COTERRA ENVIRONMENT

Revegetation Plan Addendum (Stage 2)

Carey Baptist College, Forrestdale

Revision 0 December 2019

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 24km southeast of Perth, within the City of Armadale (Figure 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 has been 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 Figure 2 and the components of the plan are discussed further below.

1.2 Site Development

1.2.1 Masterplan

The Masterplan addresses the natural attributes of the site including wetlands and their associated buffers, remnant vegetation and relevant planning easements and buffers. The plan comprises of the following:

- Primary School and associated facilities
- High school and associated facilities
- Two soccer ovals
- Football oval
- Playing courts
- Car parking and drop-off areas
- Northern and Southern driveway access points.

1.2.2 Stage 1 (completed)

Stage 1 of 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 of Stage 1 has been completed with the following facilities now provided at the school:

- Classrooms accommodating student from Kindergarten to Year 8
- Administration area and school hall
- 2 x sports fields
- Entrance driveway and car park.

1.2.3 Stage 2 (in development)

The footprint required to facilitate the Stage 2 school development extends over an area of 3.18 ha and will ultimately allow for a STEAM centre, additional classrooms, arts centre, sports centre and performing arts studio. The location of the proposed clearing area accommodating the above is shown on Figure 3.

Clearing is likely to be undertaken in stages, with the first stage allowing for the STEAM centre building footprint, Asset Protection Zone (APZ) for bushfire protection around the STEAM Building, and an access road which will include a 3m disturbance area on either side of the road as required or construction purposes.

Any areas which are cleared, but where construction does not immediately commence will be stabilised with landscaping, mulch or hydro-mulch.

1.2.4 Future Development

The final development stages of the school will include the future oval, tennis courts, third soccer field and the southern access road. A future clearing permit and the final addendum to the Revegetation Management Plan will be prepared to support this application, when required.

1.3 Previous Environmental Approvals

1.3.1 Native Vegetation Clearing Permit

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 4.26ha 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, 2014a) was approved by DER which outlined the ultimate revegetation scenario for both Stages 1 and 2
- Reporting.

The permit was amended to increase the size of the clearing area to 4.45ha in December 2014 (CPS 4860/2). A copy of this permit is provided in Appendix 1.

An additional clearing application was lodged with DER in September 2016 to facilitate construction of a 0.81ha soccer oval. DER responded to this application advising there was no native vegetation within the majority of the application area and the proponent may wish to withdraw the application. The application was then withdrawn in October 2016.

1.3.2 Environmental Protection and Biodiversity Conservation Act 1999

The full Masterplan was referred to the Federal Department of Sustainability, Environment, Water, Population and Communities 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.

1.3.3 Revegetation Plan (2014)

A Revegetation Plan was prepared to outline the works proposed to mitigate the clearing which would be undertaken for the school construction.

Revision 1 (dated April 2014) of the Revegetation Plan addressed the full development scenario for the school as shown on the Masterplan and the associated revegetation proposed. The revegetation area was divided into two stages, with Stage 1 (5.4ha) located in the eastern end of the site and Stage 2 (5.5ha) located in the western end of the site. Stage 1 works would be undertaken when first stage of the campus development occurred, and Stage 2 to be triggered when the remaining stages are done.

The Department of Environmental Regulation (DER) approved the Stage 1 Revegetation Plan for implementation in 2014. A copy of this approval confirmation is provided in Appendix 3.

The City of Armadale requested some additional information be included in the Revegetation Plan to meet the requirements of the Development Application approval. The plan was subsequently updated and the

City approved Revision 4 (dated October 2014). A copy of the City of Armadale approval is provided in Appendix 4.

1.4 Purpose of this Report

The first part of the Stage 2 development of the school is now proposed to commence as outlined in Section 1.2.3. This addendum to the 2014 Revegetation Plan has been prepared to identify the specific revegetation areas and task which will be undertaken in association with this development.

As noted in Section 1.2.4, a further addendum to the Revegetation Plan will be prepared when the final school development stages are commenced.

2 Stage 2 Development Area Description

2.1 Topography and Soil

Topography within the Stage 2 development area ranges from approximately 26 to 30mAHD (Figure 3).

The clearing area contains Bassendean Sand (S8) 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, with the western side comprising Sand (S10) which is as per S8 as a relatively thin veneer over strong, blocky, brown silts and clays. The western side of the clearing area contains Peaty Sand (SP1) (Jordan, 1986). The location of these geological units is shown on Figure 4.

Soils within the majority of the proposed clearing area are mapped as having a Moderate to Low Acid Sulfate Soil (ASS) risk. Soils within the SP1 of the proposed clearing area are mapped as having a High to Moderate ASS risk (Landgate, 2019).

2.2 Hydrology

The maximum groundwater level is approximately 25mAHD (DWER, 2019), which equates to 1 to 5m below ground level within the proposed clearing area. Groundwater flow direction is easterly toward Forrestdale Lake (located over 650m east of Lot 2).

The eastern end of Lot 2 is mapped as a Resource Enhancement category wetland (UFI 15820). The western end of Lot 2, including a small section of the proposed clearing area is mapped as a Multiple Use category wetland (UFI 7088) (Landgate, 2019). The location of wetland areas is shown on Figure 5.

2.3 Flora and Vegetation

2.3.1 Vegetation Complex

Vegetation at the site is identified to be part of the Southern River vegetation complex which is described as (Heddle et al., 1980):

> Open woodland of *Coryumbia. calophylla- Eucalyptus marginata- Banksia spp* with fringing woodland of *E. rudis- Melaleuca rhaphiophylla* along creek beds.

2.3.2 Vegetation Units

A level 2 Flora and Vegetation Survey was completed by Bennett Environmental Consulting (2011) for the site in October 2011 in accordance with EPA Guidance Statement No 51 (EPA, 2004). A full copy of the report is provided in Appendix 5.

During the survey a total of eight different vegetation units were identified. These consisted of upland and wetland vegetation (Figure 6). These are:

Upland Vegetation

- Ba: Low Woodland A of *Banksia attenuata, Banksia menziesii, Nuytsia floribunda* and Euc*alyptus 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.

The vegetation units present within the proposed clearing area are; Ba (2.47ha), Ec (0.32ha), Ec with Mp (0.09ha) Mr (0.23ha) and Et (0.07ha) (Figure 6).

2.3.3 Vegetation Condition

The condition of remnant vegetation on site varied from Very Good - Good to Completely Degraded, with over half of the site (12.5ha, 56%) being Degraded to Completely Degraded. Vegetation condition mapping is provided on Figure 7.

Vegetation condition within the area proposed to be cleared ranged from 'Very Good to Good' to 'Completely Degraded' in the 2011 survey.

Photographs showing the current condition of vegetation within the proposed clearing area are provided below.

Plate 2-1: Vegetation within the Proposed Clearing Area at the northern end (November 2019)

Plate 2-2: Vegetation within the Proposed Clearing Area at the northern end (November 2019)

2.3.4 Declared Rare and Priority Flora

No Declared Rare Flora species were found at the site.

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 6) (Bennett Environmental Consulting, 2011). These priority flora are not located within the Stage 2 area.

2.3.5 Dieback

In September 2014, NPC Consulting (Dieback mapping and management consultants) 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. A copy of the full Dieback Interpretation Report is provided in Appendix 6.

Sample results (two out of three samples were positive) confirmed field investigations which indicated that *Phytophthora cinnamomi* is present in the remnant Banksia Woodland area situated in the centre of the site. This remnant vegetation consists of the Vegetation Unit (Ba) (Figure 6).

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 REW area and areas with little or no vegetation (i.e. paddocks/cleared areas).

2.3.6 Weeds

A total of 66 weed species were recorded during the Level 2 flora and vegetation survey (Bennett Environmental Consulting, 2011). The weed species found onsite and their rating for ecological impacts, impact attributes and invasiveness are shown on Appendix 7.

The common weeds, which were identified as those occurring at a coverage of 5% or greater in at least one of the botanical plots surveyed, are as follows:

- *Arctotheca calendula*
- *Avena barbata*
- *Briza maxima*
- *Bromus diandrus*
- *Carpobrotus edulis*
- *Cynodon dactylon*
- *Cyperus tenellus*
- *Ehrharta calycina*
- *Ehrharta longiflora*
- *Eragrostis curvula*
- *Eucalyptus robusta*
- *Hypochaeris glabra*
- *Isolepis marginata*
- *Juncus bufonius*
- *Lotus subbiflorus*
- *Lupinus angustifolia*
- *Moraea flaccida*
- *Populus nigra*
- *Romulea rosea*
- *Vulpia bromoides*
- *Zantedeschia aethiopicum*

2.4 Fauna and 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.

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 (Bennett Environmental Consulting, 2011), identified four vegetation types within the site containing plant species that provide potential black cockatoo foraging habitat (Ba, Bi, Et, EM)
- 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 (*Calyptorhynchus latirostris*)
  - Forest Red-tailed Black Cockatoo (*Calyptorhynhcus 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 to provide core roosting habitat)
- Three types of foraging habitat were identified within the site as follows (see Figure 8):
  - 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.

2.5 Land Uses

Lot 2 is surrounded by rural and conservation land uses. Rural farming properties are located to the north, south and east of the site. Bush Forever Site 344 adjoins the western and southern site boundaries. Forrestdale Lake is located over 600m east of the site. The Dampier to Bunbury Natural Gas Pipeline traverses the site and is located within an easement.

Land uses can be seen on Figure 1 and 9.

