

Donningtons Quarry
Gt Northern Highway
Chittering
Flora and Vegetation Survey



PREPARED FOR LUNDSTROM ENVIRONMENTAL CONSULTANTS



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Executive Summary

Plantecology Consulting was commissioned by Lundstrom Environmental on behalf of B & J Catalano to undertake a reconnaissance vegetation survey at the Donningtons Quarry, 4884 Gt Northern Highway, Chittering. The site consisted of two separate areas covering approximately 55 ha. The purpose of the survey was to inform the proposed expansion of an active quarry.

The field survey was conducted by two botanists from Plantecology Consulting on the 31st October and 1st November 2019. The site was traversed on foot and a search made for conservation significant flora. A detailed survey of the vegetation was undertaken at eleven 100 m² sampling plots (10m x 10m quadrats) and four recce plots, which are used to record the structure, condition and dominants in a patch. The sampling plots were selected to adequately sample the flora within a stand. Plots were positioned to sample a representative and homogeneous (i.e. not located in transitional areas between communities) area of each community. The location of each corner of a plot was recorded with a hand-held GPS unit and a photograph of the plot taken looking inward to the quadrat. All vascular plant species were recorded and an estimate of the Foliage Projective Cover (FPC) percentage was made for each species.

A total of 114 native and 13 non-native (exotic) taxa were recorded within the site, representing 41 families and 93 genera. The dominant families containing mostly native taxa were Fabaceae (18 native taxa), Myrtaceae (10 native taxa), and Proteaceae (10 native taxa). Most exotic species were grasses (Poaceae, 7 exotic taxa).

No Threatened Flora pursuant to the *Biodiversity Conservation Act* (2016) nor the *EPBC Act* (1999) were recorded during the survey. One species listed as Priority Flora by the PWS was recorded during the survey. *Haemodorum loratum* (P3) was recorded at most sites, being absent from only one sampling plot in intact native vegetation stands. The species was ubiquitous throughout the site and too numerous to count, but the population is estimated to be in the thousands.

The survey identified two plant communities within the site:

Eucalyptus marginata – *Corymbia calophylla* Low Woodland

Low woodland of *Eucalyptus marginata* and *Corymbia calophylla* with occasional *Eucalyptus wandoo* subsp. *wandoo* over shrubland of *Xanthorrhoea preissii*, *Hibbertia hypericoides* and *Grevillea synapheae* subsp. *synapheae* over herbland of *Mesomelaena graciliceps*, *Haemodorum loratum* (P3) and *Banksia dallaneyi* var. *dallaneyi* on gravelly loamy sands on laterite.

Eucalyptus accedens – *Eucalyptus marginata* – *Corymbia calophylla* low woodland

Low open woodland of *Eucalyptus accedens* – *Eucalyptus marginata* – *Corymbia calophylla* with *Eucalyptus wandoo* subsp. *wandoo* over shrubland of *Xanthorrhoea preissii* and *Hakea lissocarpha* over herbland of *Mesomelaena graciliceps*, *Mesomelaena tetragona* and *Haemodorum loratum* (P3) in brown gravelly loams on laterite.

The vegetation condition within the site reflects past land practices with stands that have been allowed to regenerate or not been sown to pasture in the past being in 'Very Good' condition, and stands that have been accessible to stock grazing in poorer condition. Most of Area 1 is in 'Very Good' condition. The southern portion of Area 1 is mostly 'Degraded' or 'Completely Degraded', with the mid – and understoreys either highly altered or absent. The vegetation within the southern stand of Area 2 is mostly in 'Very Good' condition, with some alteration to the structure

but few invasive weeds. The northern portion of Area 2, which is in another paddock, has been more accessible to stock. It is mostly 'parkland cleared' and in a 'Completely Degraded' condition.

Thirteen of the taxa recorded during the survey are exotics (weeds), none of which are Declared Pests under the *Biosecurity and Agriculture Management Act 2007*.

Vegetation complex mapping for the southwest forests indicates the entire site is likely a part of the Yalanbee 6 vegetation complex, which has retained over 52% of its original pre-European extent.

The intact vegetation stands of *Eucalyptus marginata* – *Corymbia calophylla* woodlands would still represent areas of local significance as the site is situated in a landscape fragmented by rural activity and supports a sizeable population of Priority Flora.

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1 Introduction

Plantecology Consulting was commissioned by Lundstrom Environmental on behalf of B & J Catalano to undertake a reconnaissance vegetation survey at the Donningtons Quarry, 4884 Gt Northern Highway, Chittering, which is bounded by Great Northern Highway, Maddern Rd and Blue Plains Rd (the site), in the Shire of Chittering (Figure 1). The site consisted of two separate areas for assessment, of which, Areas 1 and 2 (covering approximately 55 ha) are the subject of this report. Areas 1 and 2 required a detailed survey and will be discussed in a separate report. The purpose of the survey was to inform the proposed expansion of an active quarry.

