27a-f05.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

COTERRA ENVIRONMENT

Carey Baptist College
STAGE 4 NATIVE VEGETATION CLEARING PERMIT APPLICATION
LOT 2 NICHOLSON ROAD, FORRESTDALE

Drawn: K. Watts	Date: 14 Jun 2023
Job: CBCFOR27a	Revision: A

VEGETATION UNITS (BENNETT, 2011)

Figure 5

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary
- Existing Asset Protection Zone
- Existing Infrastructure
- Proposed Concept Plan
- Proposed Clearing Area
- 4 Vegetation Condition
- Vegetation Condition Boundary

N

0 25 50 75 100m

SCALE 1 : 2 500 at A3 (MGA)

397 750mE

398 000mE

398 250mE

6 441 250mN

6 441 000mN

NICHOLSON ROAD

EXISTING ACCESS ROAD

FUTURE FIRE TANKS & PUMPS

PLAYING COURTS

EXISTING STAFF CAR PARKING

EXISTING LANDSCAPED PLAY AREA

EXIST. GRASSED AREA

EXST. PLAYING FIELD

EXISTING K/PP

OSHC CENTRE

EXIST. TRANSPORTABLES

EXISTING YEAR 1/2

EXIST PICK UP DROP OFF PARKING

EXISTING ACCESS DFES ROAD

FUTURE CHILD CARE

FUTURE ADMIN

TEACHING BLOCK

Lot 2

FUTURE STEM

EXISTING STEM CENTRE

FUTURE ARTS CENTRE FOOD TECHNOLOGY & GLA

FUTURE CENTRE FOR THE COMMUNITY

NEW CAR PARK

EXISTING SERVICE / FIRE SERVICE ACCESS ROAD

FUTURE AUDITORIUM

FUTURE STAFF PARKING

FUTURE FOOTBALL OVAL

FUTURE SOCCER

PROPOSED SPORTS HALL

FUTURE GLA'S

FUTURE PLAYING COURTS

EXTENDED FIRE SERVICE ACCESS ROAD

30

303

801

270

271

272

163

Vegetation Condition Rating
(Keighery, 1994)

1 Pristine Pristine or nearly so, no obvious signs of disturbance.

2 Excellent Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.

3 Very Good Vegetation structure altered, obvious signs of disturbance.

4 Good Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it.

5 Degraded Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management.

6 Completely Degraded The structure of the vegetation is no longer intact and the area is completely or almost completely without native species.

CADASTRAL SOURCE: Landgate, October 2019.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown April 2023.
VEGETATION CONDITION SOURCE: Bennett Environmental Consulting, 2011.
CONCEPT PLAN SOURCE: Brad Quatermaine, Dwg No. 23.01-SK01-B, 01-06-23.

PINPOINT CARTOGRAPHICS (08) 9562 7136 CBCFOR27a-r06.dgn

COTERRA ENVIRONMENT

Carey Baptist College
STAGE 4 NATIVE VEGETATION CLEARING PERMIT APPLICATION
LOT 2 NICHOLSON ROAD, FORRESTDALE

Drawn: K. Watts | Date: 5 Jul 2023
Job: CBCFOR24 | Revision: A

VEGETATION CONDITION (BENNETT, 2011)

Figure 6

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary
- Existing Asset Protection Zone
- Existing Infrastructure
- Proposed Concept Plan
- Proposed Clearing Area
- Mp — Vegetation Unit
- Vegetation Unit Boundary
- Completed (Stage 1) Revegetation Zone
- Banksia Improvement (CPS 8768-1)
- Dryland Revegetation (CPS 8768-1)
- Mesic Revegetation (CPS 8768-1)
- Additional Dryland Vegetation (CPS 9928-1)
- Proposed 0.08ha Revegetation Area
- Weed Control Area 2023

N

0 25 50 75 100m

SCALE 1 : 2 500 at A3 (MGA)

398 000mE

398 250mE

6 441 250mN

6 441 000mN

0.073ha Mp

0.74ha Bi

0.30ha Ba

0.06ha Mr

0.08ha Mr

0.51ha Mr

0.48ha Ba

Ec

Er

Ec with scattered Mp over *Paspalum urvillei* and other weeds

Ba

Ec

Deg

Ec with scattered Mp over *Paspalum urvillei* and other weeds

Mr

Et

EM

Ba

Ec

Mr

Ec

Ba

Er

Ec

Ec with scattered Mp over *Paspalum urvillei* and other weeds

Ba

Mr

Ec

Deg

Mr

Ec

Et

EM

PLAYING COURTS

EXISTING STAFF CAR PARKING

FUTURE FIRE TANKS & PUMPS

EXISTING ACCESS ROAD

EXISTING LANDSCAPED PLAY AREA

EXIST. GRASSED AREA

EXIST. PLAYING FIELD

EXISTING K/PP

OSHC CENTRE

EXIST. PLAYING FIELD

EXIST. TRANSPORTABLES

EXISTING YEAR 1/2

EXIST PICK UP DROP OFF PARKING

EXISTING ACCESS DFES ROAD

FUTURE SOCCER

FUTURE FOOTBALL OVAL

TEACHING BLOCK

EXIST. TRANSPORTABLES

FUTURE ADMIN

FUTURE CHILD CARE

Lot 2

FUTURE STEM

EXISTING STEM CENTRE

FUTURE ARTS & CENTRE FOOD TECHNOLOGY & GLA'S

FUTURE CENTRE FOR THE COMMUNITY

FUTURE GLA'S

PROPOSED SPORTS HALL

EXISTING SERVICE / FIRE SERVICE ACCESS ROAD

EXTENDED FIRE SERVICE ACCESS ROAD

FUTURE PLAYING COURTS

FUTURE AUDITORIUM

NEW CAR PARK

FUTURE BYPASS LANE

FUTURE UNDERGROUND CARPARK

FUTURE STAFF PARKING

NICHOLSON ROAD

30

303

801

270

271

272

63

Vegetation Units

Ba	Low Woodland A of *Banksia attenuata*, *Banksia menziesii*, *Nuytsia floribunda* and *Eucalyptus todtiana* over Heath B dominated by *Acacia pulchella* var. *glaberrima* over Tall Grass dominated by * *Ehrharta calycina*
Bi	Low Forest A of *Banksia attenuata* and *Banksia ilicifolia* over Tall Grass dominated by **Ehrharta calycina* and **Ehrharta longiflora*
Et	Low Woodland A of *Eucalyptus todtiana* with occasional *Banksia ilicifolia* over Open to Dense Tall Grass dominated by * *Eragrostis curvula* over Herbs dominated by **Carpobrotus edulis, *Erodium botrys, *Lotus subbiflorus* and **Hypochaeris glabra*
Mp	Open Low Woodland B of *Melaleuca preissiana* over Dense Thicket of *Kunzea glabrescens* over Open Herbs dominated by *Patersonia occidentalis* and *Drosera glanduligera*
Mr	Low Forest A of *Melaleuca rhaphiophylla* over Dense Herbs dominated by **Zantedeschia aethiopicum* and **Lotus subbiflorus*
EM	Open Low Woodland A of *Eucalyptus todtiana* and *Melaleuca preissiana* over Low Scrub A or Scrub of *Kunzea glabrescens* and *Pultenaea reticulata* over Herbs dominated by * *Carpobrotus edulis* and **Lotus subbiflorus*
Er	Low Forest A of * *Eucalyptus* species, possibly (* *Eucalyptus robusta*), *Melaleuca preissiana* and * *Populus nigra* over Dense Tall Grass dominated by * *Eragrostis curvula*
Ec	Dense Tall Grass of * *Eragrostis curvula*, **Paspalum urvillei* and/or * *Pennisetum clandestinum* or Tall Sedges of *Juncus pallidus* or Herbs dominated by * *Lotus subbiflorus*, **Moraea flaccida* and **Euphorbia terracina*

CADASTRAL SOURCE: Landgate, October 2019.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown April 2023.
CONCEPT PLAN SOURCE: Brad Quatermaine, Dwg No. 23.01-SK01-B, 01-06-23.

CBCFOR27a-r07.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

COTERRA ENVIRONMENT

Carey Baptist College
STAGE 4 NATIVE VEGETATION CLEARING PERMIT APPLICATION
LOT 2 NICHOLSON ROAD, FORRESTDALE

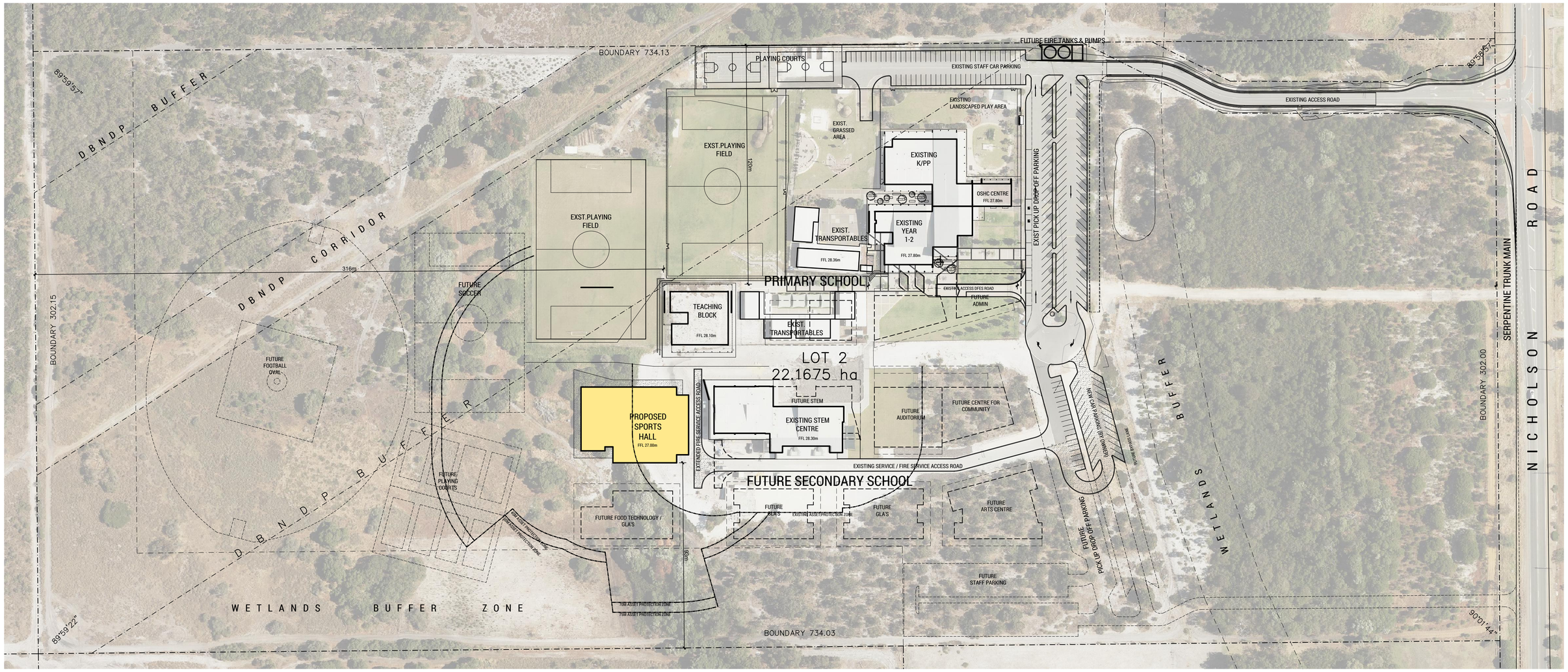
Drawn: K. Watts | Date: 17 Jul 2023
Job: CBCFOR27a | Revision: A

EXISTING REVEGETATION AND WEED CONTROL AREAS

Figure 7

Appendix 1 Carey Baptist College Forrestdale Campus Master Plan

0m 20m 40m 80m



SITE DETAILS ;
LOT 2 (540) NICHOLSON ROAD, FORRESTDALE.
SITE AREA; 221,675m2
PROPOSED BUILDING AREA; 720m2

CLIENT
Carey Baptist College

PROJECT
FORRESTDALE STAGE 4
SPORTS CENTRE

DRAWING
SITE PLAN

brad quartermaine architect
A 10 Caledonia Loop, North Coogee, WA 6163
E brad@quartermaine.com.au
M 0417 931 941

SCALE:	1:1000 @ A1
DATE:	1 MAY 2023
STATUS:	CONCEPT DESIGN
PROJECT NO:	23.01
DRAWING NO:	SK01

Appendix 2 EPBC Act Referral Decision

Australian Government

Department of Sustainability, Environment, Water, Population and Communities

Notification of

REFERRAL DECISION – not controlled action
Lot 2 Nicholson Road Forrestdale, WA (EPBC 2012/6561)

This decision is made under Section 75 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

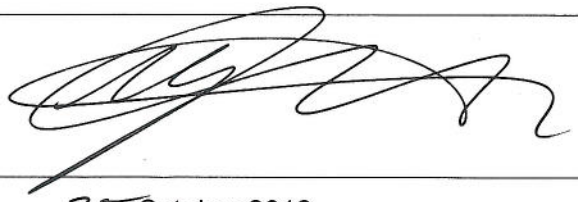
Proposed action

person named in the referral	Carey Baptist College Inc
proposed action	The construction of a school on portions of Lot 2 Nicholson Road, Forrestdale, WA [See EPBC Act referral 2012/6561].

Referral decision: Not a controlled action

status of proposed action	The proposed action is not a controlled action.

Person authorised to make decision

Name and position	Matthew Johnston Acting Assistant Secretary North, West & Offshore Assessment Branch
signature	
date of decision	25 October 2012

Appendix 3 Botanical Survey Report (BEC, 2011)

Botanical Assessment of Lot 2 Nicholson Road FORRESTDALE

Prepared for:
COTERRA ENVIRONMENT
19/336 Churchill Avenue,
SUBIACO WA 6008

Prepared by:
Bennett Environmental Consulting Pty Ltd

Sollya heterophylla

PO Box 341
KALAMUNDA 6926

December 2011

STATEMENT OF LIMITATIONS

Scope of Services

This report ("the report") has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Eleanor Bennett ("the Author"). In some circumstances a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services.

Reliance on Data

In preparing the report, the Author has relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise stated in the report, the Author has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. The Author will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to the Author.

Environmental Conclusions

In accordance with the scope of services, the Author has relied upon the data and has conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

The conclusions are based upon field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of preparing the report. Also it should be recognised that site conditions, can change with time.

Within the limitations imposed by the scope of services, the field assessment and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

Report for Benefit of Client

The report has been prepared for the benefit of the Client and no other party. The Author assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of the Author or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

Other Limitations

The Author will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report. The scope of services did not include any assessment of the title to or ownership of the properties, buildings and structures referred to in the report nor the application or interpretation of laws in the jurisdiction in which those properties, buildings and structures are located.

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SUMMARY

Bennett Environmental Consulting Pty Ltd was commissioned by Coterra Environmental Pty Ltd to undertake a vegetation and flora survey of Lot 2 Nicholson Road in the Shire of Armadale. The site had previously been used for grazing cattle and consisted of a lot of completely degraded areas. There were some sections of remnant vegetation left at the site.

The field work was undertaken on 4th October 2011 when temporary 10m x 10m quadrats were surveyed.
A total of 10 quadrats were surveyed and a listing of the weeds along the perimeter of the site with Nicholson Road was also recorded. There are two Bush Forever Sites located near to the site. These are:

- Bush Forever Site 344, Denis De Young Reserve and Gibbs Road Swamp Bushland, Banjup/Forrestdale which is located adjacent to the western boundary and
- Bush Forever Site 345 Forrestdale Lake and Adjacent Bushland, Forrestdale, which is located east of Nicholson Road.

During the survey a total of eight different vegetation units were identified. These are:

UPLAND VEGETATION

- Low Woodland A of *Banksia attenuata*, *Banksia menziesii*, *Nuytsia floribunda* and *Eucalyptus todtiana* over Heath B dominated by *Acacia pulchella* var. *glaberrima* over Tall Grass dominated by **Ehrharta calycina* in grey sand.
- Low Forest A of *Banksia attenuata* and *Banksia ilicifolia* over Tall Grass dominated by **Ehrharta calycina* and **Ehrharta longiflora* in grey sand.
- Low Woodland A of *Eucalyptus todtiana* with occasional *Banksia ilicifolia* over Open Dense Tall Grass dominated by **Eragrostis curvula* over Herbs dominated by **Carpobrotus edulis*, **Erodium botrys*, **Lotus subbiflorus* and **Hypochaeris glabra* in pale grey sand.

WETLAND VEGETATION

- Open Low Woodland B of *Melaleuca preissiana* over Dense Thicket of *Kunzea glabrescens* over Open Herbs dominated by *Patersonia occidentalis* and *Drosera glanduligera* in damp dark grey sand.
- Low Forest A of *Melaleuca rhaphiophylla* over Dense Herbs dominated by **Zantedeschia aethiopicum* and **Lotus subbiflorus* in very damp grey sand.
- Open Low Woodland A of *Eucalyptus todtiana* and *Melaleuca preissiana* over Low Scrub A or Scrub of *Kunzea glabrescens* and *Pultenaea reticulata* over Herbs dominated by **Carpobrotus edulis* and **Lotus subbiflorus* in grey sand.
- Low Forest A of **Eucalyptus* species (possibly **Eucalyptus robusta), Melaleuca preissiana* and **Populus nigra* over Dense Tall Grass dominated by **Eragrostis curvula* in grey sandy loam.
- Dense Tall Grass of **Eragrostis curvula*, **Paspalum urvillei*, and/or **Pennisetum clandestinum* or Tall Sedges of *Juncus pallidus* or Herbs dominated by **Lotus subbiflorus*, **Moraea flaccida* and **Euphorbia terracina* in damp grey sand.

No quadrats were placed in the completely degraded vegetation at the site which consisted of pasture grasses and often with clumps of **Paspalidium urvillei*.

The vegetation condition of the remnant vegetation at the site varied from good to degraded.

A total of 49 families, 108 genera and 148 taxa were recorded during the survey of which 66 species were weeds.

Two priority flora were located. These were:

- *Schoenus pennisetis*, a Priority 2 Flora is an annual sedge up to 15cm high; and
- *Jacksonia gracillima* a Priority 3 Flora is a shrub up to 1.5m tall.

1. INTRODUCTION

1.1 Background

Coterra Environment commissioned Bennett Environmental Consulting Pty Ltd to undertake a vegetation overview for Lot 2 Nicholson Road, Forrestdale, within the City of Armadale. It is approximately 22.16ha in area with 4.46ha mapped by the Department of Environment and Conservation as a Conservation Category Wetland. A wetland assessment was undertaken by Arthur Weston in December 2010 (Coterra Environment, 2011).

Figure 1. Location of the site surveyed - outlined in red (extracted from Google Maps). The dotted blue line indicates the location of the gas pipeline.

1.2 Scope of Works

The requirements for this project were to:

i. Undertake a Level 2 vegetation survey (Environmental Protection Authority, 2004); and to

ii. Search for and record all significant species at the site.

2. BACKGROUND INFORMATION

2.1 Geology and Landform

The area is included in the Bassendean Dunes which have off-white to pale grey sands at the surface and cream to yellow sands at depth. The Bassendean Dunes are again separated into three units based on the characteristics of their swamps. The study site occurs within the Southern River Complex, the sand appears to have been blown over the alluvial soils resulting in swamps with a clay base (Churchward and McArthur, 1980).

2.2 Vegetation

The Interim Biogeographical Regionalisation for Australia (IBRA) (Thackway and Cresswell, 1995) recognizes 85 bioregions. The IBRA is used as the common unit to compare biological and biophysical attributes. Bioregions represent a landscape-based approach to classifying the land surface and each region is defined by a set of major environmental influences, which shape the occurrence of flora and fauna and their interaction with the physical environment. Forrestdale occurs in the Swan Coastal Plain, which has been subdivided into the northern section and the southern section. The study area is located in the southern section, abbreviated SWA2 (Mitchell, Williams and Desmond, 2002).

The survey area is mapped by Beard (1981) as a Low Woodland of *Allocasuarina fraseriana, Banksia* species and *Eucalyptus marginata* (abbreviated e2,3Mi). Shepherd *et al.* (2002) have determined the pre-European and current extent of the vegetation associations described by Beard. In addition they have assessed the percentage of each vegetation association remaining, the amount in IUCN reserves and the percentage in other reserves. The pre-European area of e2,3Mi is estimated to be 79,001ha, the current extent is 18,398ha which represents 23.2% remaining vegetated of which 38% is included in conservation.