3 Stage 1 Revegetation Summary

3.1 Stages

The Revegetation Plan (Revision 1) (Coterra Environment, 2014a) identified that the revegetation program for Stage 1 would be staged over approximately 5 years to coincide with progressive development of the campus. The Stage 1 area was originally divided into five roughly equal zones of between 1 and 1.4ha in size. The Plan notes that '*should Carey Baptist College wish to combine some of the revegetation stages to compress the overall timeframe, the above list of actions will still be undertaken for each of the combined stage areas'*.

Following consultation with specialist revegetation consultants, Tranen Revegetation Systems, several revegetation stages were combined. The amended timing for commencement of implementation of the revegetation stages is summarised as follows:

- Amended Stage 1A (2.5ha) (Combined original stage 1A, 1B and half of 1C revegetation [up to existing fire break track]). Commenced in 2015.
- Amended Stage 1B (2.9ha) (Combined original stage half of 1C, 1D and 1E) commenced in 2017.

The location of the Stage 1 revegetation area is shown on Figure 10.

3.2 Works Summary

The progress of revegetation works onsite is summarised in Table 3-1.

Table 3-1: Completed Revegetation Works

Revegetation Works	Stage 1A	Stage 1B
Seed Collection	• Summer of 2014-2015 • Summer of 2015-2016	
Weed Control	• Winter 2015 • Autumn 2016 • Spring 2016 • Autumn 2017 • Spring 2017	• Autumn 2017 • Spring 2017 • Summer 2017-2018 • Autumn 2019
Planting	• Winter 2015 • Winter 2017	• Winter 2017 • Spring 2017
Monitoring	• Spring 2015 • Autumn 2016 • Spring 2016 • Autumn 2017 • Spring 2017 (maintenance completed) • Autumn 2019 (drainage basin only).	• Spring 2017 • Autumn 2018 • Spring 2018 • Autumn 2019
Rabbit Control		• Winter 2017 • Spring 2017

3.3 Performance Targets

Data collected from the monitoring quadrats is assessed against the completion criteria presented on Table 3-2.

Table 3-2: Revegetation Area Performance Targets

Characteristic	Minimum Target / KPI
Plant density and structure	Stage 1 (outside REW and Buffer) • 4 plants / m^2 Stage 1 (inside REW and Buffer, not including the drainage swales) • 400-600 rushes/sedges per 100m square (i.e. on average 4 to 6 sedge plants / m^2) • 150 to 200 Embankment shrubs per 100 square meters (i.e. on average 1.5 to 2 Embankment Shrub plants / m^2) • 10 to 20 fringing plants per 100 square meters (i.e. on average 1 to 2 fringing Trees plants / $10m^2$. Vegetation condition to achieve on average Good in accordance with the Keighley scale across the REW.
Species composition	75% of revegetation species list
Weed cover	10-15% in all areas

3.4 Results Summary

The findings are summarised below. Photographs of the revegetation area are provided in Plate 3-1 to Plate 3-8.

Stage 1A

The sedge/rush zone, embankment shrub zone and fringing tree zone met/exceeded all completion criteria requirements in the last monitoring event undertaken in spring 2017 and autumn 2018.

The drainage swale zone met the target species composition and weed cover completion criteria in spring 2017 and autumn 2017 but was below the target density.

Further assessment of the drainage swale against completion criteria in the spring 2018 and autumn monitoring events found:

- The drainage basin quadrat recoded 2.6 stems / m^2. Species composition of one was recorded
- Weed cover was recorded at 0%
- Native cover was recorded at 85% within the Drainage Basin (Tranen, 2019).

In relation to the basin stem density, it is noted that planting in the basin was historically undertaken just before the basin fills with rainwater and the plant survival is then impacted by the winter flooding. Planting after winter once the basin has dried has been attempted but the plants did not have enough time to put roots down to survive the summer period. The stem density has increased from 1.9 plants/m^2 in 2017/18 to 2.6 plants/m^2 in Autumn 2019 and the native cover has increased from 80% to 85% over the same period. Given the positive plant growth and coverage trends in the basin additional planting is not proposed, but the management focus will rather be maintenance of weed control to allow the established plants to further expand their cover over this area.

Stage 1B

The completion criteria were met at all assessment sites in both spring 2018 and autumn 2019.

These results have been reported annually to both DWER and the City of Armadale.

Plate 3-1: Stage 1 Revegetation Area (September 2013)

Plate 3-2: Stage 1 Revegetation Area (August 2018)

Plate 3-3: View of the REW from the eastern site boundary prior to revegetation (December 2010)

Plate 3-4: View looking south over the REW from northern site boundary prior to revegetation (December 2010)

Plate 3-5: View looking north over the REW from the southern site boundary prior to revegetation (December 2010)

Plate 3-6: Revegetation Area looking south from the central track (November 2019)

Plate 3-7: Revegetation Area looking south from the central track (November 2019)

Plate 3-8: Revegetation Area looking north from the central track (November 2019)

4 Stage 2 Revegetation Program

4.1 Area Proposed for Revegetation

The area proposed for revegetation includes Stage 2A and 2B of the 2014 Revegetation Plan which extend over 2.42ha. The features of these areas are summarised below.

Table 4-1: Stage 2A and 2B Revegetation Areas

Features	Stage 2A	Stage 2B
Size	1.79 ha	0.63 ha
Vegetation Units	Bi (0.73ha) Mp (0.78ha) Ec (0.29ha)	Ba (0.40ha) Mr (0.18ha) Ec (0.06ha)
Vegetation Condition	Good (0.74ha) Good-Degraded (0.68ha) Degraded-Completely Degraded (0.38ha)	Very Good-Good (0.37ha) Good (0.20ha) Degraded-Completely Degraded (0.07ha)
Soil Type	S8 and S10	S8, S10 and SP1
Wetland Area	Multiple Use Wetland (0.82ha)	Multiple Use Wetland (0.23ha)

4.2 Revegetation Strategy

As identified in the 2014 Revegetation Plan, Revegetation stages 2A and 2B are primarily weed control and supplementary planting areas to improve the condition and ecological value of the existing vegetation. On this basis the following works are proposed.

4.2.1 Access Management

Prior to works commencing the revegetation areas will be fenced to prevent unauthorised or inadvertent access. The fencing will be similar to that provided in Stage 1 as shown on Plate 4-1. Access points will be provided within the fencing to facilitate vehicle entry into the revegetation area for management and maintenance purposes. The location of the Stage 2A and 2B fencing is shown on Figure 10.

Plate 4-1: Stage 1 Revegetation Area fencing

4.2.2 Weed Control

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

Targeted weed control will be undertaken within Stage 2A and 2B. 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 in the 2014 Revegetation Plan. A dye will be added to any herbicide mixture applied at the site to enable areas of application to be clearly identified, as is visible on Plate 4-1.

Weed control within these areas is proposed to commence in prior to planting and be ongoing twice annually (spring and autumn) until three years post-planting, or until the performance criteria have been achieved.

4.2.3 Seed Collection and Supplementary Planting

In order to assist the regeneration of these areas, seed collection will be undertaken to provide additional stock for use in direct seeding or tubestock in-fill planting works.

Seed collection will be undertaken between October 2020 and April 2021 to obtain the stock necessary for these works. The collection will focus on harvesting seed from the Banksia areas onsite. In areas where vegetation is proposed to be cleared in the future, seed collection may utilise up to 100% of the available seeds. In areas where vegetation retention is proposed, seed collection will still be permitted but restricted to a maximum of 20% from any one plant.

Supplementary planting, where required, will utilise seed collected from the site, as well as purchased tubestock, if additional species or volumes are required. If collected seed requires propagation (i.e. cannot be used via direct seeding) this will require a minimum of 12 months for this to occur after collection. As such initial planting is proposed to commence in the 2022 planting season.

Revegetation species will include those listed in Appendix 8. The aim of the program will be to achieve an average plant density of 1 tree and 1 shrub per $5m^2$ based on the existing vegetation and any additional supplementary planting undertaken.

4.3 Performance Targets

The following performance targets have been identified for the Stage 2A and 2B revegetation program:

Table 4-2: Performance Targets

Characteristic	Minimum Target / KPI
Plant density	Average of 1 tree and 1 shrub / 5m^2
Weed Cover	Maximum of 10-15%
Species composition	75% of planted species

4.4 Monitoring

Assessments into weed control and planting success will be undertaken in autumn and spring during the establishment period, and for three years after this phase is complete. The following indicators will be assessed:

- 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 survival rate to be estimated
- Collection of photography from designated locations to build up a photographic record of progress for the site.

The monitoring methodology will utilise establishment of permanent monitoring quadrats within each revegetation stage, as well as establishment of photo point monitoring locations.

A summary monitoring report will be produced annually and submitted to DWER and the City of Armadale by the 30th June which outlines the findings of the above program. Each report will cover the previous 1 June to 31 May period.

4.5 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
- 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.

4.6 Implementation

4.6.1 Actions and Timing

Works on Stage 2A are proposed to be commenced in the 12 months following clearing commencement. Works within Stage 2B are then be started 2 years later. Should Carey Baptist College wish to combine the stages to compress the overall timeframe this can be achieved with a modification to the program. The DWER and City of Armadale will be advised of any such modifications in the annual report, which will be issued at the conclusion of each annual monitoring period.

Table 4-3 summarise the proposed components of the Stage 2A and 2B revegetation program and associated timeframes. The dates provided on this table assume that the necessary planning and environmental approvals to commence Stage 2 construction are achieved to allow construction to commence by mid 2020. If this is not the case, the annual dates may need to be moved back. DWER and the City will be advised of any necessary changes in this regard. All actions listed below are the responsibility of Carey Baptist College.