1.1 Purpose

The purpose of the survey was to provide a detailed assessment of botanical values within the site, which could then inform the development process regarding future expansion of quarrying activity.

The objectives of the survey were to:

- Undertake a detailed flora and vegetation survey in accordance with the Environmental Protection Authority's (EPA) Technical Guidance: Flora and Vegetation Survey for Environmental Impact Assessment (2016).
- Identify the presence of any Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs);
- Undertake a systematic search for all vascular plant taxa present; and
- Record the locations and numbers present of any Threatened Flora and Priority Flora.

1.2 Existing Environment

The site is currently being used for gravel extraction and was previously used for stock grazing. As a result, much of the site has been 'parkland cleared' and part of Area 1 has been cleared and allowed to regenerate as evidenced by the presence of unburnt windrows and the even-aged trees (Plate 1). The southern portion of Area 2 also supports a stand of intact native vegetation. The northern part of Area 2 has been largely cleared leaving a few copses of vegetation, mostly on breaks of slope where lateritic caprock is exposed at the surface.

1.3 Climate

The Chittering area experiences a dry Mediterranean climate of hot dry summers and cool wet winters. Long-term climatic averages indicate the site is located in an area of moderate to high rainfall, receiving 655.1 mm on average annually (data for Pearce RAAF, station number 9053, the nearest currently reporting station; Bureau of Meteorology 2019) with the majority of rainfall received between May and August. The area experiences rainfall on an average of 107 days per year. Mean maximum temperatures range from 17.9 °C in July to 33.5 °C in January. Mean minimum temperatures range from 8.2 °C in August to 17.5 °C in February.

1.4 Soils

The Atlas of Australian Soils maps the soils for the site as Map Units JZ2 and Wd9 (Natural Resource Information Centre 1991). Area 1 occurs on Map Unit JZ2, which comprises a dissected

plateau with a gentle to moderately undulating relief, and with broad swampy drainage-ways and basins. It is characterized by lateritic gravels and block laterite. The chief soils are ironstone gravels on ridges and slopes with sandy and earthy matrices overlying duricrusts of recemented ironstone gravels and/or vesicular laterite. Leached sands are a feature of the drainage-ways and basins.

Area 2 occurs on Map Unit Wd9, which comprises broad valleys and undulating interfluvial areas with some discontinuous breakaways and occasional mesas. Lateritic materials mantle the area and the chief soils are sandy acidic yellow mottled soils containing much ironstone gravel in the A horizons.

1.5 Conservation Significant Flora

Under the *Biodiversity Conservation Act 2016* ('BC Act'), the Minister for the Environment produces a gazetted list of Threatened Flora under three categories: Critically Endangered, Endangered and Vulnerable. The Parks and Wildlife Service (PWS) also produces a list of Priority Flora that have not been assigned statutory protection under the BC Act but may be under some degree of threat (PWS 2019a). The PWS recognises four Priority Flora levels. The definitions for each category of Threatened and Priority Flora are shown in Appendix E.

As well as protection under State legislation, selected flora are also afforded statutory protection at a Federal level pursuant to the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The EPBC Act provides for the protection of Threatened species, pursuant to Schedule 1 of the Act, and are defined as "Critically Endangered", "Endangered", "Vulnerable" or "Conservation Dependent" under Section 179. Definitions of these categories are shown in Appendix E. Any action likely to have a significant impact on a species listed under the EPBC Act requires approval from the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities.

A search of the DBCA database of Threatened and Priority Flora returned a list of 29 taxa with the potential to occur within the site (Table 1). Of these taxa, six are listed as Threatened under the BC Act. *Thelymitra stellata* is an orchid that occurs in gravel and lateritic loams and flowers from October to November. The timing of the survey should, therefore, be appropriate to detect this species. The other Threatened taxa are perennial shrubs and should be observable in all seasons.