Heddle *et al.* (1980) described the vegetation complexes of the Darling System at a scale of 1:250 000. There was found to be a distinct pattern of plant distribution linked to landforms, soils and climate. The most obvious trend was associated with increasing aridity from west to east on the Darling Plateau. The vegetation changes observed were a decrease in height and percentage cover of the tallest stratum and a distinct change in floristics. Forrestdale occurs in the Southern River Complex which is described as an Open Woodland of *Corymbia calophylla – Eucalyptus marginata* subsp. *marginata* and *Banksia* species with fringing Woodland of *Eucalyptus rudis* subsp. *rudis* and *Melaleuca rhaphiophylla* along creek beds.

Bush Forever (Government of Western Australia, 2000) states that 17% of the original area of the Southern River Complex remains vegetated within the Swan Coastal Plain and that the area of that Complex proposed for protection is 10%.

2.3 Threatened Ecological Communities

An ecological community is a naturally occurring biological assemblage that occurs in a particular type of habitat. A Threatened Ecological Community is one which falls into one of the following categories, presumed totally destroyed, critically endangered, endangered or vulnerable (Department Environment and Conservation, 2011b).

A possible ecological community which does not meet the above is added to the Priority Ecological Community List. Priorities 1, 2, and 3 are adequately known but are not currently believed to be threatened. Those that have recently been removed from the threatened list are listed as Priority 4. Conservation dependent ecological communities are placed in Priority 5.

2.4 Significant Flora

Prior to undertaking the field work a search was undertaken of the Department of Conservation and Environment Rare Flora Database. The resulting data is provided in Table 3.

Table 1. Code and description of Threatened and Priority Flora (Department Environment and Conservation, 2011a)

Code	Declared Rare and Priority Flora Categories
T	T (Threatened Flora) -Extant Taxa. Taxa, which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection.
X	T (Threatened Flora) -Presumed Extinct Taxa. Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently.
1	Priority One -Poorly Known Taxa. Taxa, which are known from one or a few (generally <5) populations, which are under threat.
2	Priority Two -Poorly Known Taxa. Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat.
3	Priority Three -Poorly Known Taxa. Taxa, which are known from several populations, at least some of which are not believed to be under immediate threat.
4	Priority Four - Rare, Near Threatened and other species in need of monitoring. Taxa which are considered to have been adequately surveyed and which whilst being rare, are not currently threatened by any identifiable factors.
5	Priority Five - Conservation dependent species. Species that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

Table 1 presents the definitions of Declared Rare and the four Priority Flora ratings under the Wildlife Conservation Act (1950) as extracted from Department of Environment and Conservation (2011a). Table 2 presents the definitions of the threatened species under the Environmental Protection and Biodiversity Conservation Act, 1999 (Department of Sustainability, Environment, Water, Populations and Communities, 2011).

Table 2. Categories of Threatened Flora Species (Department of Sustainability, Environment, Water, Populations and Communities, 2011)

Code	Declared Rare and Priority Flora Categories
Ex	Extinct Taxa which at a particular time if, at that time, there is no reasonable doubt that the last member of this species has died.
ExW	Extinct in the Wild Taxa which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	Critically Endangered Taxa which at any particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	Endangered Taxa, which is not critically endangered, and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.
V	Vulnerable Taxa which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	Conservation Dependent Taxa which at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

Table 3. Threatened and Priority Flora Species List as provided by the Department of Environment and Conservation

Taxon	Code	Description
Caladenia huegelii	T	Tuberous, perennial, herb, 0.25-0.6 m high. Fl. green & cream & red, Sep to Oct. Grey or brown sand, clay loam.
Diuris purdiei	T	Tuberous, perennial, herb, 0.15-0.35 m high. Fl. yellow, Sep to Oct. Grey-black sand, moist. Winter-wet swamps.
Drakaea elastica	T	Tuberous, perennial, herb, 0.12-0.3 m high. Fl. red & green & yellow, Oct to Nov. White or grey sand. Low-lying situations adjoining winter-wet swamps.
Drakaea micrantha	T	Tuberous, perennial, herb, 0.15-0.3 m high. Fl. red & yellow, Sep to Oct. White-grey sand.
Lepidosperma rostratum	T	Rhizomatous, tufted perennial, grass-like or herb (sedge), 0.5 m high. Fl. brown. Peaty sand, clay.
Eryngium pinnatifidum subsp. *palustre*	3	Erect perennial, herb, 0.15-0.5 m high. Fl. white/blue, Oct to Nov. Clay, sandy clay. Claypans, seasonally wet flats.
Jacksonia gracillima	3	No description provided.
Stylidium longitubum	3	Erect annual (ephemeral), herb, 0.05-0.12 m high. Fl. pink, Oct to Dec. Sandy clay, clay. Seasonal wetlands.
Drosera occidentalis subsp. *occidentalis*	4	Fibrous-rooted, rosetted perennial, herb, to 0.01 m high. Fl. pink/white, Nov to Dec. Sandy & clayey soils. Swamps & wet depressions
Grevillea thelemanniana subsp. *thelemanniana*	4	No description provided.
Jacksonia sericea	4	Low spreading shrub, to 0.6 m high. Fl. orange, usually Dec or Jan to Feb. Calcareous & sandy soils.

Taxon	Code	Description
Ornduffia submersa	4	No description provided.
Thysanotus glaucus	4	Caespitose, glaucus perennial, herb, 0.1-0.2 m high. Fl. purple, Oct to Dec or Jan to Mar. White, grey or yellow sand, sandy gravel.
Tripterococcus paniculatus	4	Perennial, herb, to 1 m high. Fl. yellow-green, Oct to Nov. Grey, black or peaty sand. Winter-wet flats.
Verticordia lindleyi subsp. *lindleyi*	4	Erect shrub, 0.2-0.75 m high. Fl. pink, May or Nov to Dec or Jan. Sand, sandy clay. Winter-wet depressions.

2.5 Bush Forever Sites Close to Lot 2 Nicholson Road

There are 2 Bush Forever Sites near the site. These are Bush Forever Site 344, Denis De Young Reserve and Gibbs Road Swamp Bushland, Banjup/Forrestdale which is located adjacent to the western boundary and Bush Forever Site 345 Forrestdale Lake and Adjacent Bushland, Forrestdale, which is located east of Nicholson Road.

The vegetation of Bush Forever site 344 is described as (Government of Western Australia, 2000):

Uplands:

Banksia attenuata and *Banksia menziesii* Low Woodland; and
Banksia attenuata Low Woodland with scattered *Banksia menziesii*, *Banksia ilicifolia* and *Eucalyptus todtiana.*

Wetlands:

Melaleuca preissiana Low Woodland to Forest sometimes over *Baumea juncea* Sedgeland;
Melaleuca rhaphiophylla Low Open Forest;
Pericalymma ellipticum. Astartea aff. *fascicularis, Aotus intermedia* and *Calothamnus lateralis* Closed Heath;
Pericalymma ellipticum Closed Heath; and
Baumea juncea and *Baumea articulata* Sedgelands**.**

The vegetation of Bush Forever site 345 is described as (Government of Western Australia, 2000):

Uplands:

Corymbia calophylla Open Woodland;
Banksia attenuata and *Banksia menziesii* Open Forest to Woodland with *Nuytsia floribunda;* and
Banksia ilicifolia and *Banksia menziesii* Open Forest to Woodland with *Nuytsia floribunda*.

Wetlands

Eucalyptus rudis Forest;
Melaleuca rhaphiophylla and *Melaleuca preissiana* Low Open Forest with patches of *Eucalyptus rudis;*
Melaleuca preissiana Open Woodland;
Melaleuca rhaphiophylla Low Closed Forest;
Melaleuca uncinata, Melaleuca viminea and *Melaleuca polygaloides* Closed Heath;
Regelia ciliata Closed Heath;
Melaleuca teretifolia and Melaleuca viminea Open Heath;
Mixed Closed Herbland;
Hypolaena exsulca, Lyginia barbata and *Schoenus curvifolius* Closed Sedgeland;
Leptocarpus canus Sedgeland; and
Closed Sedgeland dominated by *Baumea articulata, *Typha orientalis* and *Bolboschoenus caldwellii*.

3. METHODS

Transects were walked through the remnant bushland listing the vegetation units in the area and the dominant taxa. As this was being undertaken the bushland was searched for Declared Rare and Priority Flora. As a Level 2 vegetation survey was required temporary 10m x 10m

quadrats were recorded. The vegetation at the site is described using the vegetation classification of Muir (1977) as described in Table 4. Plants unknown in the field were collected, pressed and identified using the Reference Collection at the Western Australian Herbarium, which has limited collections and sometimes makes the positive identification difficult.

Table 4 Vegetation Classification (from Muir, 1977)

LIFE FORM / HEIGHT CLASS	Canopy Cover			
	DENSE 70 % - 100%	**MID DENSE 30% - 70%**	**SPARSE 10% - 30%**	**VERY SPARSE 2% - 10%**
Trees > 30 m	Dense Tall Forest	Tall Forest	Tall Woodland	Open Tall Woodland
Trees 15 – 30 m	Dense Forest	Forest	Woodland	Open Woodland
Trees 5 – 15 m	Dense Low Forest A	Low Forest A	Low Woodland A	Open Low Woodland A
Trees < 5 m	Dense Low Forest B	Low Forest B	Low Woodland B	Open Low Woodland B
Mallee (tree form)	Dense Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
Mallee (shrub form)	Dense Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
Shrubs > 2 m	Dense Thicket	Thicket	Scrub	Open Scrub
Shrubs 1.5 – 2 m	Dense Heath A	Heath A	Low Scrub A	Open Low Scrub A
Shrubs 1 - 1.5 m	Dense Heath B	Heath B	Low Scrub B	Open Low Scrub B
Shrubs 0.5 – 1 m	Dense Low Heath C	Low Heath C	Dwarf Scrub C	Open Dwarf Scrub C
Shrubs 0 - 0.5 m	Dense Low Heath D	Low Heath D	Dwarf Scrub D	Open Dwarf Scrub D
Mat plants	Dense Mat Plants	Mat Plants	Open Mat Plants	Very Open Mat Plants
Hummock grass	Dense Hummock Grass	Mid-Dense Hummock Grass	Hummock Grass	Open Hummock Grass
Bunch grass > 0.5 m	Dense Tall Grass	Tall Grass	Open Tall Grass	Very Open Tall Grass
Bunch grass < 0.5 m	Dense Low Grass	Low Grass	Open Low Grass	Very Open Low Grass
Herbaceous spp.	Dense Herbs	Herbs	Open Herbs	Very Open Herbs
Sedges > 0.5 m	Dense Tall sedges	Tall Sedges	Open Tall Sedges	Very Open Tall Sedges
Sedges < 0.5 m	Dense Low Sedges	Low Sedges	Open Low Sedges	Very Open Low Sedges
Ferns	Dense Ferns	Ferns	Open Ferns	Very Open Ferns
Mosses, liverworts	Dense Mosses	Mosses	Open Mosses	Very Open Mosses

4. RESULTS

Field work was undertaken on 4th October 2011. The gas pipeline traversed the site approximately NE to SW. In the following descriptions note that * indicates the plant is a weed.

4.1 Vegetation

As with the vegetation description for the Bush Forever Sites it is possible to divide the vegetation at Lot 2 Nicholson Road into Uplands and Wetlands. Detailed species lists for each of the quadrats listed under the vegetation units is provided in Appendix B.

UPLAND VEGETATION

Low Woodland A of *Banksia attenuata, Banksia menziesii, Nuytsia floribunda* and *Eucalyptus todtiana* over Heath B dominated by *Acacia pulchella* var. *glaberrima* over Tall Grass dominated by **Ehrharta calycina* in grey sand

This vegetation was recorded from the slopes and crest of the sand dune at the site. It was represented by quadrat CS05.

Low Forest A of *Banksia attenuata* and *Banksia ilicifolia* over Tall Grass dominated by **Ehrharta calycina* and **Ehrharta longiflora* in grey sand.

This vegetation was recorded from the northwest corner of the site. It was represented by quadrat CS02.

Low Woodland A of *Eucalyptus todtiana* with occasional *Banksia ilicifolia* over Open Dense Tall Grass dominated by **Eragrostis curvula* over Herbs dominated by **Carpobrotus edulis, *Erodium botrys, *Lotus subbiflorus* and **Hypochaeris glabra* in pale grey sand.

This vegetation was a small area recorded from the south eastern side. It was represented by quadrat CS07.

WETLAND VEGETATION

Open Low Woodland B of *Melaleuca preissiana* over Dense Thicket of *Kunzea glabrescens* over Open Herbs dominated by *Patersonia occidentalis* and *Drosera gigantea* in damp dark grey sand.
This vegetation was recorded from the northwest corner of the site. It was represented by quadrat CS01.

Low Forest A of *Melaleuca rhaphiophylla* over Dense Herbs dominated by **Zantedeschia aethiopicum* and **Lotus subbiflorus* in very damp grey sand.
This vegetation occurred at the southeastern area of the site where there was lying water present. It was represented by quadrats CS03 and CS10.

Open Low Woodland A of *Eucalyptus todtiana* and *Melaleuca preissiana* over Low Scrub or Scrub of *Kunzea glabrescens* and *Pultenaea reticulata* over Herbs dominated by
**Carpobrotus edulis* and **Lotus subbiflorus* in grey sand.
This vegetation occurred at the south eastern corner above the wetland represented by quadrat CS10. It was represented by quadrat CS06.

Low Forest A of **Eucalyptus* species (possibly **Eucalyptus robusta*), *Melaleuca preissiana* and **Populus nigra* over Dense Tall Grass dominated by **Eragrostis curvula* in grey sandy loam.
This occurred as a small area at the north east corner of the site. **Eucalyptus robusta* is spreading as there are several juvenile trees present. It is represented by quadrat CS08.

Dense Tall Grass of **Eragrostis curvula*, **Paspalum urvillei*, and/or **Pennisetum clandestinum* or Tall Sedges of *Juncus pallidus* or Herbs dominated by **Lotus subbiflorus*, **Moraea miniata* and **Euphorbia terracina* in damp grey sand.
This vegetation type occurred in small areas across the site. It was represented by quadrats CS04 and CD09.

Listing of weeds along Nicholson Road is site 11 and mapped as such in Appendix A.

4.2 Vegetation Condition

Bushland has been historically subject to ongoing degradation and is especially susceptible to disturbances arising as a result of indirect impacts from surrounding developments and human activity. Degradation is caused by a wide range of factors, including isolation, edge effects, weed invasion, plant diseases, changes in fire frequency, landscape fragmentation, increased predation on native fauna by feral animals, decrease in species richness and general modification of ecological function. Lot 2 has historically been used for stock grazing, phases of clearing and weed invasion. These issues affect the biodiversity rating and ecological viability of areas of remnant vegetation and should be assessed in line with conservation values.

Vegetation condition was rated according to the vegetation condition scale used in Keighery (1994). The vegetation condition at the survey site was mainly good to completely degraded with the higher ground vegetation in very good (condition 3) to good (condition 4) condition. There were groups of trees with good cover where the understorey had been completely replaced with weeds. These areas were degraded (condition 5). Where there were no trees and the weeds were dominant the vegetation condition was completely degraded (condition 6). Table 5 explains the vegetation condition rating scale and Table 5 gives the vegetation condition at the site. The vegetation condition of the site is mapped in Appendix C, Map 2.

Table 5. Explanation of Vegetation Condition Rating (Keighery, 1994)

Rating	Description	Explanation
1	Pristine	Pristine or nearly so, no obvious signs of disturbance.
2	Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
3	Very Good	Vegetation structure altered, obvious signs of disturbance.
4	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it.
5	Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management.
6	Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species.

Table 6. Vegetation Condition Recorded from the Site

Vegetation Condition	Quadrat Number
Very good to good	CS05
Good	CS02, CS03
Good to degraded	CS01, CS10
Degraded	CS06, CS08
Degraded to completely degraded	CS04, CS07
Completely degraded	CS09, Area 11, Paddocks

4.3 Taxa

A total of 49 genera, 107 genera and 147 taxa during the survey of which 66 species were weeds. The dominant families were Asteraceae (Daisy family), Fabaceae (Pea and Wattle family) and Poaceae (Grass family).

4.4 Significant Taxa

During the current survey two priority flora were recorded. These were:

- *Schoenus pennisetis*, a Priority 2 Flora, is an annual sedge up to 15cm high with dark brown to black inflorescences. It occurs in grey or peaty sand or sandy clay in swamps or winter-wet areas. This is a new record for this area but will need to be confirmed once access into the other areas of the Western Australian Herbarium is permitted. The plants were not counted but were recorded from the vicinity of CS01; and

Photograph 1. Plants of *Schoenus pennisetis*

- *Jacksonia gracillima* a Priority Flora 3 flora was recorded from 2 sites.
  i) 398647E; 6441321N (when walking traqnsects) where about 10 plants were recorded, and
  ii) quadrat CS-06 where about 5 plants were recorded.

Photograph 2. *Jacksonia gracillima* photographed at a different site but it does illustrate the divided flattened 'leaves" and the flower shape and colour.

4.5 Weeds

A total of 66 weeds were recorded during the current survey. All have been determined as weeds by the Western Australian Herbarium (2011) and Department of Environment and Conservation (2011c). There are several ratings allocated to each weed in the Invasive Plant Prioritisation but only three have been selected to include in this report. These are ecological impacts, impact attributes and invasiveness which are shown in Table 7 for each of the non-endemic species recorded. Twenty nine of the weeds are listed as having a high ecological impact on the environment and 42 are listed having a rapid rate of dispersal.

Table 6. Ecological Impacts and Invasiveness of recorded weeds

Species	Ecological Impacts		Invasiveness
	Ecological impact L – low impact species M – medium impact species H – high impact species U – unknown impact	Impact attributes 1, 2,3,4, 5, 6, 7, 8, 9, 10 See explanation below table	Rate of dispersal R=rapid, M=moderate, S=slow
**Acacia longifolia*	H	1,2,4,6,7,8,9	M
**Arctotheca calendula*	H	8,9	R
**Asparagus asparagoides*	H	6,7,8,9	R
**Avena barbata*	H		R
**Azolla filiculoides*	L		M
**Briza maxima*	U		R
**Briza minor*	U		R
**Bromus diandrus*	H		R
**Carpobrotus edulis*	H	8,9	R
**Cortaderia selloana*	H	1,6,7,8,9	R
**Cotula coronopifolia*	U		R
**Cotula turbinata*	L		M
**Cynodon dactylon*	H	9	R
**Cyperus congestus*	U		M
**Cyperus tenellus*	L		U
**Disa bracteata*	U		R

Species	Ecological Impacts		Invasiveness
	Ecological impact	Impact attributes	
**Dittrichia graveolens*	M		R
**Echium plantagineum*	H	increasing	R
**Ehrharta calycina*	H	1,2,6,8,9	R
**Ehrharta longiflora*	H	1,2,6,8,9	R
**Eragrostis curvula*	H		R
**Erodium botrys*	U		M
**Eucalyptus robusta*	Not listed		
**Euphorbia terracina*	H	8,9	R
**Ficus carica*	H		M
**Fumaria capreolata*	H	7,9	R
**Gladiolus caryophyllaceus*	H		R
**Gomphocarpus fruticosus*	H	9	R
**Holcus lanatus*	H		U
**Hypochaeris glabra*	H		R
**Isolepis marginata*	U		U
**Juncus acutus*	H	1,3,4,7,8,9	R
**Juncus bufonius*	U		R
**Juncus capitatus*	U		R
**Lolium multiflorum*	Not listed		
**Lotus subbiflorus*	U		R
**Lupinus angustifolia*	H		M
**Lupinus cosentinii*	H		M
**Lythrum hyssopifolia*	M		R
**Medicago polymorpha*	L		
**Moraea flaccida*	H	8,9	R
**Nerium oleander*	L		R
**Oenothera stricta*	L		M
**Ornithopus sativus*	M		R
**Paspalum urvillei*	H		M
**Pennisetum clandestinum*	H		S
**Persicaria maculosa*	L		U
**Populus nigra*	L		S
**Ranunculus muricata*	L		U
**Raphanus raphanistrum*	U		M
**Ricinus communis*	M	2,8,9	R
**Romulea rosea*	U		R
**Rumex crispus*	U		R
**Schinus terebinthifolia*	H	3,7,8,9	M
**Solanum americanum*	U		R
**Solanum nigrum*	M		R
*Sonchus *asper*	U		R
**Sonchus oleraceus*	U	increasing	R
**Trachyandra divaricata*	M	1,4,9	R
**Trifolium campestre*	U		U
**Trifolium hirtum*	U		U
**Typha orientalis*	H	2, 3,5,6,7,9	R
**Ursinia anthemoides*	U	increasing	R
**Vulpia bromoides*	H		R
**Wahlenbergia capensis*	U		R
**Zantedeschia aethiopicum*	H	6,7,8,9,10	R

Impact Attributes: 1 - changed fire regime; 2 - changed nutrient conditions; 3 - changed hydrological patterns; 4 - changed soil erosion patterns; 5 - changed geomorphological processes; 6 - changed biomass distribution; 7 - changed light distribution; 8 - loss of biodiversity; 9 - substantially reduces regeneration opportunities of native plants; 10 - allelopathic effects. Increasing means that the weed is increasing its distribution from original known areas.