Table 4-3: Implementation Summary

Issue	Action	Timing
Preliminary Works		
Seed Collection	Harvest seed from the Bi and Ba areas onsite for use in the supplementary planting program.	Spring 2020 - Autumn 2021
Stage 2A		
Fencing	Install fencing along the boundaries of the revegetation areas, with at least one vehicle access point provided into each revegetation area.	Prior to Spring 2021
Weed Control	Undertake targeted weed control prior to planting	Spring 2021 Autumn 2022
	Undertake targeted weed control following planting	Spring 2022 Autumn and Spring 2023 Autumn and Spring 2024 Autumn 2025
Planting	Install additional planting within the revegetation zone to meet the plant density target.	Autumn to Spring 2022
Monitoring and Reporting	Undertake monitoring of weed presence and planting success until three years post planting.	Spring 2022 Autumn and Spring 2023 Autumn and Spring 2024 Autumn 2025
	Annual summary report to be provided to DWER and CoA. The annual report is to cover the previous 1st June to 30th May period. Note: The Stage 2A and 2B reports will be combined in years where monitoring of both areas occurs.	Annually by 30th June in the following years: • 2022 • 2023 • 2024 • 2025
Contingency Actions	Assess need for remedial actions annually. Implement if required.	As required
Stage 2B		
Fencing	Install fencing along the boundaries of the revegetation areas, with at least one vehicle access point provided into each revegetation area.	Prior to Spring 2023
Weed Control	Undertake targeted weed control prior to planting	Spring 2022 Autumn 2024
	Undertake targeted weed control following planting	Spring 2024 Autumn and Spring 2025 Autumn and Spring 2026

Issue	Action	Timing
		Autumn 2027
Planting	Install additional planting within the revegetation zone to meet the plant density target.	Autumn to Spring 2024
Monitoring and Reporting	Undertake monitoring of weed presence and planting success until three years post planting.	Spring 2024 Autumn and Spring 2025 Autumn and Spring 2026 Autumn 2027
	Annual summary report to be provided to DWER and CoA. The annual report is to cover the previous 1st June to 30th May period. Note: The Stage 2A and 2B reports will be combined in years where monitoring of both areas occurs.	Annually by 30th June in the following years: • 2024 • 2025 • 2026 • 2027
Contingency Actions	Assess need for remedial actions annually. Implement if required.	As required

4.6.2 Long Term Security of Revegetation Areas

The revegetation areas will remain under the ownership of Carey Baptist College. The fencing installed prior to revegetation works being undertaken will be maintained as required to prevent unauthorised access into these areas.

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.

4.6.3 Term of the Plan

This plan will be implemented by Carey Baptist College from the year development of Stage 2 commences (anticipated to be mid 2020) to three years post planting within the revegetation areas (anticipated to be mid 2025 for Stage 2A and mid 2027 for Stage 2B).

5 References

Bennett Environmental Consulting. 2011. Botanical Assessment of Lot 2 Nicholson Road Forrestdale. Prepared for Coterra Environment.

City of Armadale (2009) Local Biodiversity Strategy. Prepared by Eco Logical Australia and Ironbark Environmental. Adopted by Council 23 November 2009.

Coterra Environment (2014a) Stage 1 Revegetation Plan – Lot 2 Nicholson Road, Forrestdale. Revision 1. Report prepared for Carey Baptist College.

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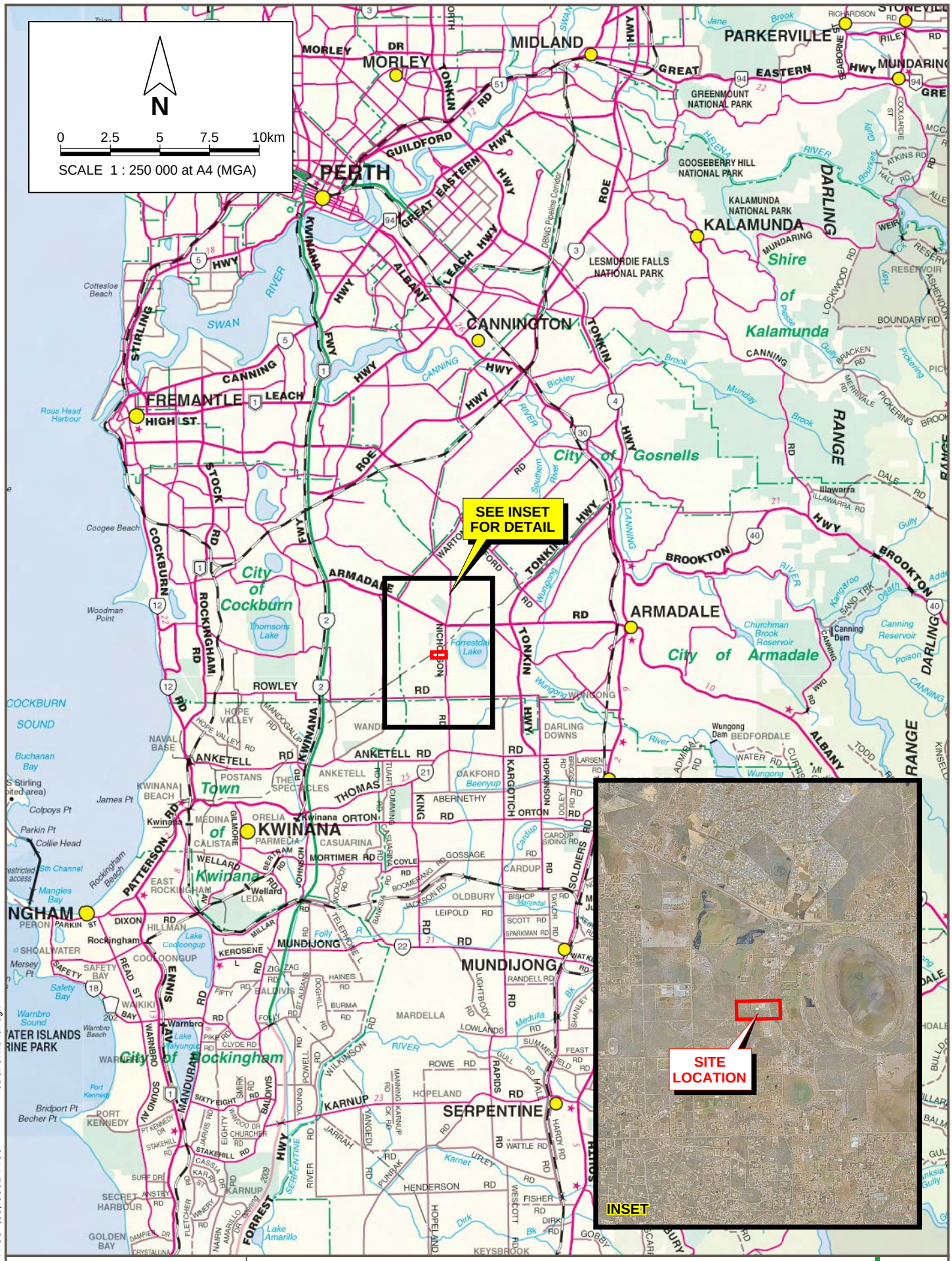
Figures