Table 1: Threatened and Priority Flora potentially occurring within the survey area based on database searches. (VU = Vulnerable; EN = Endangered; CR = Critically Endangered; T = Threatened; 1 - 4 = Priority Flora Category)

Taxa	PWS Rating	EPBC Act Category	Flowering Period
<i>Acacia anomala</i>	T	VU	Aug-Sep
<i>Acacia cummingiana</i>	3		May - Jun, Aug
<i>Acacia drummondii</i> subsp. <i>affinis</i>	3		Jul - Aug
<i>Acacia pulchella</i> var. <i>reflexa</i> acuminate bracteole variant (R.J. Cumming 882)	3		Jul - Sep
<i>Adenanthos cygnorum</i> subsp. <i>chamaephyton</i>	3		Jul, Sep - Jan
<i>Anigozanthos humilis</i> subsp. <i>chrysanthus</i>	4		Jul - Oct
<i>Caustis gigas</i>	2		May
<i>Chamelaucium</i> sp. Gingin (N.G. Marchant 6)	T	VU	
<i>Drosera sewelliae</i>	1		Oct
<i>Eryngium pinnatifidum</i> subsp. <i>palustre</i>	3		
<i>Gastrolobium crispatum</i>	1		Sep - Oct
<i>Gastrolobium nudum</i>	2		Feb
<i>Grevillea althoferorum</i> subsp. <i>fragilis</i>	T	CR	
<i>Grevillea candolleana</i>	2		Aug - Sep
<i>Grevillea corrugata</i>	T	EN	?Aug - Sep
<i>Hibbertia glomerata</i> subsp. <i>ginginensis</i>	2		Jul - Sep
<i>Hypocalymma sylvestre</i>	T		Aug
<i>Hypolaena robusta</i>	4		Sep - Oct
<i>Millotia tenuifolia</i> var. <i>laevis</i>	2		Sep - Oct
<i>Oxymyrrhine coronata</i>	4		
<i>Schoenus griffinianus</i>	3		Sep - Oct
<i>Stylidium squamellosum</i>	2		Oct - Nov
<i>Tetralia</i> sp. Chandala (G.J. Keighery 17055)	2		Aug - Oct
<i>Tetratheca pilifera</i>	3		Aug - Oct
<i>Thelymitra stellata</i>	T	EN	Oct - Nov
<i>Thysanotus</i> sp. Badgingarra (E.A. Griffin 2511)	2		Dec
<i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>	4		May, Nov - Jan
<i>Verticordia rutilastra</i>	3		Sep - Nov
<i>Verticordia serrata</i> var. <i>linearis</i>	1		Sep - Oct

1.6 Conservation Significant Communities

The PWS defines an ecological community as “a naturally occurring assemblage that occurs in a particular type of habitat” (PWS 2019b). A Threatened Ecological Community (TEC) is one that has declined in area or was originally limited in distribution. Uncommon ecological communities that do not strictly meet TEC defined criteria, or are inadequately defined, are listed by the PWS as a Priority Ecological Community (PEC). Definitions of the categories of Threatened and Priority Ecological Communities are given in Appendix E.

As well as protection under State legislation, selected ecological communities are also afforded statutory protection at a Federal level pursuant to the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The EPBC Act provides for the protection of TECs, which are listed under section 181 of the Act, and are defined as “Critically Endangered”, “Endangered” or “Vulnerable” under Section 182. Similar to flora listed under the EPBC Act, any action likely to have a significant impact on a TEC listed under the EPBC Act requires Commonwealth approval.

A search of the Department of Biodiversity, Conservation and Attractions (DBCA) databases of Threatened and Priority Ecological Communities (TECs and PECs) identified two conservation-coded community types and two sub-types with the potential to occur within the site. These were:

- *Banksia attenuata* woodlands over species rich dense shrublands (floristic community type SCP 20a), listed as an Endangered TEC; and
- Banksia-dominated woodlands of the Swan Coastal Plain IBRA region, listed as Endangered under Commonwealth legislation and includes the State-listed PECS:
 - Swan Coastal Plain *Banksia attenuata* – *Banksia menziesii* woodlands (FCT 23b); and
 - Banksia woodland of the Gingin area restricted to soils dominated by yellow to orange sands.

1.7 Ecological Linkages

Ecological linkages are important conservation tools that allow the movement of fauna, flora and genetic material between areas of remnant habitat. The movement of fauna and the exchange of genetic material between vegetation remnants improves the viability of those remnants by allowing greater access to breeding partners, food sources, refuge from disturbances such as fire and maintains the genetic diversity of plant communities and populations. The vegetation stands within the site form part of a north – south local ecological linkage. Local ecological linkages seek to improve the viability of local natural areas by providing connections to other local or regionally significant natural areas and regional ecological linkages (Shire of Chittering 2010).