5. COMPARISON WITH WETLAND SURVEY

Dr A. Weston (Coterra Environment. 2011) surveyed Lot 2 to assessed the quality, the taxa present and condition to determine the assessment of the wetland classification. He detailed each remnant section of vegetation and determined that the wetlands at the site should be downgraded after assessing the vegetation using Bulletin 686 (Coterra Environment, 2011). He photographed 13 different wetland areas, providing data on the dominant taxa. He also assessed the vegetation condition for each of the photo points. As a result of this survey he stated that the vegetation on site did not represent a conservation management category wetland as the vegetation was degraded, completely degraded or cleared.

Dr Weston did a detailed assessment of the area to the east of the high ground and did not cover the whole area as did the current survey.

6. DISCUSSION

As found by Dr Weston large areas of the site are degraded due to previous farming practices. It was mainly the lower ground where the development had occurred. The wetland remnants varied in their structure but *Melaleuca preissiana* and *Melaleuca rhaphiophylla* were the dominant trees with an understorey mainly replaced by weeds. In the centre of the site there was a sand ridge which had vegetation associated with the higher ground, *Banksia attenuata*, *Banksia menziesii* and *Eucalyptus todtiana* with an understorey of mixed shrub species.

At the north eastern end there were several Eastern Australian *Eucalyptus* trees growing. These have been tentatively identified as **Eucalyptus robusta* commonly called 'Swamp mahogany' a species which grows in wet soils. If it intended to rehabilitate this section of the wetland these plants should be removed and planted with the endemic *Eucalyptus rudis* subsp. *rudis*, a few trees of which are in the area. This remnant also included several plants of Poplar (**Populus nigra*) and Japanese pepper (**Schinus terebinthifolia*), all of which need to be removed. Poplars are inclined to sucker so may need to be removed for several years.

Two priority flora were recorded from the site. These were:

- *Jacksonia gracillima* a priority 3 flora was recorded from two locations. This is a low shrub up to about 1.5m tall with phyllodes (modified leaves) that appear to be divided into 3 at their ends; and
- *Schoenus pennisetis* a priority 2 flora was recorded from one area only. It is an annual sedge up to 15cm tall with dark brown to nearly black flowers. This species is readily overlooked once the damp areas in which it grows dries out.

Ten quadrats were established and a listing made of the species along the perimeter of the block with Nicholson Road and a listing of the weeds along Nicholson Road was also made. The vegetation condition varied from very good to completely degraded.

The client intends to retain and rehabilitate some areas. If it is possible the areas of quadrats CS01 and CS02 could be considered for retention and well as the drain represented by quadrat CS10. These three sections of the remnant bushland record the diversity of the wetland remnants. By putting any infrastructure on the higher ground, where the vegetation condition varied between good and degraded, it should overcome building problems, especially with the requirement of fill for lower areas. The higher ground recorded many *Banksia attenuata* and *Banksia menziesii* deaths, not just from the recent fire but as a result of the long hot summers and dry winters experienced over the previous two years.

If rehabilitation of the site is to occur it is recommended that seed of the endemic species be professionally collected prior to any clearing occurring. Seedlings could then be propagated on, or seed sown direct into, prepared soil. It is essential that weed control occur prior to any plantings.

Most of the site is degraded or completely degraded and includes some invasive weeds in particular, **Zantedeschia aethiopica* (Arum lily), **Euphorbia terracina* (Geraldton carnation weed) and several grasses including **Ehrharta calycina* (Perennial veldt grass) and **Bromus diandrus* (Great Brome). Control of these species should be undertaken immediately and if any other plants regrow they should be hand pulled immediately.

7. REFERENCES

Beard, J.S. (1981). *Vegetation Survey of Western Australia Swan.* University of Western Australia Press, Crawley

Beard, J.S. (1990). *Plant Life of Western Australia*. Kangaroo Press, Kenthurst NSW

Biggs, E.R. and Wilde, S.A. (1980). *Geology, Mineral Resources and Hydrology of the Darling System, Western Australia*. Department of Conservation and Environment, Perth, Western Australia

Churchward, H.M. and McArthur, W.M. (1980). *Landform and Soils of the Darling System* In *Atlas of Natural Resources, Darling System, Western Australia*. Department of Conservation and Environment, Perth, Western Australia

Commonwealth of Australia (2001). *National Objectives and Targets for Biodiversity Conservation 2001-2005.* Environment Australia; Department of Environment and Heritage, Canberra

Coterra Environment (2011). *Wetland verification and reclassification assessment – Lot 2 Nicholson Road Forrestdale.* Unpublished report for Carey College

Department of Environment and Conservation (2011a). *Declared Rare and Priority List for Western Australia.* Published list by the Department of Conservation and Land Management, Western Australia

Department of Environment and Conservation (2011b). *List of Threatened Ecological Communities on the Department of Environment and Conservation Threatened Ecological Communities (TEC) Database endorsed by the Minister for the Environment.* http://www.naturebase.net/plants_animals/watscu/pdf/tec/endorsed_tec_list_jan04.pdf

Department Environment and Conservation. (2011c). *Invasive Plant Prioritisation Process for Department of Environment and Conservation.* http://www.dec.wa.gov.au/content/view/6295/2275/1/1/

Department of Sustainability, Environment. Water. Populations and Communities (2011). *EPBC Act List of Threatened Flora.* http://www.deh.gov.au/

Environmental Protection Authority (2000). *Environmental Protection of Native Vegetation in Western Australia. EPA Position Statement No. 2.* EPA, Perth

Environmental Protection Authority (2004). *Guidance for the Assessment of Environmental Factors, Terrestrial flora and vegetation surveys for environmental impact assessment in Western Australia. No. 51.* EPA, Perth

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.* Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)

Government of Western Australia (2000). *Bush Forever*. Department of Environmental Protection, WA

Havel, J.J. (2002). *Review of Management Options of Poorly Represented Vegetation Complexes*. Unpublished report for the Conservation Commission

Hearn, R., Williams, K., Comer, S. and Beecham, B. (2002). *Jarrah Forest 2 (JF2 – Southern Jarrah Forest subregion)* In *A Biodiversity Audit of Western Australia's 53 Biogeographical subregions*. Department of Conservation and Land Management

Heddle, E.M., Loneragan, O.W. and Havell, J.J. (1980). *Vegetation of the Darling System* In *Atlas of Natural Resources, Darling System, Western Australia*. Department of Conservation and Environment, Perth, Western Australia

Hussey, B.M.J., Keighery, G.J., Cousens, R.D., Dodd, J. and Lloyd, S.G. (1997). *Western Weeds – A guide to the weeds of Western Australia.* Plant Protection Society of Western Australia

Keighery, B.J. (1994). *Bushland Plant Survey: a Guide to Plant Community Surveys for the Community.* Wildflower Society of Western Australia (Inc.) Nedlands, Western Australia

Mitchell, D., Williams, K. and Desmond, A. (2002). *Swan Coastal Plain 2 (SWA2 – Swan Coastal Plain subregion)* In *A Biodiversity Audit of Western Australia's 53 Biogeographical subregions*. Department of Conservation and Land Management

Muir, B.G. (1977). *Biological Survey of the Western Australian Wheatbelt. Part II: Vegetation and habitat of Bendering Reserve*. Records of the Western Australian Museum, Supplement No. 3

Shepherd, D.P., Beeston, G.R. and Hopkins, A.J.M. (2002). *Native Vegetation in Western Australia Extent, Type and Status. Resource Management Technical Report 249.* Department of Agriculture, Government of Western Australia

Thackway, R. and Cresswell I. D. (1995). *An Interim Biogeographical Regionalisation for Australia: a Framework for Setting Priorities in the National Reserves System Cooperative Program.* Australian Nature Conservation Agency, Canberra, ACT

Western Australian Herbarium (2011). *Florabase*. Department of Environment and Conservation. http://www.calm.wa.gov.au/science/florabase.html

APPENDIX A

Species listed alphabetically under vascular plant families

VASCULAR PLANT FAMILY	SPECIES
AIZOACEAE	**Carpobrotus edulis*
ANACARDIACEAE	**Schinus terebinthifolia*
APIACEAE	*Trachymene pilosa*
APOCYNACEAE	**Nerium oleander*
ARACEAE	*Lemna disperma*
	**Zantedeschia aethiopicum*
ASCLEPIDACEAE	**Gomphocarpus fruticosus*
ASPARAGACEAE	**Asparagus asparagoides*
	Laxmannia grandiflora
	Thysanotus manglesianus
	Thysanotus patersonii
	**Trachyandra divaricata*
ASTERACEAE	**Arctotheca calendula*
	**Cotula coronopifolia*
	**Cotula turbinata*
	**Dittrichia graveolens*
	**Hypochaeris glabra*
	Podotheca angustifolia
	Podotheca chrysantha
	Podotheca gnaphalioides
	Quinetia urvillei
	Senecio pinnatifida var. *latiloba*
	**Sonchus asper*
	**Sonchus oleraceus*
	**Ursinia anthemoides*
BORAGINACEAE	**Echium plantagineum*
BRASSICACEAE	**Raphanus raphanistrum*
CAMPANULACEAE	**Wahlenbergia capensis*
CASUARINACEAE	*Allocasuarina fraseriana*
CENTROLEPIDACEAE	*Centrolepis aristata*
COLCHICACEAE	*Burchardia umbellata*
COMMELINIACEAE	*Cartonema philydroides*
CRASSULACEAE	*Crassula colorata*
	Crassula decumbens
CYPERACEAE	**Cyperus congestus*
	**Cyperus tenellus*
	Isolepis cernua
	**Isolepis marginata*
	Isolepis oldfieldiana
	Isolepis stellata
	Lepidosperma longitudinale
	Lepidosperma pubisquameum
	Schoenus curvifolius
	Schoenus efoliatus
	Schoenus pennisetis
	Schoenus rigens

VASCULAR PLANT FAMILY	SPECIES
DASYPOGONACEAE	*Dasypogon bromeliifolius*
DILLENIACEAE	*Hibbertia racemosa*
DROSERACEAE	*Drosera erythrorhiza*
	Drosera glanduligera
EUPHORBIACEAE	**Euphorbia terracina*
	**Ricinus communis*
FABACEAE	*Acacia huegelii*
	**Acacia longifolia*
	Acacia pulchella var. *glaberrima*
	Acacia saligna
	Aotus procumbens
	Daviesia preissii
	Gompholobium tomentosum
	Jacksonia furcellata
	Jacksonia gracillima
	Jacksonia sternbergiana
	Kennedia prostrata
	**Lotus subbiflorus*
	**Lupinus angustifolia*
	**Lupinus cosentinii*
	**Medicago polymorpha*
	**Ornithopus sativus*
	Pultenaea reticulata
	**Trifolium campestre*
	**Trifolium hirtum*
FUMARIACEAE	**Fumaria capreolata*
GERANIACEAE	**Erodium botrys*
	Geranium molle
GOODENIACEAE	*Lechenaultia floribunda*
HAEMODORACEAE	*Anigozanthos humilis*
	Anigozanthos manglesii
	Conostylis aculeata
	Conostylis juncea
	Haemodorum laxum
	Haemodorum spicatum
HEMEROCALLIDACEAE	*Dianella divaricata*
IRIDACEAE	**Gladiolus caryophyllaceus*
	**Moraea flaccida*
	Patersonia occidentalis
	**Romulea rosea*
JUNCACEAE	**Juncus acutus*
	**Juncus bufonius*
	**Juncus capitatus*
	Juncus pallidus
LOBELIACEAE	*Lobelia alata*
LORANTHACEAE	*Nuytsia floribunda*

VASCULAR PLANT FAMILY	SPECIES
LYTHRACEAE	**Lythrum hyssopifolia*
MOLLUGINACEAE	*Macarthuria apetala*
MORACEAE	**Ficus carica*
MYRTACEAE	*Astartea scoparia*
	Calytrix flavescens
	**Eucalyptus robusta*
	Eucalyptus rudis subsp. *rudis*
	Eucalyptus todtiana
	Hypocalymma angustifolium
	Kunzea glabrescens
	Melaleuca preissiana
	Melaleuca rhaphiophylla
	Melaleuca teretifolia
	Melaleuca thymoides
	Melaleuca viminea
	Scholtzia involucrata
ONAGRACEAE	**Oenothera stricta*
ORCHIDACEAE	*Caladenia flava*
	Caladenia paludosa
	**Disa bracteata*
	Microtis media
POACEAE	*Amphipogon turbinatus*
	Austrostipa compressa
	**Avena barbata*
	**Briza maxima*
	**Briza minor*
	**Bromus diandrus*
	**Cortaderia selloana*
	**Cynodon dactylon*
	**Ehrharta calycina*
	**Ehrharta longiflora*
	**Eragrostis curvula*
	**Holcus lanatus*
	**Lolium multiflorum*
	Microlaena stipoides
	**Paspalum urvillei*
	**Pennisetum clandestinum*
	**Vulpia bromoides*
POLYGALACEAE	**Rumex crispus*
	**Persicaria maculosa*
PORTULACACEAE	*Calandrinia liniflora*
PROTEACEAE	*Adenanthos cygnorum*
	Banksia attenuata
	Banksia ilicifolia
	Banksia menziesii
	Stirlingia latifolia

VASCULAR PLANT FAMILY	SPECIES
RANUNCULACEAE	**Ranunculus muricata*
RESTIONACEAE	*Hypolaena exsulca*
	Lyginia barbata
SALICACEAE	**Populus nigra*
SALVINIACEAE	**Azolla filiculoides*
SOLANACEAE	**Solanum americanum*
	**Solanum nigrum*
TYPHACEAE	**Typha orientalis*
XANTHORRHOEACEAE	*Xanthorrhoea brunonis*
ZAMIACEAE	*Macrozamia riedlei*

APPENDIX B

Quadrat Data

Quadrat CS01

Location: Southern edge of site
GPS: 397671E; 6441243N
Soil Type: Dark grey sand. Flat, dampland
Vegetation Description: Open Low Woodland B of *Melaleuca preissiana* over Dense Thicket of *Kunzea glabrescens* over Open Herbs dominated by *Patersonia occidentalis* and *Drosera glanduligera*
Vegetation Condition: Good with occasional areas degraded
Notes: Consists of occasional areas of good vegetation amongst open areas. Lot of rubbish dumped

SPECIES	HEIGHT (cm)	% COVER
**Arctotheca calendula*	20	<1
**Avena barbata*	60	<1
**Briza maxima*	50	<1
Caladenia flava	40	<1
**Carpobrotus edulis*	5	<1
Crassula colorata	15	5
**Disa bracteata*	40	<1
Drosera glanduligera	10	15
**Hypochaeris glabra*	15	2
Kunzea glabrescens	400	75
**Lotus subbiflorus*	20	1
Melaleuca preissiana	300	3
Microtis media	50	<1
Patersonia occidentalis	70	3
Podotheca chrysantha	20	<1
Quinetia urvillei	10	<1

SPECIES	HEIGHT (cm)	% COVER
Schoenus rigens	70	5
**Ursinia anthemoides*	25	<1
**Vulpia bromoides*	20	1
Astartea scoparia	Opportunistic	
Austrostipa compressa	Opportunistic	
**Azolla filiculoides*	Opportunistic	
Banksia ilicifolia	Opportunistic	
Banksia menziesii	Opportunistic	
**Briza minor*	Opportunistic	
Centrolepis aristata	Opportunistic	
Crassula decumbens	Opportunistic	
**Ehrharta longiflora*	Opportunistic	
**Ehrharta calycina*	Opportunistic	
**Eragrostis curvula*	Opportunistic	
**Erodium botrys*	Opportunistic	
**Gladiolus caryophyllaceus*	Opportunistic	
Hypocalymma angustifolium	Opportunistic	
Jacksonia gracillima	Opportunistic	
**Juncus capitatus*	Opportunistic	
**Juncus bufonius*	Opportunistic	
Lemna disperma	Opportunistic	
Lepidosperma longitudinale	Opportunistic	
Lyginia barbata	Opportunistic	
**Medicago polymorpha*	Opportunistic	
Microlaena stipoides	Opportunistic	
Schoenus efoliatus	Opportunistic	
Schoenus pennisetis	Opportunistic	
**Solanum americanum*	Opportunistic	
**Solanum nigrum*	Opportunistic	
Wahlenbergia capensis	Opportunistic	
**Zantedeschia aethiopicum*	Opportunistic	

Quadrat CS02

Location: To the east of CS01
GPS: 397733E; 6441329N
Soil Type: Grey sand on a low slope
Vegetation Description: Low Forest A of *Banksia attenuata* and *Banksia ilicifolia* over Tall Grass dominated by **Ehrharta calycina* and **Ehrharta longiflora* in grey sand.
Vegetation Condition: Good
Notes: Lot of weeds especially **Ehrharta calycina* and **Zantedeschia aethiopica*. Many *Banksia* deaths

SPECIES	HEIGHT (cm)	% COVER
Acacia pulchella var. *glaberrima*	70	<1
**Arctotheca calendula*	50	1
**Avena barbata*	150	1
Banksia attenuata	600	35
Banksia ilicifolia	700	5-15
**Briza maxima*	50	5
Burchardia umbellata	100	2
Caladenia flava	30	<1
Caladenia paludosa	70	<1
**Carpobrotus edulis*	10	<1
Crassula decumbens	15	2
Dasypogon bromeliifolius	70	2

SPECIES	HEIGHT (cm)	% COVER
Dianella divaricata	70	1
Drosera erythrorhiza	5	<1
**Ehrharta calycina*	100	60
**Ehrharta longiflora*	50	15
Geranium molle	30	<1
Haemodorum spicatum	90	<1
Hibbertia racemosa	50	1
**Hypochaeris glabra*	50	<1
Hypolaena exsulca	50	<1
Isolepis cernua	10	<1
Lepidosperma pubisquameum	60	2
Lyginia barbata	70	<1
Melaleuca thymoides	100	3
Nuytsia floribunda	200	1
Patersonia occidentalis	70	1
Thysanotus manglesianus	twiner	<1
Xanthorrhoea brunonis	100	2
**Zantedeschia aethiopicum*	120	5
Allocasuarina fraseriana	Opportunistic	
**Bromus diandrus*	Opportunistic	
Eucalyptus todtiana	Opportunistic	
Kennedia prostrata	Opportunistic	
**Ornithopus sativus*	Opportunistic	
**Vulpia bromoides*	Opportunistic	

Quadrat CS03

Location: Neat the southern end of site
GPS: 397870E; 6441234N
Soil Type: Grey sandy loam, damp
Vegetation Description: Low Forest A of *Melaleuca rhaphiophylla* over Dense Herbs dominated by **Zantedeschia aethiopicum* and **Lotus subbiflorus*
Vegetation Condition: Good
Notes: Area burnt recently. Old tracks through the community were water filled

SPECIES	HEIGHT (cm)	% COVER
Acacia saligna	200	<1
**Bromus diandrus*	70	<1
Caladenia paludosa	40	5
**Carpobrotus edulis*	30	2
**Cotula coronopifolia*	25	3
Crassula decumbens	10	<1
**Cynodon dactylon*	30	1
**Cyperus tenellus*	15	3
**Ehrharta longiflora*	50	3
**Hypochaeris glabra*	90	<1
**Isolepis marginata*	10	3
Juncus pallidus	90	1
Lemna disperma	2	3
Lobelia alata	20	<1

SPECIES	HEIGHT (cm)	% COVER
**Lotus subbiflorus*	25	60
Melaleuca rhaphiophylla	600	40-60
Melaleuca teretifolia	100	<1
Patersonia occidentalis	50	<1
**Pennisetum clandestinum*	25	2
**Ranunculus muricata*	50	<1
**Romulea rosea*	20	<1
**Rumex crispus*	50	<1
**Vulpia bromoides*	60	10
**Zantedeschia aethiopicum*	100	35
**Asparagus asparagoides*	Opportunistic	
Astartea scoparia	Opportunistic	
Isolepis stellata	Opportunistic	
Jacksonia furcellata	Opportunistic	
Melaleuca preissiana	Opportunistic	
**Moraea flaccida*	Opportunistic	
**Schinus terebinthifolia*	Opportunistic	