PINPOINT CARTOGRAPHICS (08) 9562 7136 CBCFOR19-f01.dgn

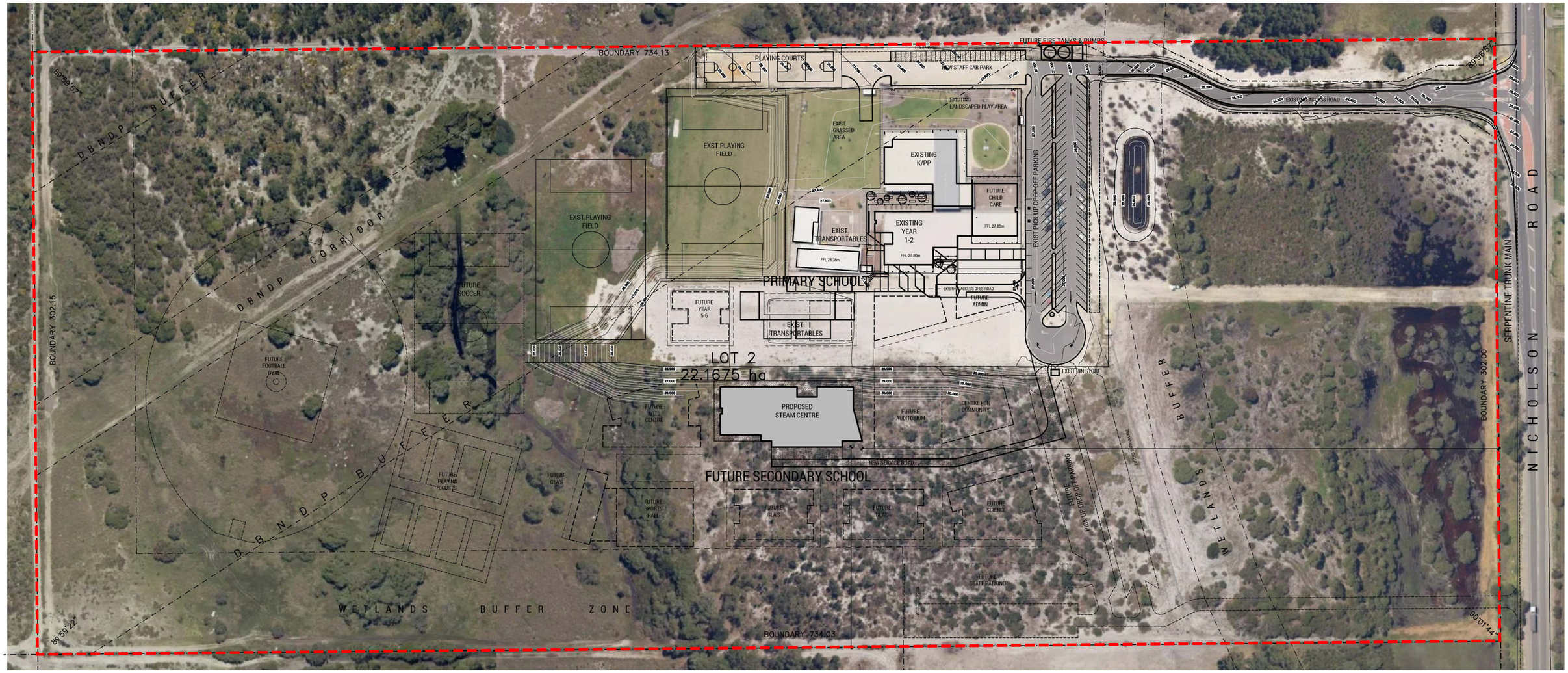
COTERRA ENVIRONMENT

Carey Baptist College
REVEGETATION PLAN
FORRESTDALE SCHOOL CAMPUS STAGE 2

Drawn: K. Watts	Date: 10 Dec 2019
Job: CBCFOR19	Revision: A

SITE LOCATION

Figure 1



brad quartermaine architect

N

0 20 40 60 80 100m

SCALE 1 : 2 000 at A3 (MGA)

Legend

Site Boundary

SOURCE: Brad Quatermaine Architect, Dwg No. 18.02-SK D.04, 18 November 2019.

COTERRA ENVIRONMENT		Carey Baptist College REVEGETATION PLAN FORRESTDALE SCHOOL CAMPUS STAGE 2	Figure 2
Drawn: K. Watts	Date: 10 Dec 2019	**SCHOOL MASTERPLAN**	
Job: CBCFOR19	Revision: A		

PINPOINT CARTOGRAPHICS (08) 9562 7136 CBCFOR19-f02.dgn

Legend

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

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

PRIMARY SCHOOL

FUTURE SECONDARY SCHOOL

Lot 2

NICHOLSON ROAD

30

1

163

270

271

272

303

800

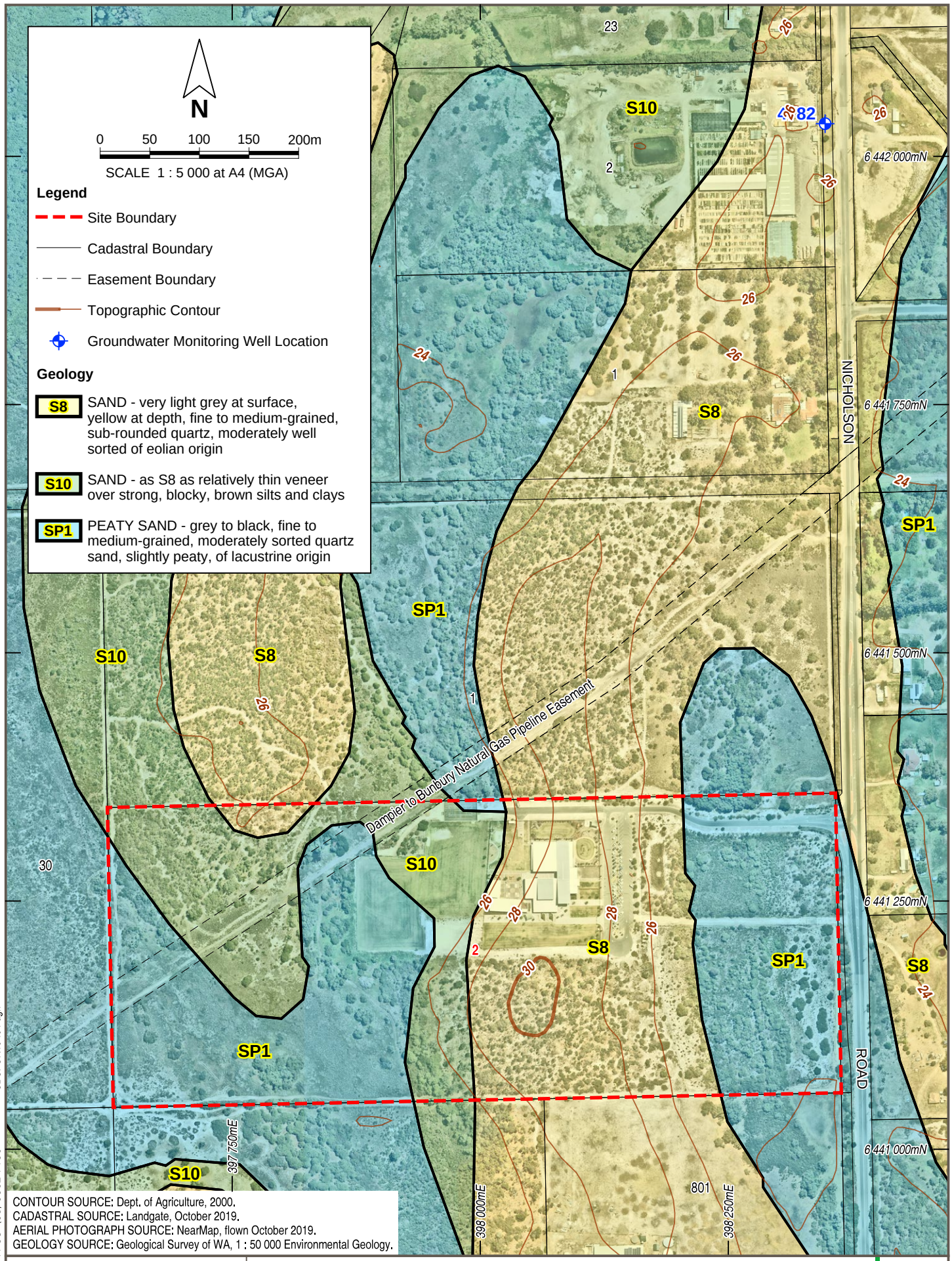
801

CADASTRAL SOURCE: Landgate, October 2019.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown October 2019.
VEGETATION UNIT SOURCE: Bennett Environmental Consulting, 2011.
CONCEPT PLAN SOURCE: Brad Quatermaine, Dwg No. 18.02-SK-D.04, 18-11-19.

COTERRA ENVIRONMENT		Carey Baptist College REVEGETATION PLAN FORRESTDALE SCHOOL CAMPUS STAGE 2	Figure 3
Drawn: K. Watts	Date: 10 Dec 2019	**PROPOSED CLEARING AREA**	
Job: CBCFOR19	Revision: A		

CBCFOR19-f03.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136



CONTOUR SOURCE: Dept. of Agriculture, 2000.
CADASTRAL SOURCE: Landgate, October 2019.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown October 2019.
GEOLOGY SOURCE: Geological Survey of WA, 1 : 50 000 Environmental Geology.

COTERRA ENVIRONMENT

Carey Baptist College
REVEGETATION PLAN
LOT 2 NICHOLSON ROAD, FORRESTDALE

Drawn: K. Watts | Date: 10 Dec 2019
Job: CBCFOR19 | Revision: A

TOPOGRAPHY AND GEOLOGY

Figure 4

PINPOINT CARTOGRAPHICS (08) 9562 7136 CBCFOR19-f04.dgn

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary

Geomorphic Wetlands

- Conservation Category
- Resource Enhancement
- Multiple Use
- 7328 Wetland UFI
- 50m Buffer to Conservation Category Wetland
- 30m Buffer to Resource Enhancement Wetland

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

7328

1

7233

270

271

272

15820

15304

7088

14835

7090

800

801

303

30

163

Lot 2

NICHOLSON ROAD

WETLANDS SOURCE: DEC, December 2011.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown October 2010.

COTERRA ENVIRONMENT		Carey Baptist College REVEGETATION PLAN LOT 2 NICHOLSON ROAD, FORRESTDALE	Figure 5
Drawn: K. Watts	Date: 10 Dec 2019	**WETLAND MAPPING**	
Job: CBCFOR19	Revision: A		

PINPOINT CARTOGRAPHICS (08) 9562 7136 CBCFOR19-f05.dgn

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary
- Existing Infrastructure
- Proposed Concept Plan
- Stage 1 Revegetation area
- Proposed Clearing Area
- Quadrat Location
- 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 Deg EM

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

PRIMARY SCHOOL

FUTURE SECONDARY SCHOOL

Lot 2

NICHOLSON ROAD

1 2 3 4 5 6 7 8 9 10 11

30 1 270 271 272 303 801 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 October 2019.
VEGETATION UNIT SOURCE: Bennett Environmental Consulting, 2011.
CONCEPT PLAN SOURCE: Brad Quatermaine, Dwg No. 18.02-SK-D.04, 18-11-19.