1.8 Vegetation Complexes

Vegetation complexes are a series of plant communities forming a regularly repeating pattern associated with a particular soil unit (Government of Western Australia 2000). Two vegetation complexes have been mapped as potentially occurring within the site. Area 2 occupies part of the Mogumber Complex – South, which is described as open woodlands of *Corymbia calophylla* with various admixtures of *Eucalyptus marginata*, *Eucalyptus todtiana* and *Banksia* species (Webb *et al.* 2016). Mogumber Complex – South has been mapped as a Swan Coastal Plain vegetation complex and has 38% of its original 14 800 ha pre-European extent remaining (Webb *et al.* 2016). Area 1 has been mapped as being part of the Yalanbee 6 vegetation complex, which are woodlands of *Eucalyptus wandoo* - *Eucalyptus accedens*, and occasionally open forest of *Eucalyptus marginata* - *Corymbia calophylla* on lateritic uplands and breakaway landscapes (Webb *et al.* 2016). The

South West Vegetation Complex Statistics Report (Webb *et al.* 2016) states that over 92 800 ha of the Yalanbee 6 complex remains, representing over 52% of its original pre-European extent.

2 Methods

2.1 Field Survey

The field survey was conducted by two botanists from Plantecology Consulting on the 31st October and 1st November 2019. The site was traversed on foot and search made for conservation significant flora. A detailed survey of the vegetation was undertaken at eleven 100 m² sampling plots (10m x 10m quadrats) and four recce plots, which are used to record the structure, condition and dominants in a patch. The sampling plots selected to adequately sample the flora within a stand (Figure 2). Plots were positioned to sample a representative and homogeneous (i.e. not located in transitional areas between communities) area of each community. The location of each corner of a plot was recorded with a hand-held GPS unit and a photograph of the plot taken looking inward to the quadrat. All vascular plant species were recorded and an estimate of the Foliage Projective Cover (FPC) percentage was made for each species.

Environmental data recorded included topographic position, aspect, slope, soil colour and texture class, rock outcropping, litter cover as well as the degree of disturbance and an estimate of the time since the last fire event. The condition of the vegetation of the site was assessed to assist in determining the conservation values of the site. The vegetation condition was rated according to Keighery (1994), a vegetation condition scale commonly used in the metropolitan and southwest regions. The categories are listed and defined in Table 2. Data on the vegetation structure was also recorded and included the height of the three main strata and the dominant species within each stratum. The vegetation structural description follows that of the National Vegetation Information System (Thackway *et al.* 2006).

All plant specimens collected during the field survey were dried, pressed and then sorted in accordance with requirements of the Western Australian Herbarium. Identification of specimens occurred through comparison with named material and through the use of taxonomic keys. Taxonomic determinations were made using reference material at the Western Australian State Herbarium. Taxa names utilise the current terminologies from FloraBase (2019). Family names utilise the revised phylogeny of the Angiosperm Phylogeny Group - APGIII (FloraBase 2019).

2.1 Study Limitations and Survey Effort

Various factors can limit the effectiveness of a vegetation survey. Pursuant to EPA Technical Guidance: Flora and Vegetation Survey for Environmental Impact Assessment (EPA 2016), these factors have been identified and their potential impact on the effectiveness of the survey has been assessed (Table 3).

The survey was undertaken end of October and beginning of November 2019 and would likely have intercepted the flowering period of annuals of conservation concern with the potential to occur within the site. However, the spring of 2019 was much drier than normal, which may have affected the flowering of some species.

Table 2: Vegetation Condition Scale (Keighery 1994)

Vegetation Condition	Definition
Pristine (1)	Pristine or nearly so, no obvious signs of disturbance.
Excellent (2)	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good	Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

Table 3: Potential limitations affecting the vegetation survey

Potential limitations	Constraint	Comment
Availability of contextual information	No	Sufficient regional and local information was available to place the survey site in its environmental context.
Competency and experience of the botanists undertaking the survey	No	The survey was undertaken by botanists with a comprehensive knowledge of Southwestern Western Australia vegetation, with at least 15 years' experience in vegetation surveys in Western Australia.
Seasonality	Minor	The survey was undertaken in spring 2019. The rainfall in the three months prior to the survey was well below average for the area, especially in September. Maximum and minimum temperatures were approximately 2 ^o higher than the mean.
Adequate ground coverage and intensity of survey effort	No	The survey area was traversed on foot. It is considered the survey quadrats and mapping points provided adequate coverage given the degraded nature of most of the site.
Proportion of Flora identified	No	The survey recorded an estimated 79% of the plant taxa present, although this still represents fewer species than could be expected from an undisturbed system.
Disturbance	Minor	Part of the site has previously been used for stock grazing and the poor condition of such patches has limited the confidence in conclusions that can be drawn regarding the vegetation types present in those patches.
Resources	No	Adequate resources were available to conduct the survey.
Access restrictions	No	All parts of the site were accessible

3 Results

3.1 Flora

3.1.1 Floristic Summary

A total of 114 native and 13 non-native (exotic) taxa were recorded within the site, representing 41 families and 93 genera. The dominant families containing mostly native taxa were Fabaceae (18 native taxa), Myrtaceae (10 native taxa), and Proteaceae (10 native taxa). Most exotic species were grasses (Poaceae, 7 exotic taxa). For a complete species list and the individual site data refer to Appendix A and Appendix B, respectively.