Quadrat CS04

Location:
GPS: 397735E; 6441140N
Soil Type: Grey sandy loam
Vegetation Description: Dense Tall Grass of **Eragrostis curvula* or Tall Sedges of *Juncus pallidus* or Herbs dominated by **Moraea flaccida* and **Euphorbia terracina*
Vegetation Condition: Degraded to completely degraded
Notes: Open area surrounded to the south by good quality wetland. Many tracks through the area Rubbish dumped

SPECIES	HEIGHT (cm)	% COVER
**Arctotheca calendula*	50	1
Calandrinia liniflora	20	2
**Carpobrotus edulis*	15	25
**Cyperus tenellus*	5	40
**Dittrichia graveolens*	50	<1
**Eragrostis curvula*	150	10-90
**Isolepis marginata*	5	25
Isolepis oldfieldiana	20	15
Isolepis stellata	30	10
**Juncus bufonius*	35	15
Juncus pallidus	120	5-50
Lobelia alata	20	5
**Lolium multiflorum*	70	1
**Lotus subbiflorus*	20	40
**Moraea flaccida*	60	2-10

SPECIES	HEIGHT (cm)	% COVER
**Pennisetum clandestinum*	30	<1
**Romulea rosea*	40	10
**Vulpia bromoides*	30	25
**Bromus diandrus*	Opportunistic	
**Cortaderia selloana*	Opportunistic	
**Echium plantagineum*	Opportunistic	
**Gomphocarpus fruticosus*	Opportunistic	
**Hypochaeris glabra*	Opportunistic	
**Lythrum hyssopifolia*	Opportunistic	
Melaleuca preissiana	Opportunistic	
Melaleuca teretifolia	Opportunistic	
Melaleuca viminea	Opportunistic	
**Paspalum urvillei*	Opportunistic	
**Rumex crispus*	Opportunistic	
**Sonchus asper*	Opportunistic	

Quadrat CS05

Location: Central dune crest
GPS: 398069E; 6441322N
Soil Type: Pale grey sand. Crest of sand dune
Vegetation Description: Low Woodland A of *Banksia attenuata*, *Banksia menziesii*, *Nuytsia floribunda* and *Eucalyptus todtiana* over Heath B dominated by *Acacia pulchella* var. *glabrescens* over Tall Grass dominated by **Ehrharta calycina*
Vegetation Condition: Very good to good
Notes: Area burnt about 3 years. Numerous *Banksia* deaths. Becomes degraded above wetland to the east

SPECIES	HEIGHT (cm)	% COVER
Acacia pulchella var. *glaberrima*	150	60
Anigozanthos humilis	30	<1
Anigozanthos manglesii	70	<1
Austrostipa compressa	70	<1
Banksia attenuata	800	10
Banksia menziesii	500	5
**Briza maxima*	70	<1
Burchardia umbellata	75	1
Calytrix flavescens	30	1
**Carpobrotus edulis*	30	1
Conostylis aculeata	50	2
Crassula decumbens	15	3
**Ehrharta calycina*	150	50
**Ehrharta longiflora*	50	5

SPECIES	HEIGHT (cm)	% COVER
Eucalyptus todtiana	600	<1
**Gladiolus caryophyllaceus*	70	1
Hibbertia racemosa	50	<1
**Hypochaeris glabra*	30	1
Macarthuria apetala	20	<1
Nuytsia floribunda	600	2
**Romulea rosea*	60	1
Scholtzia involucrata	70	<1
Stirlingia latifolia	90	2
Thysanotus patersonii	t	
**Ursinia anthemoides*	70	2
**Vulpia bromoides*	35	<1
Acacia huegelii	Opportunistic	
Adenanthos cygnorum	Opportunistic	
Allocasuarina fraseriana	Opportunistic	
Amphipogon turbinatus	Opportunistic	
**Bromus diandrus*	Opportunistic	
Caladenia flava	Opportunistic	
Cartonema philydroides	Opportunistic	
Drosera erythrorhiza	Opportunistic	
**Euphorbia terracina*	Opportunistic	
Gompholobium tomentosum	Opportunistic	
Haemodorum laxum	Opportunistic	
Hypolaena exsulca	Opportunistic	
Jacksonia furcellata	Opportunistic	
Laxmannia grandiflora	Opportunistic	
Lechenaultia floribunda	Opportunistic	
Lyginia barbata	Opportunistic	
Macrozamia riedlei	Opportunistic	
Patersonia occidentalis	Opportunistic	
Podotheca angustifolia	Opportunistic	
Podotheca gnaphalioides	Opportunistic	
Schoenus curvifolius	Opportunistic	
Trachymene pilosa	Opportunistic	

Quadrat CS06

Location: In south eastern corner
GPS: Not recorded
Soil Type: Grey sand
Vegetation Description: Open Low Woodland A of *Eucalyptus todtiana* and *Melaleuca preissiana* over Low Scrub or Scrub of *Kunzea glabrescens* and *Pultenaea reticulata* over Herbs dominated by **Carpobrotus edulis* and **Lotus subbiflorus*
Vegetation Condition: Degraded
Notes: Continues to *Melaleuca rhaphiophylla* wetland to the north where there is open water

SPECIES	HEIGHT (cm)	% COVER
Astartea scoparia	90	<1
**Avena barbata*	120	5
**Carpobrotus edulis*	20	10
**Ehrharta longiflora*	70	20
**Eragrostis curvula*	120	2
Eucalyptus todtiana	1000	5
**Hypochaeris glabra*	20	1
Jacksonia gracillima	90	<1
Kunzea glabrescens	250	5
**Lotus subbiflorus*	10	15
**Lupinus cosentinii*	60	2
Melaleuca preissiana	800	5
Pultenaea reticulata	175	5
**Romulea rosea*	30	1

SPECIES	HEIGHT (cm)	% COVER
**Ursinia anthemoides*	60	1
**Vulpia bromoides*	25	10
**Zantedeschia aethiopicum*	60	2
Acacia pulchella var. *glaberrima*	Opportunistic	
Acacia saligna	Opportunistic	
**Cortaderia selloana*	Opportunistic	
**Cotula turbinata*	Opportunistic	
**Erodium botrys*	Opportunistic	
Jacksonia furcellata	Opportunistic	
Juncus pallidus	Opportunistic	
Podotheca chrysantha	Opportunistic	
**Schinus terebinthifolia*	Opportunistic	

Quadrat CS07

Location: South eastern side
GPS: 398202E; 6441083N
Soil Type: Pale grey sand
Vegetation Description: Low Woodland A of *Eucalyptus todtiana* with occasional *Banksia ilicifolia* over Open to Dense Tall Grass dominated by **Eragrostis curvula* over Herbs dominated by **Carpobrotus edulis*, **Erodium botrys*, **Lotus subbiflorus* and **Hypochaeris glabra*
Vegetation Condition: Degraded to completely degraded
Notes: Small area only

SPECIES	HEIGHT (cm)	% COVER
Acacia pulchella var. *glaberrima*	120	<1
Aotus procumbens	20	<1
**Arctotheca calendula*	20	2
**Carpobrotus edulis*	20	10
Conostylis juncea	50	<1
Crassula decumbens	5	1
Daviesia preissii	60	1
Drosera glanduligera	10	1
**Ehrharta calycina*	120	5
**Eragrostis curvula*	150	70
**Erodium botrys*	15	5
Eucalyptus todtiana	1000	5-10
**Hypochaeris glabra*	5	5
Jacksonia sternbergiana	175	<1
Kunzea glabrescens	170	1

SPECIES	HEIGHT (cm)	% COVER
**Lotus subbiflorus*	10	5
Patersonia occidentalis	100	1
**Romulea rosea*	30	1
**Ursinia anthemoides*	70	2
Allocasuarina fraseriana	Opportunistic	
Banksia ilicifolia	Opportunistic	
Dianella divaricata	Opportunistic	

Quadrat CS08

Location: On western side near Nicholson Road
GPS: 398239E; 6441348N
Soil Type: Grey sandy loam
Vegetation Description: Low Forest A of **Eucalyptus* species, possibly **Eucalyptus robusta*, *Melaleuca preissiana* and **Populus nigra* over Dense Tall Grass dominated by **Eragrostis curvula*
Vegetation Condition: Degraded
Notes: Lot of rubbish dumped. Seedlings of **Eucalyptus robusta* were abundant. In some areas **Avena barbata* has a cover up to 30% and **Bromus diandrus* a cover up to 20%

SPECIES	HEIGHT (cm)	% COVER
**Acacia longifolia*	200	<1
**Asparagus asparagoides*	twiner	1
Astartea scoparia	60	1
**Carpobrotus edulis*	10	5
**Cortaderia selloana*	200	1
**Echium plantagineum*	50	<1
**Eragrostis curvula*	150	80
**Eucalyptus robusta*	1200	35
**Ficus carica*	120	<1
Juncus pallidus	150	2
Lepidosperma longitudinale	120	2
**Lotus subbiflorus*	15	5
Melaleuca preissiana	1000	5
**Populus nigra*	1000	2
**Schinus terebinthifolia*	400	2

SPECIES	HEIGHT (cm)	% COVER
**Zantedeschia aethiopicum*	70	1-25
**Arctotheca calendula*	Opportunistic	
**Avena barbata*	Opportunistic	
**Bromus diandrus*	Opportunistic	
**Cynodon dactylon*	Opportunistic	
Eucalyptus rudis subsp. *rudis*	Opportunistic	
**Fumaria capreolata*	Opportunistic	
Juncus acutus	Opportunistic	
**Nerium oleander*	Opportunistic	
**Paspalidium urvillei*	Opportunistic	
**Romulea rosea*	Opportunistic	
**Sonchus oleraceus*	Opportunistic	
**Typha orientalis*	Opportunistic	

Quadrat CS09

Location: Next to but not adjacent to Nicholson Road
GPS: 398300E; 6441295N
Soil Type: Sandy loam
Vegetation Description: Open Tall Grass of **Avena barbata* and **Eragrostis curvula* over Dense Herbs dominated by **Lotus subbiflorus*
Vegetation Condition: Completely degraded
Notes: Common degraded area

SPECIES	HEIGHT (cm)	% COVER
Acacia saligna	100	1
**Arctotheca calendula*	25	5
**Avena barbata*	100	10
**Bromus diandrus*	90	10
**Cortaderia selloana*	200	3
**Eragrostis curvula*	100	15
Juncus pallidus	80	1
**Lotus subbiflorus*	25	80
**Lupinus angustifolia*	70	10
**Moraea flaccida*	70	1
**Populus nigra*	200	5
**Zantedeschia aethiopicum*	60	5
**Dittrichia graveolens*	Opportunistic	
Eucalyptus rudis subsp. *rudis*	Opportunistic	
Melaleuca rhaphiophylla	Opportunistic	
**Paspalum urvillei*	Opportunistic	
**Pennisetum clandestinum*	Opportunistic	
**Rumex crispus*	Opportunistic	
**Trifolium campestre*	Opportunistic	

Quadrat CS10

Location: Near Nicholson Road
GPS: 398200E; 6441342N
Soil Type: Sandy loam
Vegetation Description: Open Low Woodland A of **Melaleuca rhaphiophylla* over Open Tall Grass of **Eragrostis curvula* over Open Low Grass of **Cynodon dactylon* over Open Herbs of **Lotus subbiflorus*
Vegetation Condition: Good to degraded
Notes: At time of survey water reasonably deep

SPECIES	HEIGHT (cm)	% COVER
**Arctotheca calendula*	10	1
Astartea scoparia	80	1
**Cynodon dactylon*	50	20
**Cyperus congestus*	50	2
**Eragrostis curvula*	120	30
**Ehrharta calycina*	70	5
**Holcus lanatus*	70	<1
**Lotus subbiflorus*	50	20
Melaleuca rhaphiophylla	600	5
**Rumex crispus*	60	1
**Zantedeschia aethiopicum*	70	2
**Avena barbata*	Opportunistic	
**Lolium multiflorum*	Opportunistic	
**Persicaria maculosa*	Opportunistic	

CS11 – listing of weeds along Nicholson Road

Location: Adjacent to Nicholson Road
GPS: 398244E; 6441095N
Soil Type: Grey sand
Vegetation Description: Grass and herbaceous weeds
Vegetation Condition: Degraded
Notes:

WEEDS RECORDED
**Avena barbata*
**Bromus diandrus*
**Euphorbia terracina*
**Lolium multiflorum*
**Lupinus angustifolius*
**Lupinus cosentinii*
**Moraea flaccida*
**Oenothera stricta*
**Pennisetum clandestinum*
**Raphanus raphanistrum*
**Ricinus communis*
**Trachyandra divaricata*
**Trifolium campestre*
**Trifolium hirtum*

APPENDIX C

Maps

i Approximate location of quadrats and vegetation units
ii Vegetation Condition

Map 1. Approximate location of quadrats (red dots with white number) and vegetation units (orange areas)

Explanation of vegetation units abbreviation

Map Abbreviation	Description
Ba	Low Woodland A of *Banksia attenuata*, *Banksia menziesii*, *Nuytsia floribunda* and *Eucalyptus todtiana* over Heath B dominated by *Acacia pulchella* var. *glaberrima* over Tall Grass dominated by **Ehrharta calycina*
Bi	Low Forest A of *Banksia attenuata* and *Banksia ilicifolia* over Tall Grass dominated by **Ehrharta calycina* and **Ehrharta longiflora*
Et	Low Woodland A of *Eucalyptus todtiana* with occasional *Banksia ilicifolia* over Open to Dense Tall Grass dominated by **Eragrostis curvula* over Herbs dominated by **Carpobrotus edulis*, **Erodium botrys*, **Lotus subbiflorus* and **Hypochaeris glabra*
Mp	Open Low Woodland B of *Melaleuca preissiana* over Dense Thicket of *Kunzea glabrescens* over Open Herbs dominated by *Patersonia occidentalis* and *Drosera glanduligera*
Mr	Low Forest A of *Melaleuca rhaphiophylla* over Dense Herbs dominated by **Zantedeschia aethiopicum* and **Lotus subbiflorus*
EM	Open Low Woodland A of *Eucalyptus todtiana* and *Melaleuca preissiana* over Low Scrub A or Scrub of *Kunzea glabrescens* and *Pultenaea reticulata* over Herbs dominated by **Carpobrotus edulis* and **Lotus subbiflorus*
Er	Low Forest A of **Eucalyptus* species, possibly (**Eucalyptus robusta*), *Melaleuca preissiana* and **Populus nigra* over Dense Tall Grass dominated by **Eragrostis curvula*
Ec	Dense Tall Grass of **Eragrostis curvula*, **Paspalum urvillei* and/or **Pennisetum clandestinum* or Tall Sedges of *Juncus pallidus* or Herbs dominated by **Lotus subbiflorus*, **Moraea flaccida* and **Euphorbia terracina*

Map 2. Vegetation condition (refer to Table 5 for interpretation of rating scale)

Appendix 4 Botanical Survey Report (FVC, 2021)

ABN 25 605 804 500 www.focusedvision.com.au

MEMORANDUM

Date	10 May 2021	**Title**	Carey Baptist College, Banksia Woodland Extent and Condition
Ref	COT20001_MEM_Rev1	**Distribution**	Kristen Watts, Catherine Rea Coterra Environment
Author	Lisa Chappell Senior Environmental Scientist	**Review**	Kellie Bauer-Simpson Principal Ecologist/Environmental Manager

Background and Scope of Work

Coterra Environment (Coterra) are assisting Carey Baptist College with progressing approval to develop various areas at Lot 2 Nicholson Road, Forrestdale, for expansion of the school (**Figure 1**). A Native Vegetation Clearing Permit (NVCP) application is planned to be lodged in 2021 to further develop the campus. Bennett Environmental Consulting Pty Ltd (Bennett 2011) completed a detailed flora and vegetation assessment of the entire Lot 2 Nicholson Road during 2011, which encompasses the current study area.

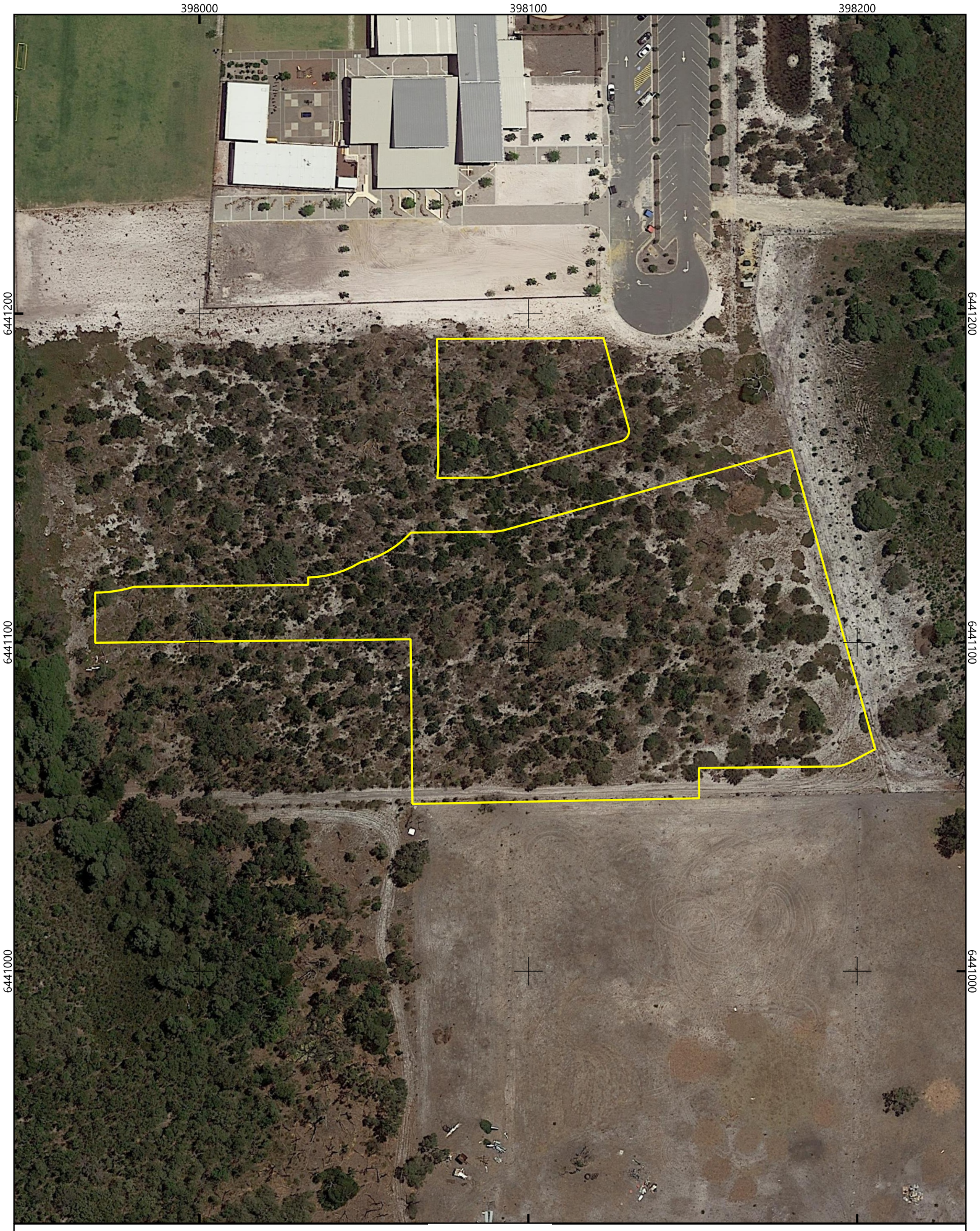
Focused Vision Consulting Pty Ltd (FVC) was commissioned by Coterra to conduct an out of season assessment to determine the condition and map the extent of Banksia Woodland under the proposed NVCP application area, south of the current school precinct.

This correspondence presents the findings of the out of season assessment of Banksia Woodland extent and condition.

Methodology

The field assessment was conducted on 15 March 2021, by Senior Botanist, Lisa Chappell to verify the extent of previously mapped Banksia Woodland (Bennet 2011) and its condition within the current NVCP application area. Only the Banksia woodland extent was mapped as part of this assessment as mapping of other vegetation units within the study area did not form part of the current scope. These areas not supporting Banksia woodland are referred to as 'unmapped' in this report. The entire area was traversed on foot and field data was collected using an electronic tablet with customised data forms and mobile spatial mapping capability, within the software program, Mappt™.