PINPOINT CARTOGRAPHICS (08) 9562 7136 CBCFOR19-f06.dgn

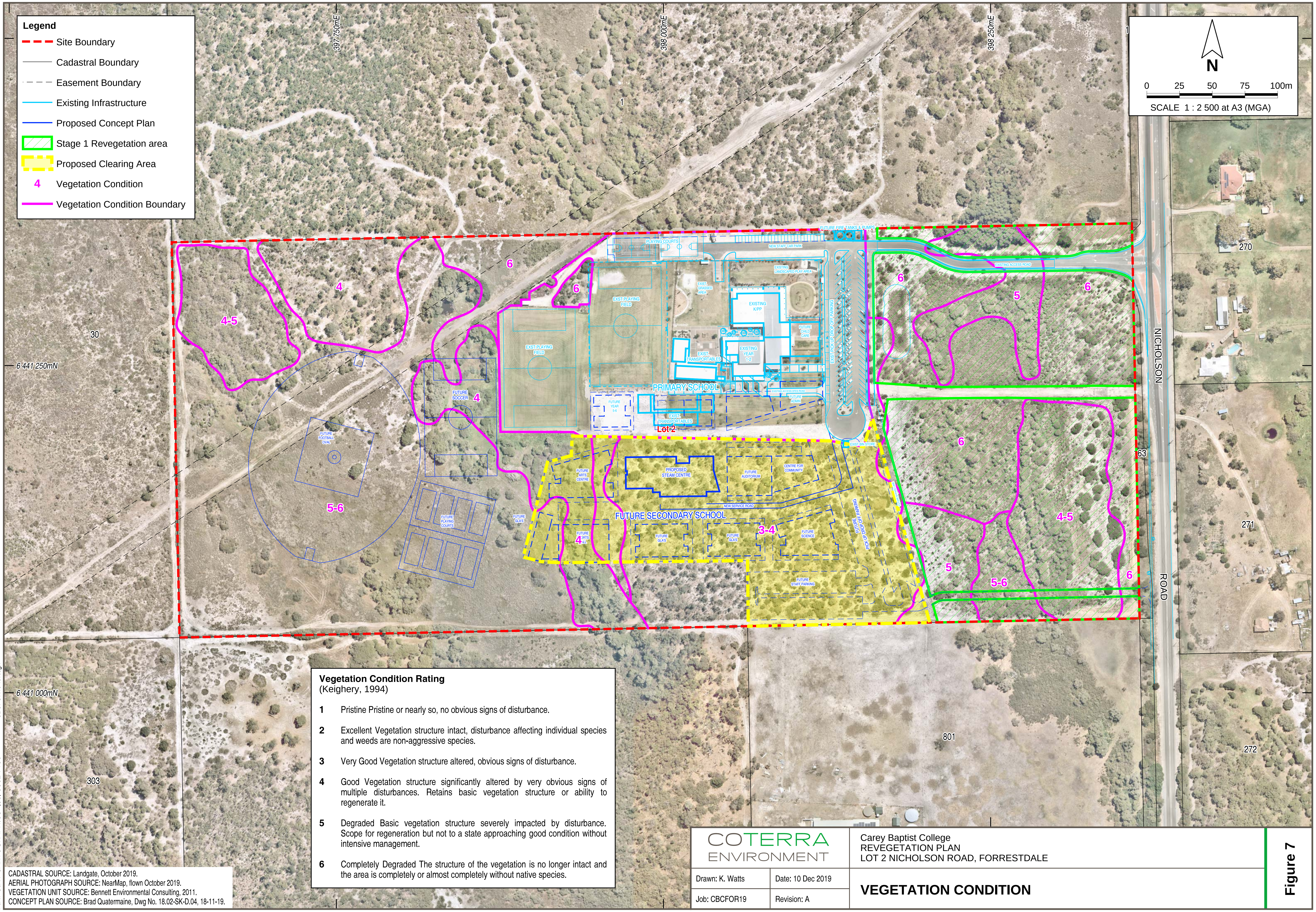
COTERRA ENVIRONMENT

Carey Baptist College
REVEGETATION PLAN
LOT 2 NICHOLSON ROAD, FORRESTDALE

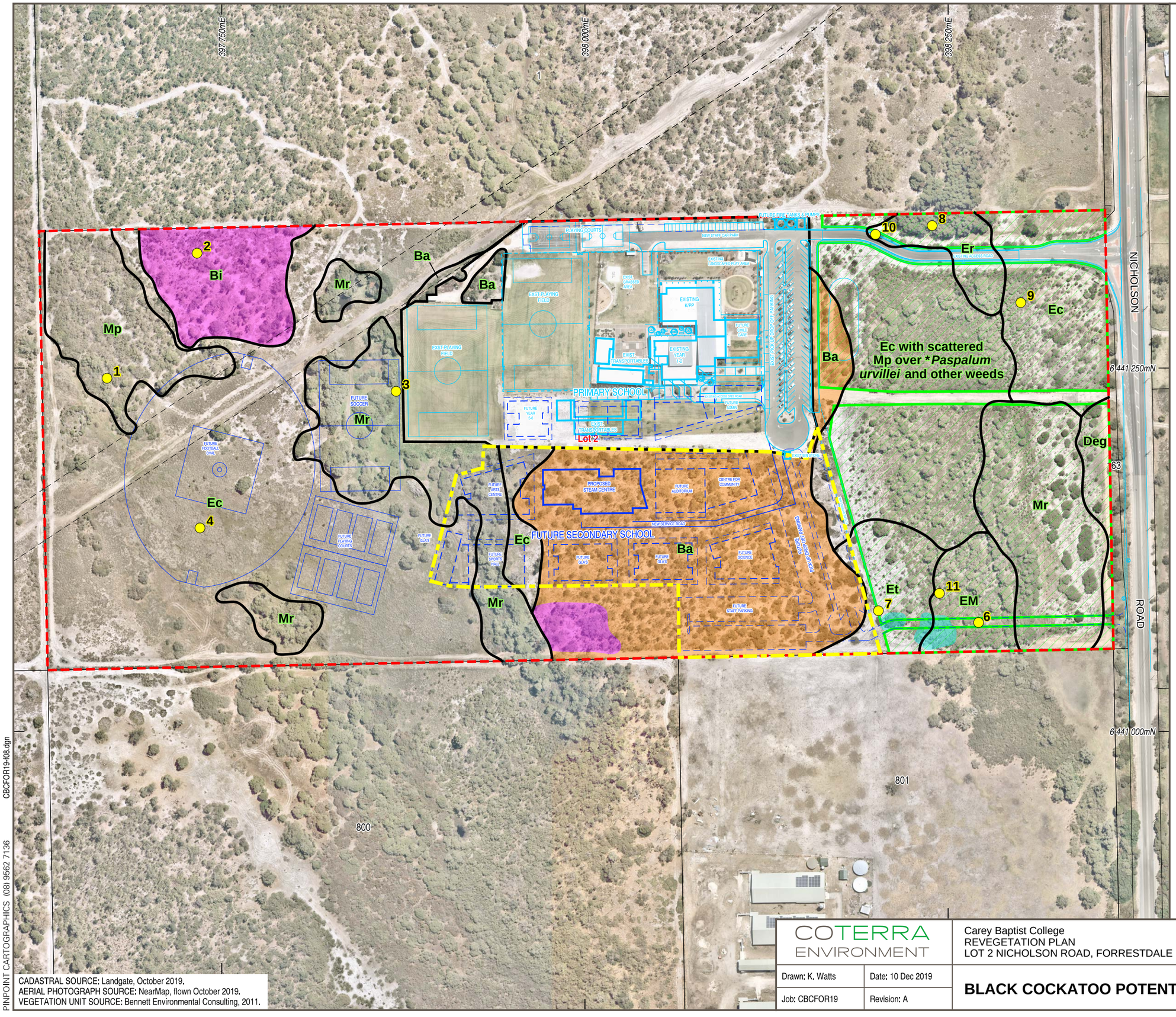
Drawn: K. Watts | Date: 10 Dec 2019
Job: CBCFOR19 | Revision: A

VEGETATION UNITS

Figure 6



Legend
Site Boundary
Cadastral Boundary
Easement Boundary
Existing Infrastructure
Proposed Concept Plan
Stage 1 Revegetation area
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
PRIMARY SCHOOL
FUTURE SECONDARY SCHOOL
PROPOSED STEAM CENTRE
Lot 2
4-5
4
6
5
5-6
3-4
30
303
801
270
271
272
63
1
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 October 2019.
VEGETATION UNIT SOURCE: Bennett Environmental Consulting, 2011.
CONCEPT PLAN SOURCE: Brad Quatermaine, Dwg No. 18.02-SK-D.04, 18-11-19.
PINPOINT CARTOGRAPHICS (08) 9562 7136
CBCFOR19-i07.dgn
COTERRA ENVIRONMENT
Drawn: K. Watts
Date: 10 Dec 2019
Job: CBCFOR19
Revision: A
Carey Baptist College
REVEGETATION PLAN
LOT 2 NICHOLSON ROAD, FORRESTDALE
VEGETATION CONDITION
Figure 7



N

0 25 50 75 100m

SCALE 1 : 2 500 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary
- Existing Infrastructure
- Mp — Proposed Concept Plan
- Stage 1 Revegetation area
- Proposed Clearing Area
- Quadrat Location
- Vegetation Unit
- Vegetation Unit Boundary

Habitat Mapping

- Good quality *Eucalyptus todtiana* foraging habitat
- Good quality *Banksia sp.* foraging habitat
- Poor quality *Banksia sp.* foraging habitat

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 October 2019.
VEGETATION UNIT SOURCE: Bennett Environmental Consulting, 2011.