3.1.2 Threatened and Priority Flora

No Threatened Flora pursuant to the *Biodiversity Conservation Act* (2016) nor the *EPBC Act* (1999) were recorded during the survey.

One species listed as Priority Flora by the PWS was recorded during the survey. *Haemodorum loratum* (P3) was recorded at most sites, being absent from only one sampling plot in intact native vegetation stands. The species was ubiquitous throughout the site and too numerous to count, but the population is estimated to be in the thousands, although only a few were flowering at the time of the survey. The location of each plot in which *Haemodorum loratum* was recorded is shown in Table 4.

Table 4: Locations of sampling plots with *Haemodorum loratum* (P3) present (GDA94, Zone 50).

Plot	Easting	Northing
1-2	410209	6517466
1-3	410327	6517369
1-4	410451	6517584
1-5	410598	6517588
1-6	410505	6517450
1-7	410328	6517232
1-8	410297	6517054
1-9	410236	6516913
1-10	410180	6517151
2-1	409707	6515925
2-2	409708	6515794

3.2 Vegetation

3.2.1 Plant Associations

The survey identified two plant communities within the site (Figure 2):

Eucalyptus marginata – *Corymbia calophylla* Low Woodland (Plates 2 and 3)

Low woodland of *Eucalyptus marginata* and *Corymbia calophylla* with occasional *Eucalyptus wandoo* subsp. *wandoo* over shrubland of *Xanthorrhoea preissii*, *Hibbertia hypericoides* and

Grevillea synapheae subsp. *synapheae* over herbland of *Mesomelaena graciliceps*, *Haemodorum loratum* (P3) and *Banksia dallanneyi* var. *dallanneyi* on gravelly loamy sands on laterite.

This unit occurs on the crests and flats on top of lateritic uplands in Area 1 and Area 2. Other common species include *Banksia bipinnatifida* subsp. *multifida*, *Philotheca spicata*, *Mesomelaena tetragona*, *Desmocladius fasciculatus*, *Lepidosperma pubisquameum*, *Hibbertia lasiopus*, *Tetraria octandra* and *Conostylis setosa*.

Eucalyptus accedens – *Eucalyptus marginata* – *Corymbia calophylla* low woodland (Plate 4)

Low open woodland of *Eucalyptus accedens* – *Eucalyptus marginata* – *Corymbia calophylla* with *Eucalyptus wandoo* subsp. *wandoo* over shrubland of *Xanthorrhoea preissii* and *Hakea lissocarpa* over herbland of *Mesomelaena graciliceps*, *Mesomelaena tetragona* and *Haemodorum loratum* (P3) in brown gravelly loams on laterite.

This unit occurs at the break of slopes and on upper slopes with exposed or shallow lateritic caprock. Other common species include *Lepidosperma pubisquameum*, *Tricoryne elatior*, *Babingtonia camphorosmae* and *Acacia applanata*

3.2.2 Vegetation Condition

The vegetation condition within the site reflects past land practices with stands that have been allowed to regenerate or not been sown to pasture in the past being in 'Very Good' condition, and stands that have been accessible to stock grazing in poorer condition. Most of Area 1 is in 'Very Good' condition (Figure 3). This area appears to have been cleared but not converted to pasture as there are still unburnt windrows present in the woodland. Also, the trees were of similar height and diameter indicating they are even-aged. The vertical structure of the vegetation is, therefore, regenerating and the density of the understorey has prevented colonisation from invasive weed species.

The southern portion of Area 1 is mostly 'Degraded' or 'Completely Degraded', with the mid – and understoreys either highly altered or absent (Plate 5). The core of the vegetation remnant in this part of Area 1 has retained its basic structure and is 'Good' condition and the weeds present were not in high abundance.

The vegetation within the southern stand of Area 2 is mostly in 'Very Good' condition, with some alteration to the structure but few invasive weeds. Condition deteriorates toward the eastern end of the stand as the understorey has been invaded by pasture grasses. The northern portion of Area 2, which is in another paddock, has been more accessible to stock. It is mostly 'parkland cleared' and in a 'Completely Degraded' condition. Three remnant stands have retained some of their original structure, two of which are in 'Good' condition (Plate 6). The third occurs on exposed lateritic rocks at a break in slope that hasn't previously supported pasture and is still in 'Very Good' condition, although the understorey is more open than patches that have not been grazed (Plate 7).