Vegetation condition was assessed and documented at various locations within the Banksia woodland within the study area using the current bushland condition scale, which is an adaptation of Keighery (1994) and Trudgen (1991), as described in EPA (2016). The spatial extent of the varying vegetation condition was prepared in the field using Mappt™ and transferred to GIS for presentation in the report.



0 15 30 45 60 m

GDA 94 / MGA Zone 50

Legend

Study Area

Figure 1 - Study Area

FOCUSED VISION consulting

COT20001 29 March 2021

Results

The study area has been previously defined by Bennett (2011) to support one vegetation unit (Ba). This vegetation unit is broadly described as a *Banksia attenuata, Banksia menziesii, Nuytsia floribunda* and *Eucalyptus todtiana* Low Woodland as summared in **Table 1**.

Table 1 - Summary of Recorded Vegetation Unit

Vegetation Unit and Description (Bennett 2011)	Study Area	
	Area (ha)	% of Study Area
Ba Low Woodland A of *Banksia attenuata*, *Banksia menziesii*, *Nuytsia floribunda* and *Eucalyptus todtiana* over Heath B dominated by *Acacia pulchella* var. *glaberrima* over Tall Grass dominated by **Ehrharta calycina*	1.29	83.04
Unmapped	0.26	16.96
TOTAL	**1.55**	**100**

The site inspection verified that this Banksia woodland is present throughout the majority of the study area as presented spatially presented in **Figure 2**. The remaining, 'unmapped' areas support vegetation that is highly modified or not Banksia woodland (e.g. Paperbark woodland).

The condition of the Banksia woodland mapped within the study area was found to range from 'Completely Degraded' to 'Good - Degraded', with the majority observed to be in 'Degraded' condition (**Table 2**, **Figure 3**). The study area supports Banksia Woodland ranging from 'Degraded - Completely Degraded' to 'Good – Degraded' condition.

Table 2 - Vegetation Condition

Vegetation Condition Rating	Study Area	
	Area (ha)	% of Study Area
Good - Degraded	0.09	5.67
Degraded	1.02	66.07
Degraded – Completely Degraded	0.18	11.30
Unmapped	0.26	16.96
TOTAL	**1.55**	**100**

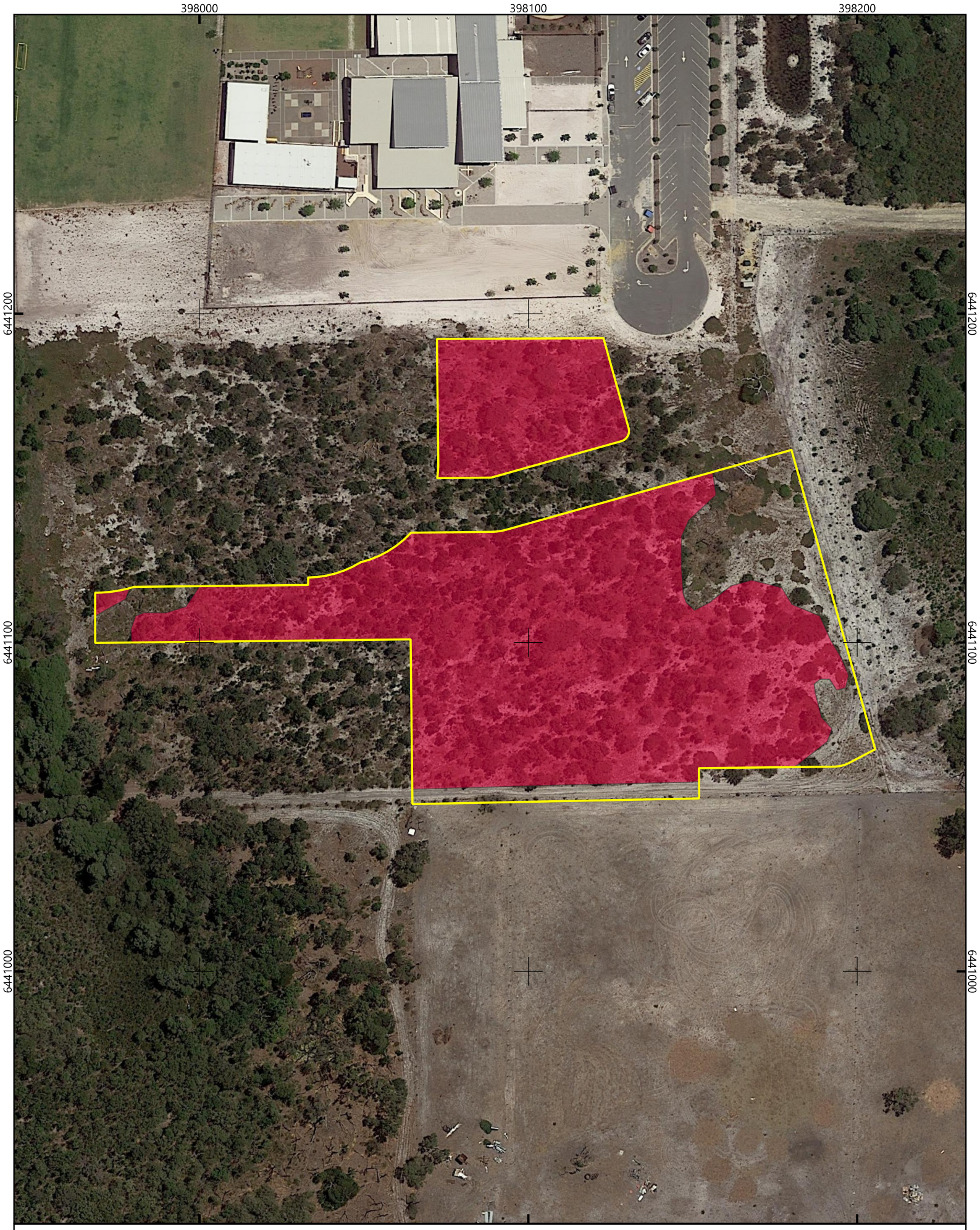


Figure 2 - Banksia Woodland Extent

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COT20001 29 March 2021

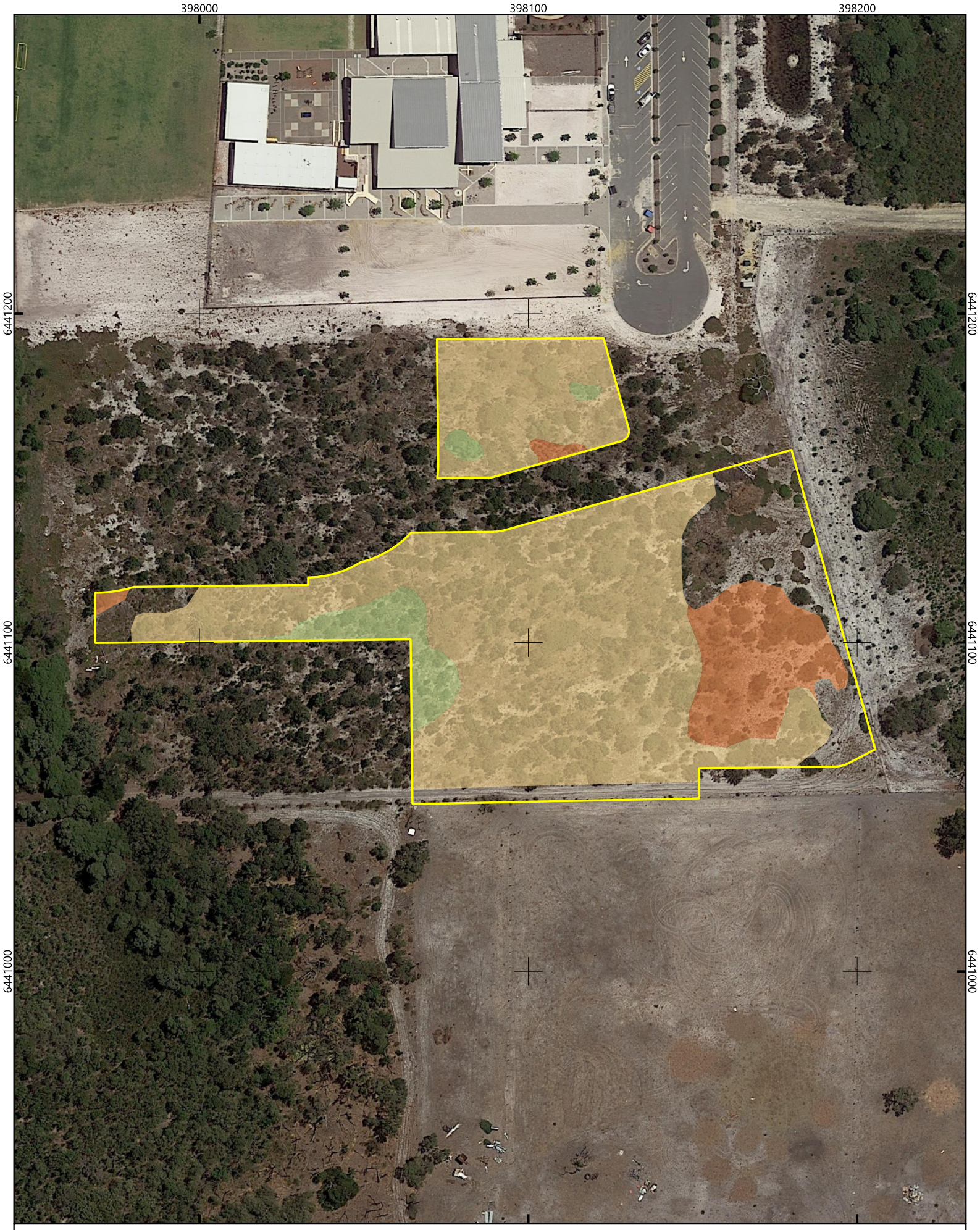

Figure 3 - Banksia Woodland Condition

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Closing

Should you require further information or clarification regarding the information provided in this memorandum, please do not hesitate to contact the undersigned.

Best Regards,
Kellie Bauer-Simpson
Director & Principal Ecologist/Environmental Manager
Focused Vision Consulting Pty Ltd

Appendix 5 Dieback Report (NPC, 2014)

***Phytophthora* Dieback Interpretation Report**

Lot 2 Nicholson Road

Forrestdale

Lot 2 Nicholson Rd Forrestdale:	**22.0 hectares**
Assessment Undertaken:	11th September 2014
Map Expiry:	6th October 2017

DIEBACK MAPPING & MANAGEMENT

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1 Introduction

1.1 Background

Dieback disease caused by the pathogen *Phytophthora cinnamomi* is a major threat to the biodiversity of south-western Australia. The spread of this water mould is facilitated by the movement of soil infested with spores, particularly under warm, moist conditions. Consequently, a major component is the strategy to constrain this disease which involves managing access and soil-disturbance activities within native vegetation. Knowledge of the occurrence of the disease in the landscape is therefore an essential prerequisite to formulating suitable hygiene management practices.

NPC Consulting has been requested by Coterra Environment to map the occurrence of *Phytophthora cinnamomi* within the property of Lot 2 Nicholson Road in Forrestdale. The Dieback assessment was undertaken on the 11th September 2014.

1.2 Location and Size of Areas

Lot 2 Nicholson Road is located south of the intersection of Nicholson and Armadale Roads in Forrestdale. The suburb of Forrestdale is located approximately 25 kilometres south of Perth. The property is fenced and gated but is accessible along the northern boundary from Nicholson Road. The property is approximately 22 hectares in size.

1.3 Historical Land Use and Past Disturbances

Lot 2 Nicholson Road is semi-rural private property. The property is situated on the Swan Coastal Plain. The vegetation in this area is generally that of Banksia woodlands. There are some remnants of Banksia woodland on the property however the majority of the property is removed of vegetation. The disturbance in the vegetation is considered moderate to high. It is possible that cattle were kept on the property in the past which has led to the absence of vegetation, particularly in the understorey. Dumping of rubbish appears to be a regular occurrence on this property.

2 Methods

2.1 Interpretation

Field interpretation followed the standard methods and operating procedures described in the document titled "*Phytophthora* Dieback Interpretation Procedures Manual' (DPaW 2014), which is a working draft.

Presence or absence was determined not only through observation but by sampling of recently-dead plant species. Non-differential, hand-held global positioning system (GPS) receivers were used for navigation and to record survey boundaries and waypoints within the areas.

2.2 Demarcation

Infested areas are demarcated using 25 or 50 mm day-glow tape with the knots facing the infestation. Uninterpretable areas are demarcated using 25 mm pink and black striped flagging tape. The excluded category is not demarcated as there is normally a clearly visible boundary between that category and others (i.e. pasture).

2.3 Soil and Tissue Sampling

Soil and tissue sample(s) associated with dead or dying plants were taken to confirm the presence or absence of the *Phytophthora sp.* These soil and plant samples were forwarded to the Vegetation Health Service (DPaW) laboratory at Kensington, where diagnostic baiting was conducted. The samples were used to as evidence for the presence of *Phytophthora cinnamomi* in the area. The sample point locations were recorded with GPS receivers. Appendix I summarizes the laboratory results of the sampling.

2.4 Mapping

The field observations, boundaries, waypoints and survey data were downloaded into a Geographic Information System from a Global Positioning System unit (GPS) to generate a map of *Phytophthora cinnamomi* occurrence for the area.

Following DPaW guidelines for determining 'Protectable Areas', boundaries were defined and provided on the Management Map to support hygiene management and planning.

2.5 Vegetation Assessment

The vegetation condition of the property was assessed. This assessment was carried out using methods based upon the condition scale from Keighery B J (1994). These methods are described in Bush Forever Vol. 2 –Directory of Bush Forever Sites.

3 Results

3.1 Disease Distribution

Phytophthora cinnamomi is present in the remnant Banksia Woodland area situated in the middle of the property. This remnant vegetation is approximately 4 hectares in size, extends from north boundary to south boundary and is moderately disturbed. Weeds and grasses are present throughout this area.

3.2 Temporarily Uninterpretable

The small area of vegetation, approximately 0.5 hectares in size, along the northern boundary at the western end of the property contains mostly mature Banksias but has no understorey. This vegetation was part of a larger area that was burnt around January 2014. Due to the fire this area is categorised as Temporarily Uninterpretable (See Glossary of Terms for definition). This category will change in 2-3 years' time, when the vegetation becomes assessable again.

3.3 Excluded

The majority of the property (17.5 hectares) is highly degraded with significant areas where the vegetation has been mostly or completely removed. In these areas weeds and grasses are present. These areas are categorised as Excluded. The Excluded area includes remnant vegetation of mostly Melaleucas scattered around the property. (See Glossary of Terms for definition). It is not possible to determine the presence or absence of the disease in Excluded areas.

3.4 Disease Expression and Impact

The disease expression is considered poor to average within the infested Banksia woodland area. There were very few recent plant deaths at the time of the assessment and as a result only 3 soil and tissue samples were taken. There were greater numbers of older indicator species deaths present. Many of them have suffered from the impact of fire if not prior to from *Phytophthora*.

The impact is variable across the Banksia woodland area. A decrease in biomass and biodiversity is the result of disturbance but may also be from the presence of *Phytophthora*. Higher disturbance and possibly higher Dieback impact areas form a mosaic across the remnant Banksia woodland area.

3.5 Vegetation Condition

Excluded sections of the property east of the Banksia woodland area to Nicholson Road and on the west side of the Banksia woodland area are predominantly 5 or 6 on the Keighrey scale. The vegetation close to the north-west corner which contains mature Banksias is considered a 4-5 whilst the Banksia woodland in the middle of the property is a 4 on the Keighrey scale.

3.6 Soil and Tissue Sampling

Three soil and root tissue samples were taken within the property. These samples were taken only from within the remnant Banksia woodland area. This

is because recent susceptible plants species deaths were present only in this area. Had there been more recent plant deaths at the time of sampling then more samples would have been taken.

The samples were taken to support field based decisions that the area is infested. Two of the three samples returned positive results for *Phytophthora cinnamomi.*

4 Recommendations

4.1 Protectable Areas

It is recommended that the area categorised as being Temporarily Uninterpretable be protected. The reasons for this are that healthy indicator species appear to be present even though current deaths are fire related and that vegetation outside of Lot 2 immediately to the north may well be free of the disease and possibly protectable. This area will become interpretable again in 2-3 years' time.

A recheck should be carried out on the Temporarily Uninterpretable area after January 2017 if operations are ongoing beyond this point but only if this area has not been cleared by this point.

Excluded areas of the property are not protectable because of the high level of historical disturbance, current use of the property and the likelihood of disease being present. The Banksia woodland area is also not protectable. This is due to the disease being present.

4.2 Hygiene Management

There is one hygiene management recommendation for all areas of the property. If BRM is to be sourced from the property it **must not** be used on or adjacent to Protectable Areas away from the property.

The hygiene management recommendations for the Temporarily Uninterpretable area are as follows:

- Clean on Entry and Exit are required (depending on direction of traffic) along the northern boundary of the property at the boundary of the Temporarily Uninterpretable area. Vehicles and machinery need to be cleaned down on entering this area.
- Machinery must be cleaned down prior to clearing this area. Machinery may be cleaned at a depot and transported to site.
- Vehicles and machinery must not traverse from Lot 2 to neighbouring properties as the presence or absence of the disease has not been determined for these areas and no hygiene management recommendations are available.

5 Discussion

5.1 Mapping

The remnant Banksia woodland area has not only experienced a change in biomass and biodiversity, particularly in the understorey and possibly from grazing but has more recently experienced fire approximately 5 years ago. From observing the deaths in the mature Banksias this fire was hot and intense and has eliminated the chronology of plant deaths that would have been present, particularly in the mid to understorey, before the fire. This chronology is generated by the autonomous movement of the disease.

Although there was poor expression and very few recent Banksia or other indicator species deaths observed during the assessment, areas of significant decrease in biomass and biodiversity were observed. Prickly Moses (*Acacia pulchella)* has taken over the understorey in the remnant Banksia woodland. This plant is not susceptible to Dieback but is thriving with a lack of competition, which may have been caused by the presence of *Phytophthora cinnamomi.*

Also, recent deaths appeared in the vegetation in the remnant Banksias after sampling was carried out and the field assessment was completed. These deaths are similar to those sampled, where positive results were retrieved. This is not unusual as spring and autumn are the best times for disease expression, with a mix of moisture and warmth ideal for sporulation of the pathogen.

All these factors suggest that the disease is present although expressing poorer within parts of the remnant Banksia woodland.

5.2 Management

The infested Banksia woodland area has not been demarcated as there is an easily observable boundary between vegetated (Infested) and non-vegetated areas (Excluded) areas. Both of these areas are not protectable and have the same requirements on hygiene management so demarcation is not required.

The Temporary Uninterpretable area has been demarcated. This is to ensure that there is a clear understanding of where this boundary is located for the benefits of accurate Clean on Entry and Exit.

There is a higher risk of the potential for disease to be present within areas that have experienced a high level of disturbance. The Excluded areas of the property are at a higher risk of being infested because of the historical and current disturbances as well as being down slope of an infested area. This is a contributing factor toward identifying Excluded areas as being not protectable.

6 Conclusion

Lot 2 Nicholson Road Forrestdale was assessed for *Phytophthora* Dieback on the 11th September 2014 and finalised on the 2nd October 2014. The property is in most part is highly degraded, has experienced a decrease in biomass and biodiversity and is categorised as Excluded. The Banksia woodland area is infested from the disease caused by *Phytophthora cinnamomi.*

Poor to average expression of the disease observed and grasses and weeds were present throughout. The impact of the disease was considered variable with significant changes in biomass and biodiversity and the greater presence of non-susceptible species in part.

A total of 3 soil and root tissue samples were taken. Two of these returned positive results for *Phytophthora cinnamomi*.

Excluded and Infested areas of the property are not protectable. The Temporarily Uninterpretable area is protectable and hygiene management recommendations apply to this area only.

If BRM is to be sourced from the property it **must not** be used on or adjacent to Protectable Areas away from the property.

A map has been prepared to show disease boundaries and hygiene information. This map is valid until 6th October 2015. No rechecks are required on Excluded or Infested areas. A recheck should be carried out on the Temporarily Uninterpretable area after January 2017 if operations are ongoing beyond this point but only of the area has not already been cleared.