COTERRA ENVIRONMENT

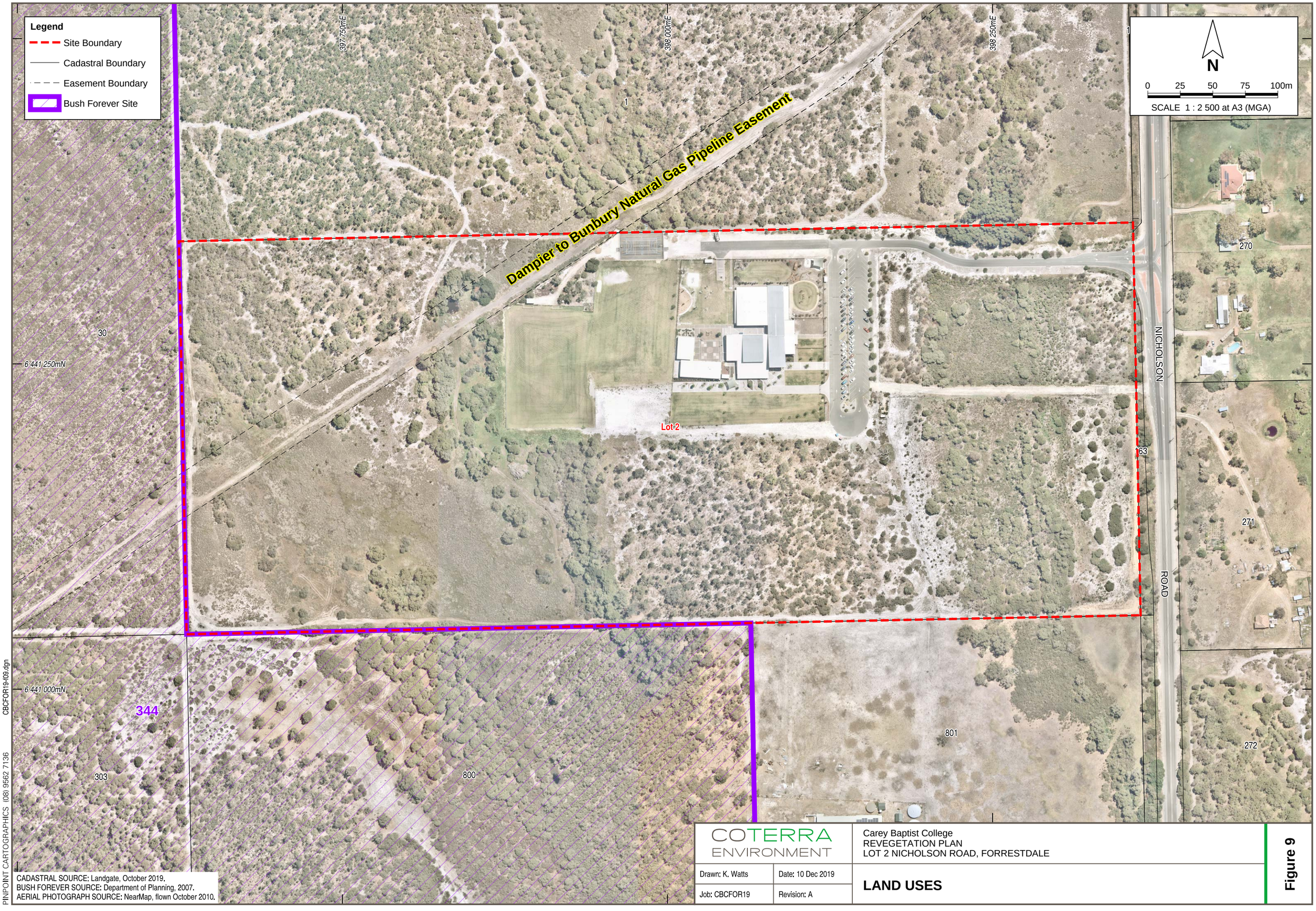
Carey Baptist College
REVEGETATION PLAN
LOT 2 NICHOLSON ROAD, FORRESTDALE

Drawn: K. Watts | Date: 10 Dec 2019
Job: CBCFOR19 | Revision: A

BLACK COCKATOO POTENTIAL HABITAT MAPPING

Figure 8

CBCFOR19-108.dgn
PINPOINT CARTOGRAPHICS (08) 9562 7136



CADASTRAL SOURCE: Landgate, October 2019.
BUSH FOREVER SOURCE: Department of Planning, 2007.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown October 2010.

PINPOINT CARTOGRAPHICS (08) 9562 7136 CBCFOR19-09.dgn

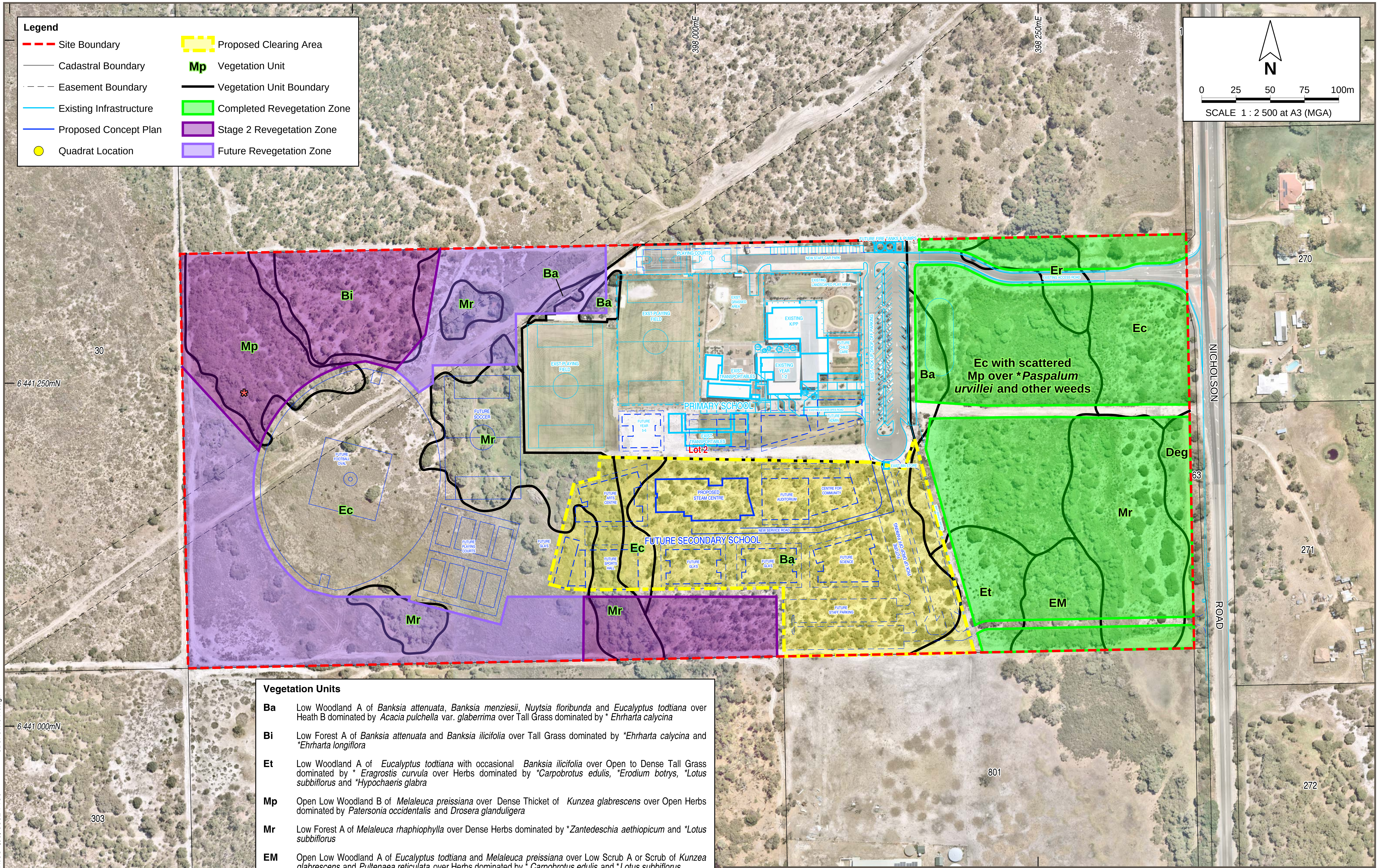
COTERRA ENVIRONMENT

Carey Baptist College
REVEGETATION PLAN
LOT 2 NICHOLSON ROAD, FORRESTDALE

Drawn: K. Watts | Date: 10 Dec 2019
Job: CBCFOR19 | Revision: A

LAND USES

Figure 9



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 October 2019.
VEGETATION UNIT SOURCE: Bennett Environmental Consulting, 2011.
CONCEPT PLAN SOURCE: Brad Quatermaine, Dwg No. 18.02-SK-D.04, 18-11-19.

PINPOINT CARTOGRAPHICS (08) 9562 7136 CBCFOR19-f10.dgn

COTERRA ENVIRONMENT

Carey Baptist College
CLEARING APPLICATION
FORRESTDALE SCHOOL CAMPUS STAGE 2

Drawn: K. Watts	Date: 8 Dec 2019
Job: CBCFOR18	Revision: A

REVEGETATION AREAS

Figure 10

Appendix 1 DER Clearing Permit CPS 4860/2

GOVERNMENT OF
WESTERN AUSTRALIA

CLEARING PERMIT

Granted under section 51E of the Environmental Protection Act 1986

Purpose Permit number:	CPS 4860/2
Permit Holder:	Carey Baptist College Inc
Duration of Permit:	21 June 2014– 21 June 2024

The Permit Holder is authorised to clear native vegetation subject to the following conditions of this Permit.

PART I –CLEARING AUTHORISED

1. **Purpose for which clearing may be done**
   Clearing for the purpose of constructing a school site and engineering batters.

2. **Land on which clearing is to be done**
   Lot 2 on Diagram 75868 (Forrestdale 6112)

3. **Area of Clearing**
   The Permit Holder must not clear more than 4.45 hectares of native vegetation within the area hatched yellow on attached Plan 4860/2a.