3.2.3 Weeds

Thirteen of the taxa recorded during the survey are exotics (weeds), none of which are Declared Pests under the *Biosecurity and Agriculture Management Act 2007*. The most abundant weeds were pasture grasses recorded in the more degraded areas of the site.

4 Discussion

4.1 Flora

No species of Threatened Flora were recorded during the survey. One species of Priority Flora was recorded from most sites within the *Eucalyptus marginata* – *Corymbia calophylla* Low Woodland. *Haemodorum loratum* (P3) occurs from Eneabba to Perth on the eastern side of the Swan Coastal Plain and adjacent slopes of the Dandaragan Plateau. Its usual habitat is in grey and yellow sands in low heath, and eucalypt and banksia woodlands. The soil within the *Eucalyptus marginata* - *Corymbia calophylla* woodland within the site was generally grey loamy sands to brown sandy loams, all over laterite. The local population was estimated to be well in excess of a thousand plants and due to its size, that few individuals were flowering at the time of the survey and that *Haemodorum paniculatum* was identified from the reconnaissance survey of Areas 3 – 6 (Plantecology Consulting 2019), it was considered unviable to do an accurate census during the current survey. Although the basal leaves of *Haemodorum paniculatum* are narrower than *Haemodorum loratum*, a survey when both species were flowering would present the best opportunity of an accurate census of the latter species.

4.2 Plant Communities

Eucalyptus marginata – *Corymbia calophylla* low woodland is generally in ‘Very Good’ condition where stock have been excluded, but some parts of this are degrading from invasion by pasture grasses. All areas of this vegetation unit in ‘Very Good’ condition appear to have been cleared in the past, but the substrate was mostly left intact. This has allowed the native vegetation to regenerate without a strong invasion of exotic grasses and other weeds. Descriptively, this unit aligns with S18 ‘*Eucalyptus marginata* – *Corymbia calophylla* woodlands on laterites’ (Department of Environmental Protection 1996).

Intact remnants of *Eucalyptus accedens* – *Eucalyptus marginata* – *Corymbia calophylla* low woodland in Area 2 are either in ‘Very Good’ or ‘Good’ condition. However, most of this unit in Area 2 has been ‘parkland cleared’ or converted to pasture. Descriptively, this unit aligns to S8 ‘*Eucalyptus wandoo* woodlands (Scarp)’ (Department of Environmental Protection 1996). Neither vegetation type identified in this survey is listed as a PEC.

Mapping of vegetation complexes for the Swan Coastal Plain places much of the Area 2 within the Mogumber Complex – South, which is described as open woodlands of *Corymbia calophylla* with various admixtures of *Eucalyptus marginata*, *Eucalyptus todtiana* and *Banksia* species (Webb *et al.* 2016). This description does not accurately describe the vegetation for Area 2 and is likely due to variance from the scale of mapping as the site straddles the boundary between the vegetation complex mapping for the Swan Coastal Plain and that of the southwest forests. Vegetation complex mapping for the southwest forests indicates the entire site is likely a part of the Yalanbee 6 vegetation complex. The South West Vegetation Complex Statistics Report (Webb *et al.* 2016) states that over 92 800 ha of the Yalanbee 6 complex remains, representing over 52% of its original pre-European extent. Therefore, the remnant vegetation within the site represents a vegetation type with more than 30% of its original extent remaining.

The intact vegetation stands of *Eucalyptus marginata* – *Corymbia calophylla* woodlands would still represent areas of local significance as the site is situated in a landscape fragmented by rural activity and supports a sizeable population of Priority Flora. The generally poor condition of the native vegetation remnants in the northern part of Area 2, however, means they are unlikely to be considered a critical asset to the conservation estate.

5 Summary

One species of Priority Flora was recorded from within the site. The local population of *Haemodorum loratum* (P3) is estimated to be well in excess of a thousand plants and the vegetation where it occurs can be considered locally significant.

Neither the *Eucalyptus marginata* – *Corymbia calophylla* woodland nor the *Eucalyptus accedens* – *Eucalyptus marginata* – *Corymbia calophylla* low woodland are listed as PECs. The vegetation complex within the site (Yalanbee 6) has retained over 50% of its original pre-European extent.

The vegetation condition of the site varies from ‘Completely Degraded’ in pasture and parkland cleared areas to ‘Very Good’ in intact woodland that supports few invasive weed species.