7 References

Department of Parks and Wildlife, DPaW, (2014) "Phytophthora Dieback Interpretation Procedures Manual' (working draft),

Department of Conservation and Land Management (2001) Phytophthora cinnamomi and disease caused by it. Volume II Interpreter guidelines for detection, diagnosis and mapping

Botanic Gardens Trust Sydney NSW. Armillaria root Rot – fact sheet. http://www.rbgsyd.gov.au/information_about_plants/pests_diseases/fact_sheets/armillaria_root_rot

Keighery B J (1994), Bush Forever Volume 2, Directory of Bush Forever Sites (Vegetation Condition Scale).

8 Appendices

8.1 Appendix 1 - Summary of Soil and Tissue Samples

Lot 2 Nicholson Road Sample Summary

Sample No	Plant Sampled	Reference No	Result (POS, NEG)
1	*Banksia attenuata*	**E** 398 046 **N** 6441 122	POS
2	*Banksia attenuata*	**E** 398 014 **N** 6441 175	NEG
3	*Banksia attenuata*	**E** 398 059 **N** 6441 296	POS

Positive sample results are for *Phytophthora cinnamomi.*

8.2 Glossary of Terms

***Phytophthora* Dieback**; is the name given to the disease that is caused by the pathogen. There are multiple species of *Phytophthora* in the south west however it is *Phytophthora cinnamomi* that causes significant destruction in naturally vegetated areas.

Infested; areas that have been deemed by an accredited Dieback Interpreter to have plant disease symptoms consistent with *Phytophthora* Dieback.

Uninfested; areas that have been deemed by an accredited Dieback Interpreter to be free of any visible plant disease symptoms consistent with *Phytophthora* Dieback.

Uninterpretable; areas that do not contain plant species that are susceptible to *Phytophthora cinnamomi*, therefore not allowing the presence or absence of the disease *Phytophthora* Dieback to be determined.

Temporary Uninterpretable; applies to vegetated areas where there are susceptible plant species to the disease present but there has been some type of recent disturbance and determining the presence or absence of the disease is not possible. This includes fire, timber harvesting or other temporary disturbances.

Excluded; applies to areas with little or no vegetation like paddocks and other cleared areas. These areas are identifiable from aerial photographs. The presence or absence of the disease in these areas is also unknown.

Protectable Area; are areas of native vegetation that are disease free or uninterpretable, of a certain size or that will not become infested in the short to midterm. Hygiene management applies to Protectable Areas.

Pathogen; is an organism or other factor that causes disease within a host plant.

Disease; is a combination of a pathogen, host and correct environmental conditions which results in disease symptoms or death of a host.

Environment; is the sum of all external factors which act on an individual organism in its lifetime.

***Phytophthora* Occurrence Map**; is the map produced by the Dieback interpreter (surveyor/assessor) which indicates the boundaries of the categories of Dieback.

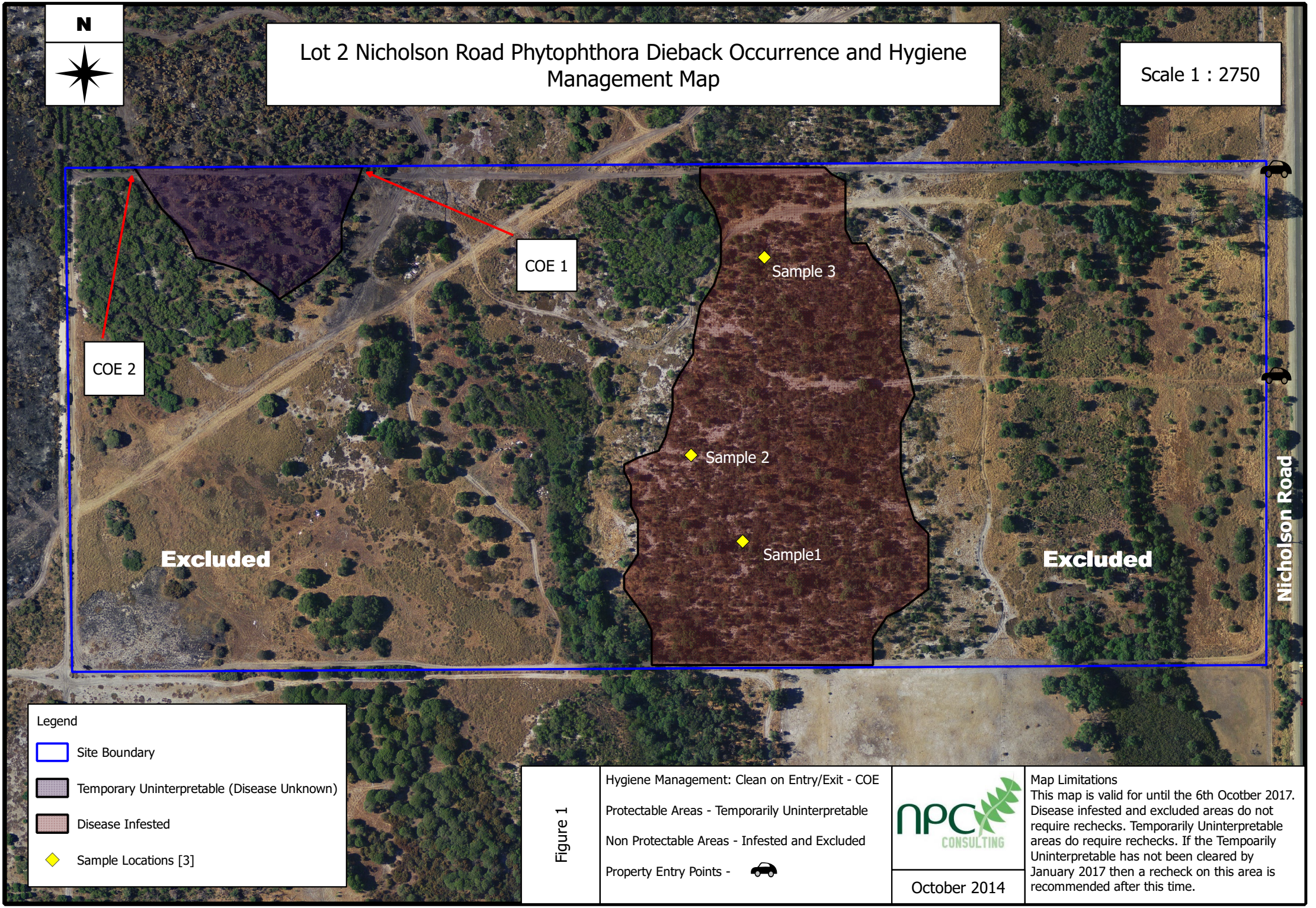
***Phytophthora* Hygiene Management Plan/Map**; is the document/map produced by the Dieback interpreter (surveyor/assessor) which indicates all the relevant hygiene recommendations for a particular area.

Dry soil access; is any access along tracks or operations that are undertaken during the drier months of the year. During these times the risk spread of the disease is minimal.

Susceptible species; refers to plants which will not survive as a result of being infected with the pathogen.

Indicator Species Deaths; is a plant death from a species of plant that is susceptible to the disease and therefore indicates the diseases presence.

Basic Raw Material (BRM); refers to the raw material in the form of rock, gravel, limestone and sand that is sourced from the ground.


N
Lot 2 Nicholson Road Phytophthora Dieback Occurrence and Hygiene Management Map
Scale 1 : 2750
COE 1
COE 2
Sample 3
Sample 2
Sample1
Excluded
Excluded
Nicholson Road
Legend
Site Boundary
Temporary Uninterpretable (Disease Unknown)
Disease Infested
Sample Locations [3]
Figure 1
Hygiene Management: Clean on Entry/Exit - COE
Protectable Areas - Temporarily Uninterpretable
Non Protectable Areas - Infested and Excluded
Property Entry Points -
NPC CONSULTING
October 2014
Map Limitations
This map is valid for until the 6th Ocotber 2017. Disease infested and excluded areas do not require rechecks. Temporarily Uninterpretable areas do require rechecks. If the Tempoarily Uninterpretable has not been cleared by January 2017 then a recheck on this area is recommended after this time.

Appendix 6 Revegetation Plan

COTERRA
ENVIRONMENT

Revegetation Plan

Carey Baptist College (Stage 4)

Revision 0 July 2023

CALIBRE | COMMITMENT | COLLABORATION

This report was prepared by: Coterra Pty Ltd trading as COTERRA ENVIRONMENT
ABN: ABN: 92 143 411 456
Our Ref: CBCFOR27
Author(s): C. Norman
Reviewer: K. Watts
Report Version: Revision 0
Date: July 2023

This report was prepared for:

Carey Baptist College
51 Wright Road
Harrisdale WA 6112

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Figure 1 Revegetation Areas 2023

1 Introduction

1.1 Background

Carey Baptist College Forrestdale campus is located at Lot 2 (540) Nicholson Road, Forrestdale. An aerial photograph of the site is provided in Plate 1-1.

Plate 1-1: Aerial Photograph

Source: Landgate, 2023

1.2 Stage 4 Clearing Area

Clearing is required to facilitate the construction and associated bushfire protection requirements for the Stage 4 portion of the Carey Baptist College Forrestdale campus. The size of the clearing area is 2.015 ha. The location of the clearing area is highlighted on Plate 1-2.

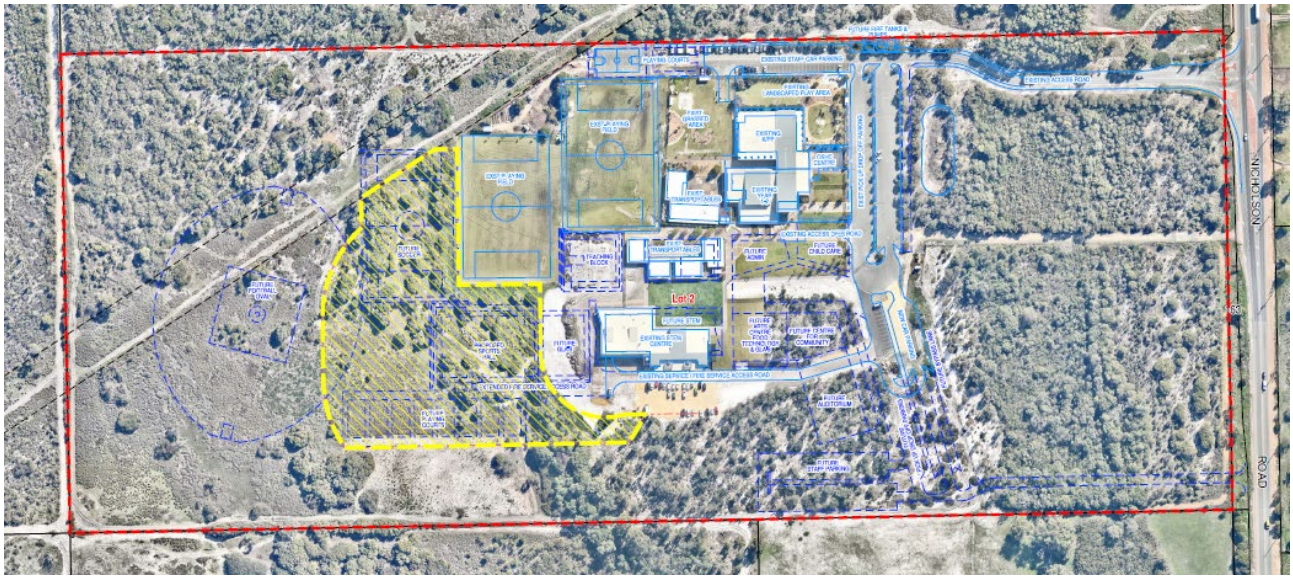

Plate 1-2: Proposed Clearing Area

1.3 Purpose of this Report

This Revegetation Plan has been prepared to outline the proposed revegetation and vegetation management works associated with the Stage 4 clearing area.

This Revegetation Plan has been designed based on previous plans prepared for other stages in the Carey Baptist College development.

2 Stage 4 Development Area Overview

A summary of the environmental features of the Stage 4 development area is provided below. A more detailed description is available within the NVCP Supporting Information report (Coterra Environment, 2023).

2.1 Topography

Topography within the proposed clearing area is flat and is approximately 25 m Australian Height Datum (m AHD).

2.2 Geology and Soils

The clearing area contains the following geology and soil types, as described by Jordan (1986):

- Thin Bassendean Sand over Guildford Formation (S10): 'very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted of eolian origin'
- Peaty Sands (SP1): 'greyish brown, medium-grained quartz, moderately well sorted, variable organic content, of lacustrine origin.'

The Department of Primary Industry and Regional Development (DPIRD) mapped soils within the proposed clearing area are Bassendean B1 phase (212Bs_B1) and Bassendean B4 phase (212Bs_B4). These units are described below.

Table 2-1: Land Systems

Mapping Units	Land System	Description
212Bs_B1	Bassendean B1 Phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant
212Bs_B4	Bassendean B4 Phase	Broad poorly drained sandplain with deep grey siliceous sands or bleached sands, underlain at depths generally greater than 1.5 m by clay or less frequently a strong iron-organic hardpan

Source: DPIRD, 2023

2.3 Hydrology

The maximum groundwater level in this location is approximately 24 to 25 mAHD (DWER, 2023), which equates to 1 to 2 m below ground level within the proposed clearing area. Minimum groundwater levels range from 21 to 22mAHD (DWER, 2023). Groundwater flow direction is easterly toward Forrestdale Lake (located over 1 km east of the proposed clearing area).

The Department of Biodiversity, Conservation and Attractions (DBCA) geomorphic wetland dataset for the Swan Coastal Plain maps one Multiple Use Wetland (MUW) within the eastern portion of the site, including part of the proposed clearing area (Plate 2-1).

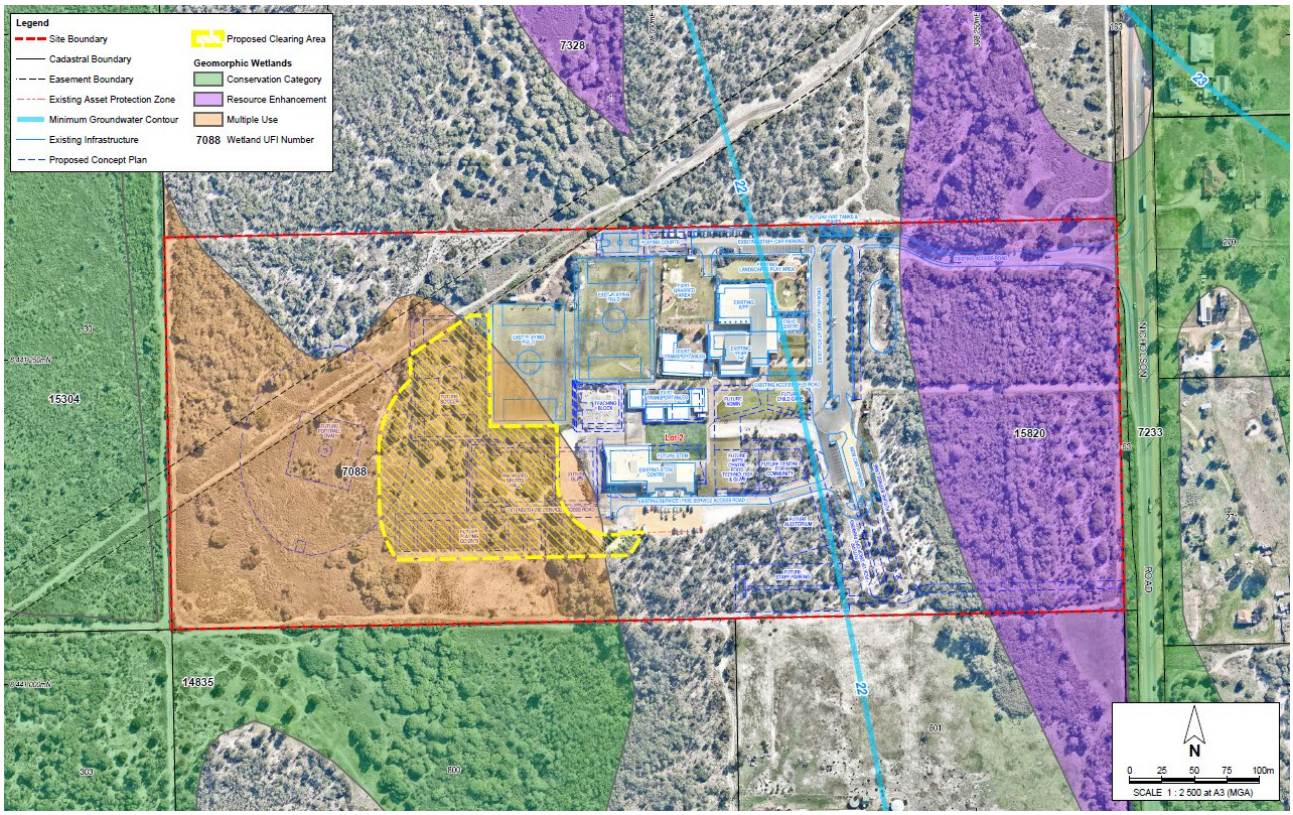

Plate 2-1: Hydrological Features

2.4 Flora and Vegetation

Vegetation at the site is identified to be part of the Southern River vegetation complex which is described as 'Open woodland of *Corymbia calophylla- Eucalyptus marginata- Banksia* spp with fringing woodland of *E. rudis – Melaleuca rhaphiophylla* along creek beds' (Heddle et al., 1980).

A Level 2 Flora and Vegetation Survey was completed by Bennett Environmental Consulting (2011) for the entire site in October 2011. This survey has been submitted to DWER with a reference number of IBSA-2023-0334. The vegetation units identified in this survey which are located within the clearing area (Plate 2-2) are as follows:

Table 2-2: Vegetation Units

Vegetation Unit	Description	Extent within Clearing Footprint
Ba	Low Woodland A of *Banksia attenuata, Banksia menziesii, Nuytsia floribunda* and Eu*calyptus todtiana* over Heath B dominated by *Acacia pulchella* var. *glaberrima* over Tall Grass dominated by **Ehrharta calycina* in grey sand	0.033 ha
Ec	Dense Tall Grass of **Eragrostis curvula*, **Paspalum urvillei,* and/or **Pennisetum clandestinum* or Tall Sedges of *Juncus pallidus* or Herbs dominated by **Lotus subbiflorus, *Moraea flaccida* and **Euphorbia terracina* in damp grey sand	1.078 ha
Mr	Low Forest A of *Melaleuca rhaphiophylla* over Dense Herbs dominated by **Zantedeschia aethiopicum* and **Lotus subbiflorus* in very damp grey sand	0.904 ha

The condition of vegetation within the proposed clearing footprint based on the Level 2 survey (BEC, 2011) (Plate 2-3) is as follows:

- Very Good-Good – 0.03 ha (1.6% of clearing footprint)
- Good – 0.69 ha (33.2% of clearing footprint)
- Degraded-Completely Degraded- 1.21 ha (60.2% of clearing footprint)
- Completely Degraded – 0.10 ha (5.0% of clearing footprint)

In March 2021, Focused Vision Consulting (FVC) undertook an assessment of a targeted area of Banksia woodland vegetation within Lot 2 to update the condition mapping and identify if this was likely to represent the Banksia Woodland of the Swan Coastal Plain Priority Ecological Community (PEC).This survey did not encompass the area proposed to be cleared under this application but does include the connected Banksia Woodland area to the east. This survey has previously been submitted to DWER as part of the CPS 9928/1 permit assessment with an IBSA reference number of IBSA-2022-0355. This survey identified that the condition of the banksia woodland patch to the connected to east of the clearing area was predominately in degraded condition (FVC, 2021).