4. **Application**
   This Permit allows the Permit Holder to authorise persons, including employees, contractors and agents of the Permit Holder, to clear native vegetation for the purposes of this Permit subject to compliance with the conditions of this Permit and approval from the Permit Holder.

PART II –MANAGEMENT CONDITIONS

5. **Dieback and weed control**
   When undertaking any clearing or other activity authorised under this Permit, the Permit Holder must take the following steps to minimise the risk of the introduction and spread of *weeds* and *dieback*:
   (a) clean earth-moving machinery of soil and vegetation prior to entering and leaving the area to be cleared;
   (b) ensure that no *dieback* or *weed*-affected soil, *mulch*, *fill* or other material is brought into the area to be cleared; and
   (c) restrict the movement of machines and other vehicles to the limits of the areas to be cleared.

6. **Offset - Revegetation Plan**
   The Permit Holder must, within the area shaded red on attached Plan 4860/2b, implement and adhere to the offset commitments as outlined in the Stage 1: Revegetation Plan – Lot 2 Nicholson Road, Forrestdale, Revision 4, October 2014 attached as Appendix A to this permit.

PART III - RECORD KEEPING AND REPORTING

7. Records must be kept

In relation to the Offset – Revegetation of areas pursuant to condition 6:

(a) the location of any area of offsets recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994 (GDA94), expressing the geographical coordinates in Eastings and Northings;

(b) a description of the offset activities undertaken; and

(c) the size of the offset area (in hectares).

8. Reporting

The Permit Holder must provide to the CEO on or before 30 June of each year, a written report:

(a) of records required under condition 7 of this Permit; and
concerning activities done by the Permit Holder under this Permit between 1 January to 31 December of the calendar year.

(b) If no clearing authorised under this Permit was undertaken between 1 January to 31 December of the preceding calendar, a written report confirming that no clearing under this permit has been carried out, must be provided to the CEO on or before 30 June of each year.

(c) Prior to 21 March 2024, the Permit Holder must provide to the CEO a written report of records required under condition 7 of this Permit where these records have not already been provided under condition 8(a) of this Permit.

DEFINITIONS

The following meanings are given to terms used in this Permit:

dieback means the effect of *Phytophthora* species on native vegetation;
fill means material used to increase the ground level, or fill a hollow;
mulch means the use of organic matter, wood chips or rocks to slow the movement of water across the soil surface and to reduce evaporation;
soil disease status means soil types either infested, not infested, uninterpretable or not interpreted with a pathogen.
weed/s means any plant -

(a) that is a declared pest under section 22 of the *Biosecurity and Agriculture Management Act 2007*; or

(b) published in a Department of Parks and Wildlife Regional Weed Rankings Summary, regardless of ranking; or

(c) not indigenous to the area concerned.

M Warnock
SENIOR MANAGER
CLEARING REGULATION

Officer delegated under Section 20
of the Environmental Protection Act 1986

18 December 2014

Plan 4860/2a

LEGEND

- Local Government Authorities
- Road Centrelines
- Cadastre
- Clearing Instruments
- Areas Approved to Clear

N

0 ~100 m

Scale 1:3483

(Approximate when reproduced at A4)

Geocentric Datum Australia 1994

Note: the data in this map have not been projected. This may result in geometric distortion or measurement inaccuracies.

18/12/14

Date

M Warnock

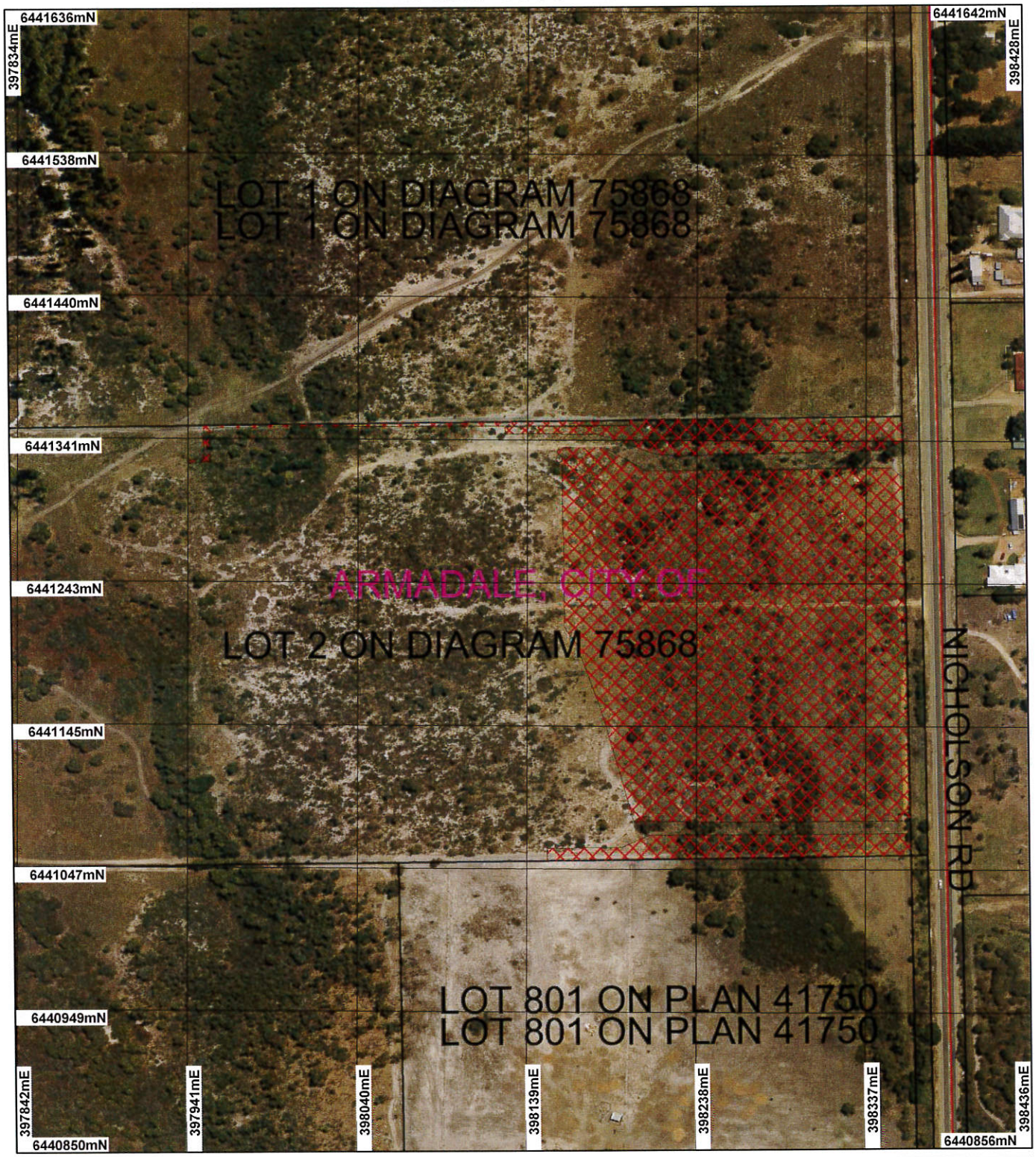
Officer with delegated authority under Section 20 of the Environmental Protection Act 1986

Information derived from this map should be confirmed with the data custodian acknowleged by the agency acronym in the legend.

Government of Western Australia
Department of Environment Regulation

WA Crown Copyright 2002

Plan 4860/2b



LEGEND

- Local Government Authorities
- Road Centrelines
- Cadastre
- Clearing Instruments
- Areas Subject to Conditions

N

0 ~100 m

Scale 1:3483
(Approximate when reproduced at A4)

Geocentric Datum Australia 1994

Note: the data in this map have not been projected. This may result in geometric distortion or measurement inaccuracies.

M Warnock
Officer with delegated authority under Section 20 of the Environmental Protection Act 1986

Date 18/12/14

Information derived from this map should be confirmed with the data custodian acknowleged by the agency acronym in the legend.

Government of Western Australia
Department of Environment Regulation

WA Crown Copyright 2002

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).

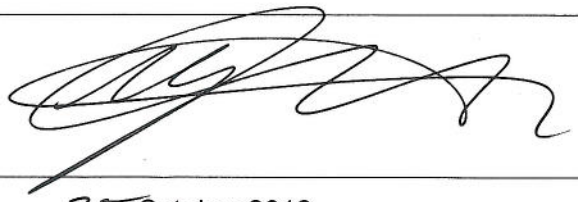
Proposed action

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 DER Approval of the Revegetation Plan (April 2014; Revision 1)

Government of **Western Australia**
Department of **Environment Regulation**

Your ref CBCFOR02
Our ref CPS 4860/1
Enquiries Clare Ryan
Phone 6467 5028
Fax 6467 5039
Email nvp@der.wa.gov.a

Ms Kristen Bennetts
Director
Coterra Environment
2/460 Roberts Road
SUBIACO WA 6008

Dear Ms Bennetts

APPLICATION TO CLEAR NATIVE VEGETATION UNDER THE *ENVIRONMENTAL PROTECTION ACT 1986*

I refer to your application on behalf of Carey Baptist College Inc to clear 11.76 hectares of native vegetation on Lot 2 on Plan 75866, Forrestdale, for building a school (reference CPS 4860/1).

As indicated in the then Department of Environment and Conservation's letter dated 30 May 2012, the offset proposal submitted for this project required additional information including a map outlining the boundary of the areas to be retained and revegetated, and a suitable revegetation plan prior to making a final decision. Thank you for your email dated 6 May 2013 providing this additional information.

The revegetation plan and map have been assessed and I consider that your offset proposal now meets the requirements to mitigate and minimise the impacts from the proposed clearing of 11.76 hectares of native vegetation.