6 References

- Bureau of Meteorology (2019) Climate Statistics Pearce RAAF meteorological station 9053. Bureau of Meteorology. <http://www.bom.gov.au/climate/data/>
- Department of Environmental Protection (1996) *System 6 and Part System 1 Update Programme*, Unpublished bushland plot and area records, Department of Environmental Protection, Perth, Western Australia
- Environmental Protection Authority (2016) *Technical Guidance: Flora and Vegetation Survey for Environmental Impact Assessment*, Perth.
- FloraBase (2019). FloraBase the Western Australian Flora. Parks and Wildlife Service, Como, Western Australia. <http://florabase.dpaw.wa.gov.au/>
- Government of Western Australia (2000) *Bush forever: keeping the bush in the city*, Department of Environmental Protection, Perth.
- Keighery, BJ (1994), *Bushland plant survey: A Guide to Plant Community Survey for the Community*, Wildflower Society of WA (inc), Nedlands, Western Australia.
- Natural Resource Information Centre (1991) Digital Atlas of Australian Soils, Bureau of Rural Sciences, Canberra.
- Parks and Wildlife Service (2019a) Conservation Codes for Western Australian Flora and Fauna, Department of Environment and Conservation, Perth.
- Parks and Wildlife Service (2019b) Definitions, Categories and Criteria for Threatened and Priority Ecological Communities, Parks and Wildlife Service, Perth.
- Plantecology Consulting (2019) *Donningtons Quarry Reconnaissance Flora and Vegetation Survey*, Unpublished letter report for B & J Catalano.
- Shire of Chittering (2010) *Local Biodiversity Strategy*, Shire of Chittering, Bindoon.
- Thackway, R., Neldner, J. and Bolton, M. (2006) Chapter 8: *Vegetation*, in: The Blue Book: Australian Soil and Land Survey Handbook Guidelines for Conducting Surveys, CSIRO, Canberra.
- Webb, A., Kinloch, J., Keighery, G. & Pitt, G. (2016) *The extension of vegetation complex mapping to landform boundaries within the Swan Coastal Plain landform and forested region of south-west Western Australia*, Department of Biodiversity, Conservation and Attractions, Kensington

Figures

Figure 1: Locality Plan Donningtons Quarry Flora and Vegetation Survey

Figure 2: Plant Communities Donningtons Quarry Flora and Vegetation Survey

Figure 3: Vegetation Condition Donningtons Quarry Flora and Vegetation Survey

Plates



Plate 1: View of unburnt windrows in Area 1 within *Eucalyptus marginata* – *Corymbia calophylla* woodland



Plate 2: View of *Eucalyptus marginata* – *Corymbia calophylla* woodland at Plot 1-3 (Area 1).



Plate 3: View of *Eucalyptus marginata* – *Corymbia calophylla* woodland at Plot 2-2 (Area 2).



Plate 4: View of *Eucalyptus accedens* – *Eucalyptus marginata* – *Corymbia calophylla* low woodland at Plot 2-3 (Area 2).



Plate 5: View of parkland cleared vegetation at Plot 1-9 (Area 1).



Plate 6: View of 'Good' condition vegetation at Plot 2-5 (Area 2)



Plate 7: View of 'Very Good' condition vegetation at Plot 2-4 (Area 2).

Appendix A

List of flora recorded within the survey area

NB: * indicates introduced flora

Family	Taxon
Lauraceae	<i>Cassytha glabella</i> forma <i>casuarinae</i>
Colchicaceae	<i>Burchardia congesta</i>
Orchidaceae	<i>Pterostylis recurva</i>
Iridaceae	* <i>Gladiolus caryophyllaceus</i> * <i>Orthrosanthus laxus</i> <i>Patersonia juncea</i> * <i>Romulea rosea</i>
Xanthorrhoeaceae	<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i> <i>Xanthorrhoea preissii</i>
Asparagaceae	<i>Laxmannia ramosa</i> subsp. <i>ramosa</i> <i>Lomandra caespitosa</i> <i>Lomandra hermaphrodita</i> <i>Lomandra sericea</i> <i>Thysanotus sparteus</i> <i>Thysanotus thyrsoides</i>
Hemerocallidaceae	<i>Agrostocrinum scabrum</i> <i>Dianella revoluta</i> var. <i>divaricata</i> <i>Tricoryne elatior</i> <i>Tricoryne humilis</i>
Haemodoraceae	<i>Anigozanthos manglesii</i> <i>Conostylis setosa</i> <i>Haemodorum loratum</i> <i>Haemodorum paniculatum</i> <i>Haemodorum spicatum</i>
Dasyogonaceae	<i>Calectasia narragara</i>
Cyperaceae	<i>Lepidosperma pubisquameum</i> <i>Mesomelaena graciliceps</i> <i>Mesomelaena tetragona</i> <i>Tetraria octandra</i>
Restionaceae	<i>Alexgeorgea nitens</i> <i>Desmocladius fasciculatus</i>
Poaceae	<i>Austrostipa hemipogon</i> * <i>Briza maxima</i> * <i>Ehrharta calycina</i> * <i>Ehrharta longiflora</i> * <i>Hordeum leporinum</i> * <i>Lolium rigidum</i> <i>Neurachne alopecuroidea</i> <i>Rytidosperma setaceum</i> * <i>Avena barbata</i> * <i>Bromus diandrus</i>