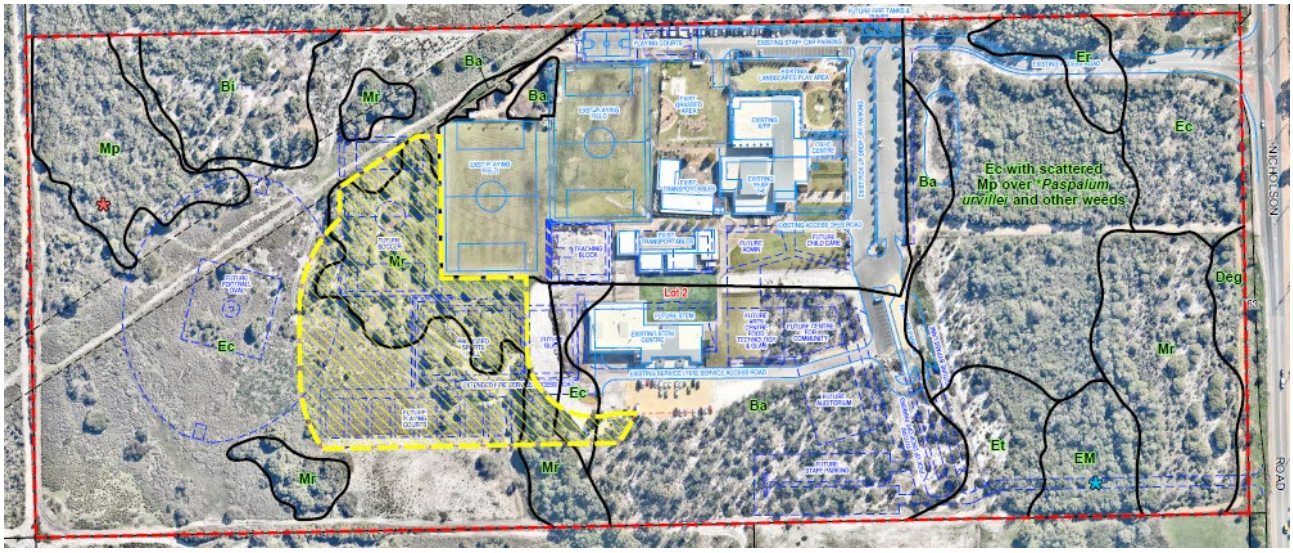

Plate 2-2: Vegetation Units

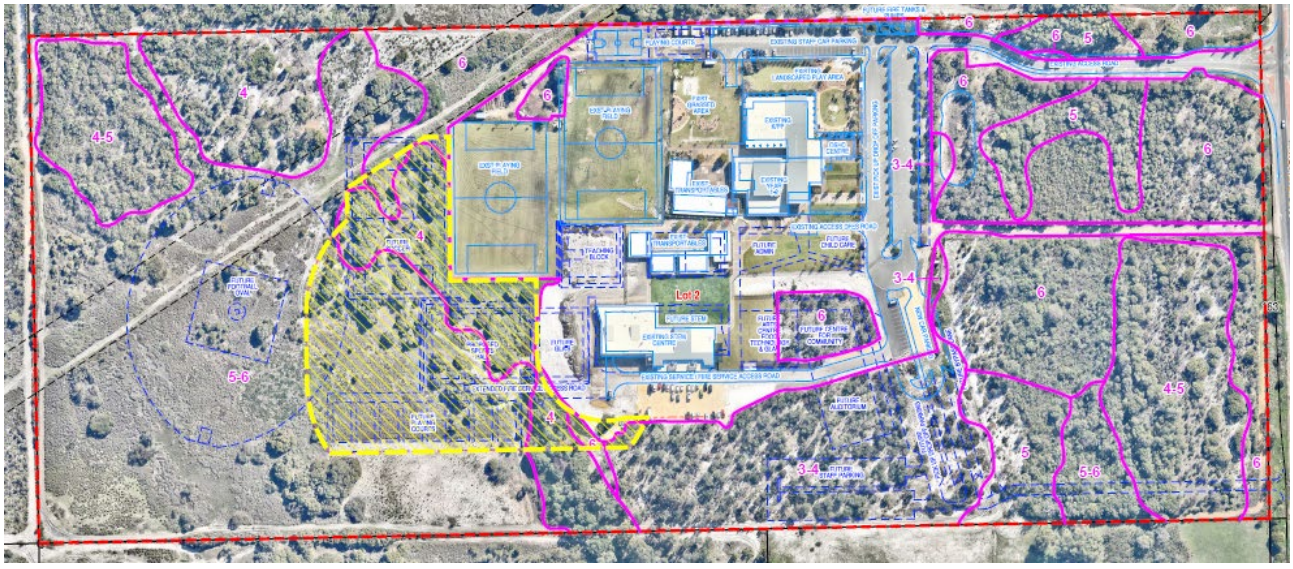

Plate 2-3: Vegetation Condition

The key features of the vegetation units within the clearing extent as identified through vegetation survey plot data is summarised on Table 2-3.

Table 2-3: Quadrat vegetation composition

Vegetation Unit	Total native Species	Native species density (species/m^2)	Opportunistic native species	Total weed species	Weed species density (species m^2)	Opportunistic weed species	Weeds with >2% cover
Mr (Quadrat 3)	9	0.09	4	15	0.15	3	9
Ec (Quadrat 4)	5	0.05	3	13	0.13	9	9
Ba (Quadrat 5)	17	0.17	20	9	0.09	2	4

Source: BEC, 2011

For the Ba vegetation unit plot data relating to black cockatoo habitat is summarised below.

- Species which provide black cockatoo habitat opportunities:
  - *Banksia attenuata* – 10% cover
  - *Banksia menziesii* – 5% cover
  - *Eucalyptus todtiana* - <1% cover
  - *Jacksonia furcellata* – opportunistic observation

A 15% coverage of species offering black cockatoo habitat species represents approximately 0.0049 ha of the Ba clearing area extent.

3 Clearing

Clearing will comprise 0.033 ha from the Ba vegetation unit and 1.98 ha of vegetation from the Mr and Ec vegetation units (Table 3-1).

Table 3-1: Extent of Clearing

Vegetation type	Vegetation unit	Clearing extents
Dryland vegetation	Banksia Woodland (Ba vegetation unit)	Area: 0.033 ha Existing condition: 'Very Good-Good' (BEC, 2011)
Wetland/mesic vegetation	Melaleuca Woodland (Mr vegetation unit)	Area: 0.904 ha Existing condition: 'Good' and 'Completely Degraded' (BEC, 2011)
	Dense Tall Grass dominated by weed species (Ec vegetation unit)	Area: 1.078 ha Existing condition: 'Completely Degraded-Degraded' and 'Completely Degraded' (BEC, 2011)

4 Revegetation Program

Revegetation areas comprise wetland management areas and revegetation areas to compensate for impacts associated with clearing proposed for the Stage 4 development works.

4.1 Vision and Objectives

The vision for the revegetation works is to improve the ecosystem quality and the amenity of revegetation areas through:

- Revegetation areas becoming sustainable with minimal management
- Revegetation areas achieving the target vegetation type and conditions outcomes
- Wetland management to improve the quality and condition of onsite retained wetland environments

The overall objective of the revegetation and rehabilitation program is to establish and protect 0.08 hectares (ha) of Carnaby's Black Cockatoo foraging habitat and to undertake management of a future 1.25 ha of retained wetland and vegetation areas onsite.

4.2 Area Proposed for Revegetation

4.2.1 Clearing of Banksia Woodland Offset

The DWER Environmental Offset Calculator (DAWE, 2012) has been used to identify the revegetation areas for the clearing of 0.033 ha of Ba vegetation to address potential loss of habitat for black cockatoos, including Carnaby's Black Cockatoo. Based on the calculator the revegetation area required to address the Ba vegetation unit offset requirements is 0.08 ha (Table 4-1).

It is proposed to undertake revegetation works incorporating key foraging species for Carnaby's Black Cockatoos, within mesic vegetation areas onsite.

Table 4-1: Offset calculation results

Revegetation Area (ha)	Percentage contribution to offset requirements	Description
0.08	100%	REVEGETATION and protection of completely degraded landscape from condition 1 (Completely Degraded to Degraded) to condition 5 (Good to Very Good). The revegetation planting will include species which provide Carnaby's Black Cockatoo foraging opportunities.

The location of the proposed onsite revegetation area is shown on Figure 1.

4.2.2 Wetland Management

The clearing of 1.98 ha of wetland/mesic vegetation (Mr and Ec vegetation units) will be compensated through the undertaking of wetland management including weed control activities within 1.25 ha of retained wetland and vegetation areas onsite. This is consistent with the approach approved for the previous clearing permits for the site (e.g., CPS 8768/1).

It is proposed that weed control works (1.25 ha) are undertaken within the Mp vegetation unit in the north-western corner of the site and the Mr vegetation units on the southern boundary of the site (Figure 1).

4.3 Suitability to address Clearing Impacts

4.3.1 Clearing of Ba vegetation unit

The clearing proposal will result in removal of 0.033 ha of 'good' to 'very-good' condition Banksia woodland which may provide foraging opportunities for black cockatoos. The revegetation proposed will create/protect 0.08 ha of additional good to very good quality vegetation including species which will provide both foraging and roosting opportunities.

Based on the banksia cover within the onsite Ba vegetation unit (15%) this would equate to a potential habitat extent of 0.0049 ha (i.e. 15% of 0.033 ha) which is to be removed. In order to ensure no net loss of potential habitat the revegetation area would need to ensure a minimum of 0.0049 ha cover for potential foraging species which equates to approximately 6% cover within this area (i.e. 0.0049 ha out of 0.08 ha).

It is proposed to increase the cover to 10% (0.008 ha) of black cockatoo foraging species within the revegetation area rather than just replacing what will be removed. In addition, the species proposed will also provide roosting opportunities once mature which the Banksia woodland does not currently provide.

The tree species which have been identified to assist to increase canopy coverage within the revegetation area with potential Carnaby's Black Cockatoo foraging value include:

- *Corymbia calophylla* (Marri) – Canopy spread of 8 m (50 m^2)
- *Eucalyptus marginata* (Jarrah) – Canopy spread of up to 35 m (960 m^2)
- *Eucalyptus todtiana* (Coastal Blackbutt) – Canopy spread of 5-10 m (20 – 80 m^2)
- *Eucalyptus rudis (Flooded Gum) – Canopy spread 12m (113m^2)*
- *Banksia attenuata* (Candlestick banksia) – Canopy spread of 8 m (50 m^2)
- *Banksia ilicifolia* (Holly-Leaf Banksia) – canopy Spread of 8 m (50 m^2)
- *Banksia menziesii* (Firewood banksia) – canopy spread of up to 8 m (50 m^2)
- *Banksia littoralis – tree is approximately 3-10m width when mature (assume an average canopy coverage of 33m^2)*

Width information sourced from:

- City of Wanneroo Tree species list (https://www.wanneroo.wa.gov.au/consultations/downloads/586c8c54dfd44.pdf)

To achieve 10% coverage within the revegetation area, the required density of the above species has been calculated and outlined on Table 4-2.

Table 4-2: Stem Density to achieve 10% coverage

Species	Canopy Radius (m)	Canopy Area (m^2)	Stem Density to achieve 10% canopy coverage (stems/ha)
Corymbia calophylla	4	50.27	19.89
Eucalyptus marginata	17.5	962.11	1.04
Eucalyptus todtiana	2.5	19.63	50.93
Eucalyptus rudis	6	113.10	8.84
Average of the Corymbia & Eucalypt species above			**20.2**

Species	Canopy Radius (m)	Canopy Area (m^2)	Stem Density to achieve 10% canopy coverage (stems/ha)
Banksia attenuata *Banksia ilicifolia* *Banksia menziesii*	4	50.27	19.89
Banksia littoralis	3 – 10 (use 6.5)	33	30.14

Based on the above, the planting numbers within the 0.08ha revegetation area which would be required to achieve or exceed the necessary coverage (0.008 ha) are:

- Marri – 2 trees (i.e. 2 x 50m^2 = 0.010 ha); or
- Flooded Gum – 1 tree (i.e. 1 x 113m^2 = 0.011 ha); or
- *B. attenuata* / *B ilicifolia* / *B menziesii*– 2 trees (i.e. 2 x 50m^2 = 0.0010 ha); or
- *B littoralis* – 3 trees (i.e. 3 x 33m^2 = 0.0099 ha)

4.3.2 Clearing of Ec and Mp vegetation units

The clearing of 1.98 ha of wetland/mesic vegetation (Mr and Ec vegetation units) will be compensated through the undertaking of wetland management including weed control activities within 1.25 ha of retained wetland areas onsite. This is consistent with the approach approved for previous clearing permits for the site (e.g. CPS 8768/1).

The proposed 1.25 ha wetland management areas within the of Mp and Mr vegetation units are shown on Figure 1. The mapped condition of these areas is 'Good', 'Good-Degraded' and 'Degraded-Completely Degraded'.

4.4 Revegetation Methodology – Ba unit offset area

Similar to approved revegetation plans for previous stages of the Carey Baptist College development, the following methodology outlines works to be undertaken for the Stage 4 development.

4.4.1 Access Management

Targeted fencing will be installed to prevent unauthorised or inadvertent access to revegetation areas, using similar fencing to that provided in Stage 1 (Plate 4-1). Access points will be provided within the fencing to facilitate vehicle entry into the revegetation area for management and maintenance purposes.

Plate 4-1: Stage 1 Revegetation Area fencing

4.4.2 Weed Control

Weeds are prevalent across much of the degraded areas of the site. African Lovegrass (**Eragrostis curvula*) and **Lotus subbiflorus* (Hairy Bird's-Foot Trefoil) are the main weeds present within the revegetation areas.

Targeted weed control will be undertaken within the revegetation areas. Weed control within these areas will be undertaken via spot-spraying with a grass selective herbicide such as fusillade, or other method as suitable to the target species identified at the site. A dye will be added to any herbicide mixture applied at the site to enable areas of application to be clearly identified (Plate 4-1).

Weed control will be ongoing at least twice annually for three years (i.e. 2025 to 2028), or until the performance criteria have been achieved within the revegetation areas identified Table 4-5.

4.4.3 Species Selection and Sourcing

Revegetation species will include a selection of species that occur naturally on site and/or species that provide use for Carnaby's Black Cockatoo including species listed Table 4-3. Stock of these species for use in the planting program will either be from onsite seed resources previously collected from the site or purchased from an accredited dieback-free commercial supplier.

Table 4-3: Revegetation Species List

Species	Growth Form	Upland Habitat	Lowland / Wetland Habitat	Used by Carnaby's Black Cockatoo
Acacia huegelii	Shrub	Y		
Acacia pulchella	Shrub	Y		
Acacia salinga	Tree/Shrub	Y	Y	Y
Adenanthos cygnorum	Shrub	Y		
Allocasuarina fraseriana	Tree	Y		
Anigozanthos humilis	Herb	Y		

Species	Growth Form	Upland Habitat	Lowland / Wetland Habitat	Used by Carnaby's Black Cockatoo
Anigozanthos manglesii	Herb	Y		
Aotus procumbens	Shrub		Y	
Astartea scoparia	Shrub		Y	
Banksia attenuata	Tree	Y		Y
Banksia grandis	Tree	Y		Y
Banksia ilicifolia	Tree	Y	Y	Y
Banksia littoralis	Tree		Y	Y
Banksia menziesii	Tree	Y		Y
Banksia sessilis	Shrub	Y		Y
Baumea juncea	Sedge		Y	
Bolboschoenus caldwellii	Sedge		Y	
Callistemon phoeniceus	Shrub	Y	Y	Y
Callitris acuminata	Shrub	Y	Y	Y
Callitris pyramidalis	Shrub	Y	Y	Y
Conostylis aculeata	Herb	Y	Y	
Conostylis juncea	Herb	Y		
Corymbia calophylla	Tree	Y	Y	Y
Daviesia preissii	Shrub	Y		
Dianella divaricata	Herb	Y	Y	
Eucalyptus marginata	Tree	Y		Y
Eucalyptus rudis	Tree		Y	Y
Eucalyptus todtiana	Tree	Y		Y
Gahnia trifida	Sedge		Y	
Gompholobium tomentosum	Shrub	Y		
Haemodorum laxum	Herb	Y		
Haemodorum spicatum	Herb	Y		
Hakea prostrata	Shrub	Y		Y
Hakea ruscifolia	Shrub	Y		Y
Hakea varia	Shrub		Y	Y
Hibbertia racemosa	Shrub	Y	Y	
Hypocalymma angustifolium	Shrub	Y	Y	
Isolepis cernua	Rush / sedge		Y	
Jacksonia furcellata	Shrub	Y		Y
Jacksonia sternbergiana	Shrub	Y		

Species	Growth Form	Upland Habitat	Lowland / Wetland Habitat	Used by Carnaby's Black Cockatoo
Juncus pallidus	Rush / sedge		Y	
Kennedia prostrata	Shrub	Y		
Kunzea glabrescens	Shrub		Y	
Lechenaultia floribunda	Shrub	Y	Y	
Leptocarpus canus	Rush / sedge		Y	
Melaleuca preissiana	Tree		Y	
Melaleuca rhaphiophylla	Tree		Y	
Melaleuca teretifolia	Shrub		Y	
Melaleuca thymoides	Shrub		Y	
Melaleuca viminea	Shrub		Y	
Patersonia occidentalis	Herb	Y	Y	
Pericalymma ellipticum	Shrub		Y	
Pultenaea reticulata	Shrub		Y	
Regelia ciliata	Shrub		Y	
Regelia inops	Shrub	Y	Y	
Stirlingia latifolia	Shrub	Y		
Xanthorrhoea brunonis	Shrub	Y		
Xanthorrhoea preissii	Tree/Shrub	Y	Y	Y

4.4.4 Plant Densities and Establishment

Planting onsite will utilise seed collected from the site or purchased tubestock. Planting is proposed to commence in the 2025 planting season (optimal planting timing is May-June).

The aim of the planting program will be to achieve an average plant density of between 1 to 2 stems/m^2 based on the existing vegetation and any additional supplementary planting undertaken. The planting mix will include a minimum number of black cockatoo habitat trees as identified in Section 4.3).

Where direct seeding is undertaken, methodology involves:

- seeding would occur during the optimal seeding timeframe of April-June
- seeds would be prepared and installed to meet the requirements of each specific species
- direct seeding rates may be up to 3 kg/ha, depending upon the presence of existing vegetation and the species mix.

4.5 Wetland Management Methodology

Weed presence has been recorded within the Mp and Mr vegetation units which are proposed for management onsite. Weed presence in these areas is summarised on Table 4-4.

Table 4-4: Weed Species

Species	Vegetation Type (% cover)				Ecological Impacts		Invasiveness
	Mp (Quadrat CS01)	Mr (Quadrat CS03)	Mr (Quadrat CS04)	Ba (Quadrat CS05)	Level of Impact	Impact Attributes	Rate of Dispersal
**Arctotheca calendula*	<1		1		H	8,9	R
**Avena barbata*	<1				H		R
**Briza maxima*	<1			<1	U		R
**Briza minor*	Op				U		R
**Bromus diandrus*		<1	Op	Op	H		R
**Carpobrotus edulis*	<1	2	25	1	H	8,9	R
**Cortaderia selloana*			Op		H	1,6,7,8,9	R
**Cotula coronopifolia*		3			U		R
**Cotula turbinata*					L		M
**Cynodon dactylon*		1			H	9	R
**Cyperus tenellus*		3	40		L		U
**Disa bracteata*	<1				U		R
**Dittrichia graveolens*			<1		M		R
**Echium plantagineum*			Op		H	Increasing	R
**Ehrharta calycina*	Op			50	H	1,2,6,8,9	R
**Ehrharta longiflora*	Op	3		5	H	1,2,6,8,9	R
**Eragrostis curvula*	Op		10-90		H		R
**Erodium botrys*	Op				U		M
**Euphorbia terracina*				Op	H	8,9	R
**Gladiolus caryophyllaceus*	Op			1	H		R
**Gomphocarpus fruticosus*			Op		H	9	R
**Hypochaeris glabra*		<1	Op	1	H		R
**Isolepis marginata*		3	25		U		U
**Juncus bufonius*	Op		15		U		R
**Juncus capitatus*	Op				U		R
**Lolium multiflorum*			1		Not listed		
**Lotus subbiflorus*	1	60	40		U		R
**Lythrum hyssopifolia*			Op		M		R
**Medicago polymorpha*	Op				L		

Species	Vegetation Type (% cover)				Ecological Impacts		Invasiveness
	Mp (Quadrat CS01)	Mr (Quadrat CS03)	Mr (Quadrat CS04)	Ba (Quadrat CS05)	Level of Impact	Impact Attributes	Rate of Dispersal
**Moraea flaccida*		Op	2-10		H	8,9	R
**Paspalum urvillei*			Op		H		M
**Pennisetum clandestinum*		2	<1		H		S
**Ranunculus muricata*		<1			L		U
**Romulea rosea*		<1	10	1	U		R
**Rumex crispus*		<1	Op		U		R
**Solanum americanum*	Op				U		R
**Solanum nigrum*	Op				M		R
**Sonchus asper*			Op		U		R
**Ursinia anthemoides*	<1			2	U	Increasing	R
**Vulpia bromoides*	1	10	25	<1	H		R
**Zantedeschia aethiopicum*	Op	35			H	6,7,8,9,10	R

Targeted weed control will be undertaken within the identified wetland/mesic vegetation management areas. Weed control within these areas will be undertaken via spot-spraying with a grass selective herbicide such as fusillade, or other method as suitable to the target species identified at the site. A dye will be added to any herbicide mixture applied at the site to enable areas of application to be clearly identified (Plate 4-1).