While the assessment of this application has been undertaken, under s51O(4) of the *Environmental Protection Act 1986*, I am also required to have regard to any planning instrument or other matter considered relevant. I note your advice that a Development Application has been submitted and is currently under assessment by the City of Armadale.

I advise that I have deferred my decision on this application until you are able to provide a copy of the Development Approval from the City of Armadale.

Please ensure this approval is provided by 4 October 2013 as a decision on this application will be finalised on the information available to the Department of Environment Regulation at this time.

If you have any queries regarding this application, please contact Clare Ryan at the Department's Native Vegetation Conservation Branch on 6467 5028.

Yours sincerely

B. Walker -

Belinda Walker
A/MANAGER
NATIVE VEGETATION CONSERVATION BRANCH

Officer delegated under Section 20
of the Environmental Protection Act 1986

8 July 2013

Attachments: Preliminary Assessment Report (CPS 4860/1)

Appendix 4 City of Armadale Approval of the Revegetation Plan (October 2014; Revision 4)

CITY OF Armadale

Ref : DD010.2012.00000071.001
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6 November 2014

Ms Katrina Cooper
Cottera Environment
2/460 Roberts Road
Subiaco WA 6008

Dear Katrina

RE: REVEGETATION AND WETLAND MANAGEMENT PLAN - LOT 2 NICHOLSON ROAD FORRESTDALE

Thank you for revision 4 of the Lot 2 Nicholson Road Revegetation and Landscape Plan submitted to the City of Armadale for approval on 23/10/2014.

The Revegetation and Landscape Plan adequately meets requirements the City of Armadale planning approval (Council reference D18/3/13) conditions 1b, 1d, 1g, 1h and 1i. Approval of the Revegetation and Landscape Plan is conditional on the following.

1) The Revegetation and Landscape Plan must be consistent with the Fire Management Plan, Landscape Plan, Urban Water Management Plan, Dust Management Plan, Nutrient and Irrigation Management Plan and any civil drawings submitted and approved as a part of the City of Armadale planning approval. Any inconsistencies across the documents will require the Revegetation and Landscape Plan to be resubmitted for consideration.
2) The area shown on Figure 10 as "approved clearing area" relates to the clearing applications process under the Environmental Protection Act and not to City of Armadale approvals. Clearing works must not exceed the area shown as "Stage 1" in Figure 2 of the submitted Revegetation Plan. The City of Armadale recommends demarcation or fencing of the "Stage 1" boundary to avoid accidental incursion by vehicles and clearing beyond the approved boundary.
3) The Revegetation and Landscape Plan only considers revegetation associated with the Stage 1 clearing area as shown on Figure 2 of the plan. Any further proposals to increase the clearing area will be subject to further consideration of environmental impact, and is likely to require additional revegetation.

On 20 October 2014 you responded to the City of Armadale, via email, with more information relating to Dieback management in the revegetation area. The City expressed concern relating to the planting of dieback susceptible species into a dieback infected site. To avoid unnecessary loss of investment into revegetation as a result of disease, the City would recommend further development of your species list to use more dieback resistant species.

Changes to the suite of species (as an alternative to those detailed in the approved plan), can be further discussed with the Environmental Services Department.

If you have any queries relating to the Lot 2 Nicholson Road Revegetation and Landscape Plan, please contact myself on 9399 0417 or email nburbridge@armadale.wa.gov.au

Kind Regards,

N. Burbridge .

Neil Burbridge

Environmental Manager

Appendix 5 Level 2 Flora and Vegetation Survey Report

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.

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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 6 Dieback Survey Report

***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

Contents

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.

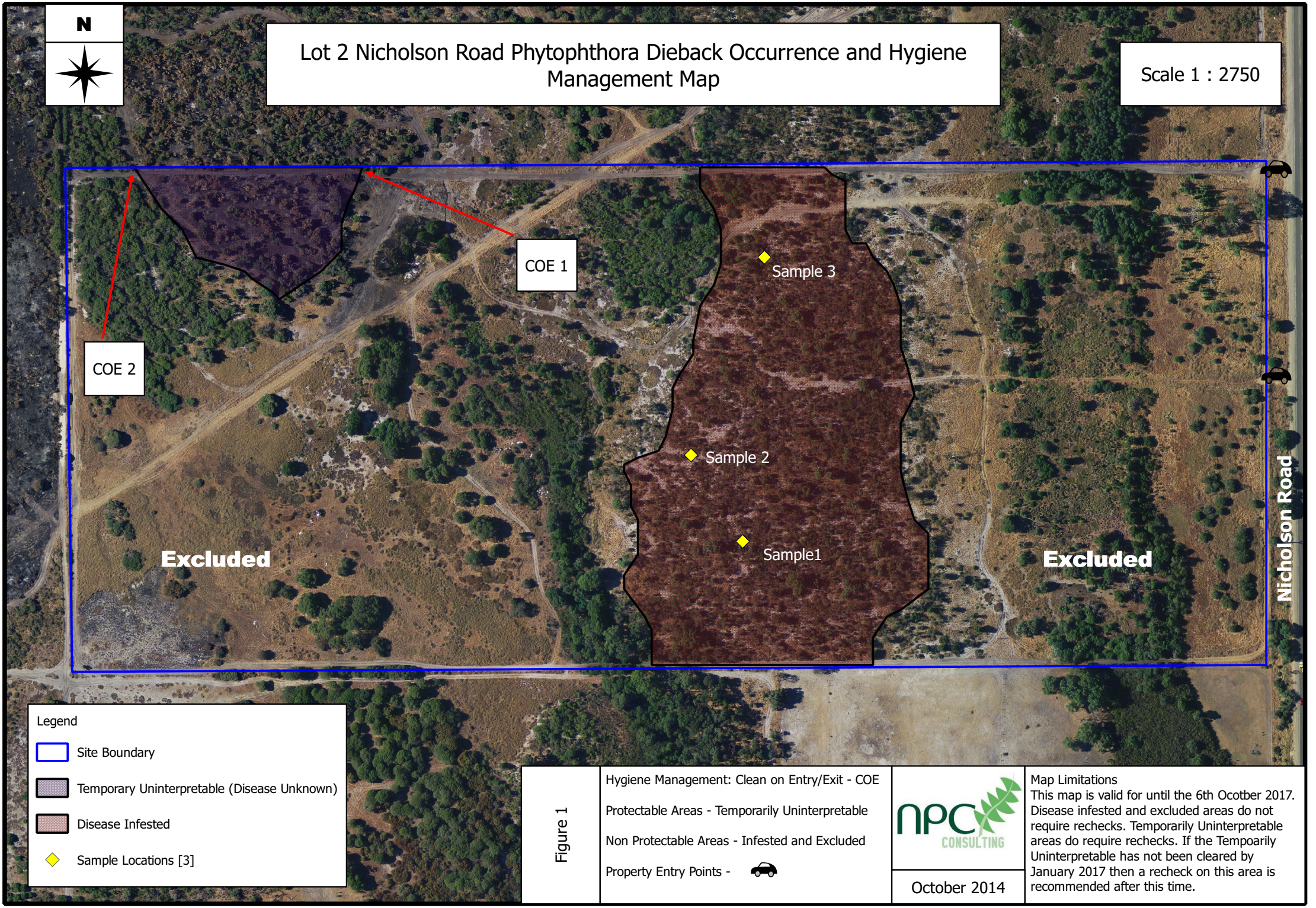
***Phytophthora* Hygiene Management Plan/Map**; is the document/map produced by the Dieback interpreter (surveyor/assessor) which indicates all the relevant hygiene recommendations for a particular area.

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 7 Weed Species Present Onsite

WEED SPECIES PRESENT ONSITE

Species	Ecological Impacts		Invasiveness
	Level of Impact	Impact Attributes	Rate of Dispersal
**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
**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

Species	Ecological Impacts		Invasiveness
	Level of Impact	Impact Attributes	Rate of Dispersal
**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

Species	Ecological Impacts		Invasiveness
	Level of Impact	Impact Attributes	Rate of Dispersal
**Ursinia anthemoides*	U	Increasing	R
**Vulpia bromoides*	H		R

Level of Impact: L – low impact; M – medium impact; H – high impact; U – unknown impact.

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.

Rate of Dispersal: R – rapid; M – moderate; S – slow.

Appendix 8 Revegetation Species List

REVEGETATION SPECIES LIST

Species	Growth Form	Upland Habitat	Lowland / Wetland Habitat	Used by Carnaby's Black Cockatoo
Acacia huegelii	Shrub	Y		
Acacia pulchella var. glaberrima	Shrub	Y		
Adenanthos cygnorum	Shrub	Y		
Allocasuarina fraseriana	Tree	Y		
Anigozanthos humilis	Herb	Y		
Anigozanthos manglesii	Herb	Y		
Aotus procumbens	Shrub		Y	
Astartea scoparia	Shrub		Y	
Banksia attenuata	Tree	Y		Y
Banksia ilicifolia	Tree	Y	Y	Y
Banksia menziesii	Tree	Y		Y
Baumea juncea	Sedge		Y	
Bolboschoenus caldwellii	Sedge		Y	
Conostylis aculeata	Herb	Y	Y	
Conostylis juncea	Herb	Y		
Daviesia preissii	Shrub	Y		
Dianella divaricata	Herb	Y	Y	
Eucalyptus rudis subsp. 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 varia	Shrub		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		
Juncus pallidus	Rush / sedge		Y	

Species	Growth Form	Upland Habitat	Lowland / Wetland Habitat	Used by Carnaby's Black Cockatoo
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		

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