Weed control will be ongoing at least twice annually for three years (i.e. 2025 to 2028), or until the performance criteria have been achieved within the revegetation areas identified Table 4-5.

4.6 Performance Targets

The program will achieve a 'Good-Very Good' (DWER level 5) condition level within the revegetation and rehabilitation areas.

The following quantitative completion criteria have been identified for revegetation works, which are consistent with SMART principles (specific, measurable, achievable, relevant, time-bound) to confirm this level has been achieved.

Baseline floristic data has been obtained from the Banksia Woodland (Ba unit) area survey data (BEC, 2011).

Table 4-5: Completion Criteria

Characteristic	Measure	Baseline floristic data	Completion Target	Completion Criteria
			Vegetation in Good to Very Good condition as per Keighery (1994)	
Ba unit offset area				
A. Species richness	i. Total species richness (site)	27 species (trees, shrubs and herbs) have been recorded in Ba vegetation type	Minimum of 60% native species, based on baseline data, including any existing vegetation	Minimum of 16 species (trees, shrubs and herbs) to be present in the revegetation areas, including any existing vegetation
B. Species density	i. Total	Information not previously recorded. An average plant density of 2 plants/m^2 in Banksia woodland environments is used as the baseline measure.	Minimum of 60% stems/ha, based on baseline data, including any existing vegetation	Minimum of 1.2 stem/m^2 on average across all dryland revegetation area, including any existing vegetation
C. Black Cockatoo habitat	i. Species Diversity	4 of the 37 native species recorded in the Banksia vegetation are identified to provide black cockatoo habitat opportunities.	Equal or exceed species richness of reference site providing black cockatoo foraging habitat, including any existing vegetation.	A minimum of 4 species which provide Black Cockatoo habitat opportunities are present across all dryland revegetation areas, including any existing vegetation
	ii. Species Density	The percentage cover of species providing black cockatoo habitat opportunities recorded in the Banksia vegetation was 15% which equates to 0.0049 ha potential habitat to be cleared.	Replace greater than 0.0049 ha black cockatoo foraging habitat when plans are mature. In order to achieve this minimum cover of 0.008 ha black cockatoo foraging habitat to be set as the target.	A minimum of 2 plants from the species listed on Table 4-3 to be present within the 0.08 ha revegetation area, including existing vegetation.
D. Weed Cover	i. General weed species	Weeds observed in the clearing area reference site were generally competitive species. The highest weed cover recoded was: • *Ehrharta calycina* (50% cover) • *Ehrharta longiflora* (5% cover) • *Ursinia anthemoides* (2% cover).	Reduction in weed cover lower than reference site	Maximum of 15% weed cover

Characteristic	Measure	Baseline floristic data	Completion Target	Completion Criteria
			Vegetation in Good to Very Good condition as per Keighery (1994)	
		Total coverage of all weed was 61%.		
	ii. Declared weeds	No declared weeds were present onsite.	No declared weeds to be present within revegetation area.	0% cover
Wetland Management Area				
E. Weed Cover	i. General weed species	Weeds observed in the clearing area reference site for the Mp and Mr vegetation units were generally competitive species. The highest weed cover recoded was: • *Cyperus tenellus* (40%) • *Ehrharta calycina* (50%) • *Eragrostis curvula (10-90%)* • *Lotus subbiflorus* (50% & 60%)	Reduction in weed cover lower than reference sites	Maximum of 15% weed cover
	ii. Declared weeds	No declared weeds were present onsite.	No declared weeds to be present within revegetation area.	0% cover

Achievement of these performance targets will result in:

- creation/protection of 0.08 ha of vegetation providing Carnaby's Black Cockatoo habitat opportunities
- improvement in condition and therefore ecological value of the revegetation sites from 'Completely Degraded-Degraded' to 'Good-Very Good'
- increase in the extent of Carnaby's Black Cockatoo habitat currently in the clearing and rehabilitation areas from approximately 0.0049 ha to approximately 0.008 ha (increase by approximately 63%).

4.7 Monitoring and Reporting

Assessments into weed control and planting success will be undertaken for three years in autumn and spring (see Section 4.10.1). The following indicators will be assessed against performance targets (Table 4-5):

- range of species present in revegetation zones and health of planted vegetation
- presence of weeds in the revegetation zone (including an estimated density / percentage cover)
- comments on estimated mortality for planted vegetation to allow for stem density counts to be estimated

- collection of photography from designated locations to build up a photographic record of progress for the site.

Monitoring methodology will utilise establishment of permanent monitoring quadrats (5 m x 5 m) within each revegetation state, as well as establishment of photo point monitoring locations.

Monitoring locations will be selected to best reflect the works areas.

A summary monitoring report will be produced annually and submitted to DWER by 30 June, which outlines the findings of the Revegetation Plan. Each report will cover the previous 1 June to 31 May period.

4.8 Contingency Actions

Should the performance targets not be met in revegetation stages remedial works which may be implemented include:

- Additional revegetation works to increase plant densities and species representation
- Further weed management
- Rubbish removal
- Fauna control
- Continuing/maintaining plant protection measures (e.g. tree guards) and removing when no longer required.

Performance targets would then be re-checked for these areas in next annual monitoring event.

4.9 Conservation Covenant

In order to ensure the long-term protection of the Ba offset site a conservation covenant will be put in place over this area. This will extent the existing conservation covenants which are to be finalised for the site as required by clearing permits CPS 8768/1 and CPS 9928/1.

4.10 Implementation

4.10.1 Actions and Timing

Works onsite are proposed to be commenced in the 12 months following clearing commencement. The timeline below assumes that clearing will be undertaken in early 2024.

The proposed components of the revegetation and rehabilitation program will be the responsibility of Carey Baptist College.

The Implementation Schedule (Table 4-6) assumes the necessary planning and environmental approvals to commence Stage 4 construction are achieved to allow construction to commence by early-2024. If this is not achievable, the annual dates may need to be moved back. DWER will be advised of any necessary changes in this regard.

Table 4-6: Implementation Schedule

Matter	Action	Timing
Fencing	Install targeted fencing to prevent inadvertent damage to the revegetation areas	Prior to planting
	Inspect fencing and repair as needed	As required

Matter	Action	Timing
Site preparation	Pre-planting weed control within the revegetation area	Autumn 2025
Weed Control	Undertake targeted weed control in the revegetation and wetland management areas	Spring 2025 Autumn and Spring 2026 Autumn and Spring 2027 Autumn 2028
	Undertake weed control within the Mp vegetation unit	
Planting	Install additional planting via direct seeding or tubestock installation within the revegetation zone to meet the plant density target.	Autumn to Spring 2025
Monitoring and Reporting	Advise DWER and CoA of specific monitoring locations	First annual report
	Undertake monitoring of weed presence and planting success until three years post planting.	Spring 2025 Autumn and Spring 2026 Autumn and Spring 2027 Autumn 2028
	Annual summary report to be provided to DWER. The annual report is to cover the previous 1 June to 31 May period.	Annually by 30th June in the following years: • 2026 • 2027 • 2028
Contingency Actions	Assess need for remedial actions annually. Implement if required.	As required

4.10.2 Long Term Security of Revegetation Areas

The revegetation areas will remain under the ownership of Carey Baptist College.

Passive surveillance of the revegetation areas will be undertaken by maintenance staff at the college, as well as students and teachers utilising adjacent college facilities.

Once revegetation is concluded in each stage, the areas would be available as a continued teaching resource for the school. The revegetation areas will remain in private ownership, therefore they can be maintained and protected from unauthorised usage such as 4WD access.

The conservation covenant prosed for the Ba unit offset area will also provide further protection of this revegetation area.

4.10.3 Term of the Plan

This plan will be implemented by Carey Baptist College from the year development of Stage 4 commences, anticipated to be in 2024 (Table 4-6). Based on the anticipated schedule, the last task will be undertaken by 30 June 2028, assuming that the completion criteria have been met by this time.

5 References

Bennett Environmental Consulting (2011). *Botanical Assessment of Lot 2 Nicholson Road, Forrestdale*. Unpublished report prepared for Coterra Environment, Perth, Western Australia.

Coterra Environment (2014). *Stage 1 Revegetation Plan – Lot 2 Nicholson Road, Forrestdale (Revision 1)*. Unpublished report prepared for Carey Baptist College, Perth, Western Australia.

Coterra Environment (2020). *Revegetation Plan Addendum (Stage 2) – Carey Baptist College, Forrestdale (Revision 2)*. Unpublished report prepared for Carey Baptist College, Perth, Western Australia.

Tranen Revegetation Systems (2021). *Carey Group Stage 2 Monitoring Report – Spring 2019.* Unpublished report prepared for Carey Baptist College, Perth, Western Australia.

Figures

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary
- Existing Asset Protection Zone
- Existing Infrastructure
- Proposed Concept Plan
- Proposed Clearing Area
- Mp — Vegetation Unit
- Vegetation Unit Boundary
- Completed (Stage 1) Revegetation Zone
- Banksia Improvement (CPS 8768-1)
- Dryland Revegetation (CPS 8768-1)
- Mesic Revegetation (CPS 8768-1)
- Additional Dryland Vegetation (CPS 9928-1)
- Proposed 0.08ha Revegetation Area
- Weed Control Area 2023

N

0 25 50 75 100m

SCALE 1 : 2 500 at A3 (MGA)

398 000mE

398 250mE

6 441 250mN

6 441 000mN

0.073ha Mp

0.74ha Bi

0.30ha Ba

Mr 0.06ha

0.08ha Mr

0.51ha Mr

0.48ha Ba

Ec

Ec with scattered Mp over *Paspalum urvillei* and other weeds

Ba

Er

Ec

Deg

Et

EM

Mr

NICHOLSON ROAD

LOT 2

EXISTING ACCESS ROAD

EXISTING STAFF CAR PARKING

EXIST PICK UP DROP OFF PARKING

EXISTING ACCESS DFES ROAD

EXISTING SERVICE / FIRE SERVICE ACCESS ROAD

EXTENDED FIRE SERVICE ACCESS ROAD

NEW CAR PARK

FUTURE BUS PASSAGE

FUTURE DROP OFF PARKING

FUTURE FIRE TANKS & PUMPS

PLAYING COURTS

EXIST PLAYING FIELD

EXIST GRASSED AREA

EXISTING LANDSCAPED PLAY AREA

EXISTING K/PP

OSHC CENTRE

EXIST TRANSPORTABLES

EXISTING YEAR 1/2

TEACHING BLOCK

FUTURE ADMIN

FUTURE CHILD CARE

FUTURE SOCCER

FUTURE FOOTBALL OVAL

PROPOSED SPORTS HALL

FUTURE GLA'S

EXISTING STEM CENTRE

FUTURE STEM

FUTURE ARTS & CENTRE FOOD TECHNOLOGY & GLA'S

FUTURE CENTRE FOR THE COMMUNITY

FUTURE AUDITORIUM

FUTURE STAFF PARKING

FUTURE PLAYING COURTS

30

303

63

270

271

272

801

Vegetation Units

Ba Low Woodland A of *Banksia attenuata*, *Banksia menziesii*, *Nuytsia floribunda* and *Eucalyptus todtiana* over Heath B dominated by *Acacia pulchella* var. *glaberrima* over Tall Grass dominated by * *Ehrharta calycina*

Bi Low Forest A of *Banksia attenuata* and *Banksia ilicifolia* over Tall Grass dominated by **Ehrharta calycina* and **Ehrharta longiflora*

Et Low Woodland A of *Eucalyptus todtiana* with occasional *Banksia ilicifolia* over Open to Dense Tall Grass dominated by * *Eragrostis curvula* over Herbs dominated by **Carpobrotus edulis, *Erodium botrys, *Lotus subbiflorus* and **Hypochaeris glabra*

Mp Open Low Woodland B of *Melaleuca preissiana* over Dense Thicket of *Kunzea glabrescens* over Open Herbs dominated by *Patersonia occidentalis* and *Drosera glanduligera*

Mr Low Forest A of *Melaleuca rhaphiophylla* over Dense Herbs dominated by **Zantedeschia aethiopicum* and **Lotus subbiflorus*

EM Open Low Woodland A of *Eucalyptus todtiana* and *Melaleuca preissiana* over Low Scrub A or Scrub of *Kunzea glabrescens* and *Pultenaea reticulata* over Herbs dominated by * *Carpobrotus edulis* and **Lotus subbiflorus*

Er Low Forest A of * *Eucalyptus* species, possibly (* *Eucalyptus robusta*), *Melaleuca preissiana* and * *Populus nigra* over Dense Tall Grass dominated by * *Eragrostis curvula*

Ec Dense Tall Grass of * *Eragrostis curvula*, **Paspalum urvillei* and/or * *Pennisetum clandestinum* or Tall Sedges of *Juncus pallidus* or Herbs dominated by * *Lotus subbiflorus*, **Moraea flaccida* and **Euphorbia terracina*

CADASTRAL SOURCE: Landgate, October 2019.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown April 2023.
CONCEPT PLAN SOURCE: Brad Quatermaine, Dwg No. 23.01-SK01-B, 01-06-23.

CBCFOR27b-f01.dgn

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Carey Baptist College
STAGE 4 REVEGETATION PLAN
LOT 2 NICHOLSON ROAD, FORRESTDALE

Drawn: K. Watts | Date: 20 Jul 2023
Job: CBCFOR27b | Revision: A

EXISTING REVEGETATION AND WEED CONTROL AREAS

Figure 1

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Appendix 7 Offset Calculation Spreadsheet

WA Environmental Offsets calculator

PLEASE ENABLE MACROS FOR THIS SPREADSHEET

Produced by:

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

Purpose:

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

Data currency:

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

Process for using the WA Environmental Offsets Calculator

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

WA Environmental Offsets Calculator

Step 1: Determining conservation significance

Key:
- Data to be entered
- Drop-down selection
- Automatically-generated scores (Or, if appropriate, manual data entry permitted)

Area / feature **(Impact site)**

Conservation significance determination for the environmental value impacted		
Conservation significance	**Description**	Banksia Woodland vegetation (Ba Unit) that may provide Black Cockatoo value
	Type of environmental value	Species (flora/fauna)
	Conservation significance of environmental value	Rare/threatened species - endangered
	Conservation significance score	**1.2%**

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

Step 2: Calculating significant residual impact

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

Environmental value (step 1)	Banksia Woodland vegetation (Ba Unit) that may provide Black Cockatoo value

***Area* (impact site)**

Part A: Significant impact calculation *Area*

Significant impact	Description	Quantum of impact	
	Clearing of native vegetation for various infrastuncture (sports ovals, cpourts and a sports hall) construction	Significant impact (hectares)	0.03
		Quality (scale)	5.00
		Total quantum of impact	0.02

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

Rehabilitation Credit	Description				
		Proposed rehabilitation (area in hectares)		Time until ecological benefit (years)	
		Current quality of rehabilitation site (scale)		Confidence in rehabilitation result (%)	
		Future quality WITHOUT rehabilitation (scale)		Rehabilitation credit	0.00
		Future quality WITH rehabilitation (scale)			

Part C: Significant residual impact calculation *Area*

Significant residual impact		
	Total quantum of impact	0.02
	Rehabilitation credit	0.00
	Significant residual impact	0.02

WA Environmental Offsets Calculator

Step 3: Calculating offsets

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

Environmental value (step 1)	Banksia Woodland vegetation (Ba Unit) that may provide Black Cockatoo value	Significant impact (step 2, part A)	0.03
		Rehabilitation credit (step 2, part B)	0.00
		Significant residual impact (step 2, part C)	0.02

Area **(offset site)**

Offset calculation
Area

Offsets calculation							
	Description	**Proposed offset (area in hectares)**	0.08	**Duration of offset implementation (maximum 20 years)**	5.00	**Offset value**	**0.02**
	Onsite offset rehabilitation within a Degdraded-Completely Degraded portion of the site	**Current quality of offset site (scale)**	1.00	**Time until offset site secured (years)**	0.00		**100.8%**
		Future quality WITHOUT offset (scale)	1.00	**Risk of future loss WITHOUT offset (%)**	40.0%		
		Future quality WITH offset (scale)	5.00	**Risk of future loss WITH offset (%)**	10.0%		
		Time until ecological benefit (years)	10.00				
		Confidence in offset result (%)	80.0%			**OFFSET ADEQUATE?**	**NO**

WA Environmental Offsets Calculator

Rationale for scores used in the offsets calculator

Environmental value to be offset			
Calculation	***Score (Area)***		***Rationale***
Conservation significance			
Description	Banksia Woodland vegetation (Ba Unit) that may provide Black Cockatoo value		The vegetation within the clearing area may provide potential foraging habitat for black cockatoos
Type of environmental value	Species (flora/fauna)		Carnaby's Cockatoo was identified as the species with the highest conservation significance of those with the potential to be impacted by the clearing.
Conservation significance of environmental value	Rare/threatened species - endangered		Carnaby's Cockatoo is listed as endangered
Landscape-level value impacted	yes/no		
Significant impact			
Description	Clearing of native vegetation for various infrasturcture (sports ovals, cpourts and a sports hall) construction		Clearing is required to facilitate the construction of the Stage 4 school buidings, including the associated Asset Protection Zone.
Significant impact (hectares) / Type of feature	0.03		Banksia Woodland (0.033ha)
Quality (scale) / Number	5.00		A score of 5 was applied to the 0.033ha of vegetation ot be cleared. This was based on the Bamford Consulting Ecologists (BCE) scoring guide with the following values assigned: (A) Site condition - 4; (B) Site Context - 1; (C) Species Density - 0
Rehabilitation credit			
Description	0		Rehabilitation of the proposed clearing area is not proposed due to the permananet land use change for the site (i.e. future construction). Retsoration of a degraded area onsite is the alternative approach proposed.
Proposed rehabilitation (area in hectares)	0.00		
Current quality of rehabilitation site / Start number (of type of feature)	0.00		
Future quality WITHOUT rehabilitation (scale) / Future number WITHOUT rehabilitation	0.00		
Future quality WITH rehabilitation (scale) / Future number WITH rehabilitation	0.00		
Time until ecological benefit (years)	0.00		
Confidence in rehabilitation result (%)	0		
Offset			
Description	Onsite offset rehabilitation within a Degdraded-Completely Degraded portion of the site		The proposed offset is located within the same lot as the clearing area.
Proposed offset (area in hectares)	0.08		0.08ha represents 100% offset for the clearing proposed
Current quality of offset site / Start number (of type of feature)	1.00		A start quality of 1 has been assigned based on the vegetation condition of the offset site being degraded-completely degraded and lacking cockatoo habitat species. This is consistend with the values applied as part of the CPS 8768-1 offset
Future quality WITHOUT offset (scale) / Future number WITHOUT offset	1.00		A score of 1 has been assigned as without management this area is unlikely to imporve in quality
Future quality WITH offset (scale) / Future number WITH offset	5.00		A score of 5 has been assigned based on the foraging habitat values proposed to be established and the proponents proven track record of successful rehabilitation. This value is consistent with the score applied to the mesic woodland rehabilitation as part of CPS 8768-1.
Time until ecological benefit (years)	10.00		10 years has been assigned which is consistent with the score appied to the medic woodland rehabilitation as pasrt of CPS 8768-1 and CPS 9928-1
Confidence in offset result (%)	0.8		A confidence result of 80% for the risk of loss has been assigned as there is high level of confidence that proven management strategies will mitigate the risk of loss. This is consistent with the score applied to the mesic woodland rehabilitation as part of CPS 8768-1 and CPS 9928-1
Duration of offset implementation (maximum 20 years)	5.00		The rehabilitation works will commence immediately with the proposed rehabilitation program, including site preparation, plant establishment, management and monitoring propsed for a 5 year period.
Time until offset site secured (years)	0.00		The offset site is already owned by the proponent and forms part of the school landholdings at the site
Risk of future loss WITHOUT offset (%)	40.0%		A risk of loss of 40% has been assigned based upon vegetation in the region being subject to continuing land degradation pressures. This is consistent with the score applied to the mesic woodland rehabilitation as part of CPS 8768-1 and CPS 9928-1

Risk of future loss WITH offset (%)	10.0%		A risk of loss of 10% has been assigned based on the risk reduction of a managed site that includes fencing, revegetation, weed control, dieback control, installation of firebreaks and monitoring. This is consistent with the score applied to the mesic woodland rehabilitation as part of CPS 8768-1.
Offset ratio (Conservation area only)	N/A		

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