Family	Taxon
Proteaceae	<i>Banksia bipinnatifida</i> subsp. <i>multifida</i> <i>Grevillea synapheae</i> subsp. <i>synapheae</i> <i>Hakea lissocarpha</i> <i>Hakea stenocarpa</i> <i>Petrophile linearis</i> <i>Petrophile striata</i> <i>Synaphea spinulosa</i> subsp. <i>spinulosa</i> <i>Banksia dallanneyi</i> var. <i>dallanneyi</i> <i>Banksia sessilis</i> <i>Banksia sphaerocarpa</i> var. <i>sphaerocarpa</i>
Dilleniaceae	<i>Hibbertia ?pilosa</i> <i>Hibbertia ?huegelii</i> <i>Hibbertia ?pilosa</i> <i>Hibbertia huegelii</i> <i>Hibbertia hypericoides</i> <i>Hibbertia lasiopus</i>
Halorogaceae	<i>Glischrocaryon aureum</i> <i>Gonocarpus cordiger</i>
Fabaceae	<i>Acacia applanata</i> <i>Acacia barbinervis</i> subsp. <i>barbinervis</i> <i>Acacia lasiocarpa</i> var. <i>lasiocarpa</i> <i>Acacia microbotrya</i> <i>Bossiaea eriocarpa</i> <i>Daviesia decurrens</i> <i>Daviesia preissii</i> <i>Dillwynia laxiflora</i> <i>Gastrolobium villosum</i> <i>Gompholobium knightianum</i> <i>Gompholobium marginatum</i> <i>Gompholobium preissii</i> <i>Gompholobium shuttleworthii</i> <i>Hovea chorizemifolia</i> <i>Hovea trisperma</i> <i>Kennedia prostrata</i> <i>Sphaerolobium medium</i> <i>Bossiaea ornata</i>
Polygalaceae	<i>Comesperma calymega</i>
Rhamnaceae	<i>Trymalium angustifolium</i>
Celastraceae	<i>Tripterococcus brunonis</i>
Elaeocarpaceae	<i>Tetratheca nuda</i>
Euphorbiaceae	<i>Monotaxis grandiflora</i> var. <i>grandiflora</i>
Phyllanthaceae	<i>Phyllanthus calycinus</i>
Myrtaceae	<i>Babingtonia camphorosmae</i> <i>Calothamnus sanguineus</i>

Family	Taxon
Myrtaceae	<i>Corymbia calophylla</i> <i>Eucalyptus accedens</i> <i>Eucalyptus marginata</i> <i>Eucalyptus wandoo</i> subsp. <i>wandoo</i> <i>Hypocalymma angustifolium</i> <i>Hypocalymma xanthopetalum</i> <i>Kunzea glabrescens</i> <i>Calytrix variabilis</i>
Rutaceae	<i>Boronia ramosa</i> subsp. <i>ramosa</i> <i>Philotheca spicata</i>
Thymeleaceae	<i>Pimelea imbricata</i> subsp. <i>piligera</i> <i>Pimelea spectabilis</i>
Santalaceae	<i>Santalum acuminatum</i>
Droseraceae	<i>Drosera callistos</i>
Caryophyllaceae	* <i>Petrorhagia dubia</i>
Amaranthaceae	<i>Ptilotus esquamatus</i> <i>Ptilotus manglesii</i>
Ericaceae	<i>Astroloma pallidum</i> <i>Leucopogon conostephioides</i> <i>Leucopogon nutans</i>
Rubiaceae	<i>Opercularia vaginata</i>
Ericaceae	<i>Styphelia tenuiflora</i>
Lamiaceae	<i>Hemiandra linearis</i>
Campanulaceae	<i>Isotoma hypocrateriformis</i>
Stylidiaceae	<i>Levenhookia stipitata</i> <i>Stylidium amoenum</i> var. <i>?caulescens</i> <i>Stylidium diuroides</i> subsp. <i>diuroides</i> <i>Stylidium hispidum</i> <i>Stylidium repens</i>
Goodeniaceae	<i>Dampiera linearis</i> <i>Goodenia coerulea</i> <i>Lechenaultia biloba</i> <i>Scaevola glandulifera</i>
Asteraceae	<i>Hyalosperma cotula</i> * <i>Hypochoeris glabra</i> <i>Lagenophora huegelii</i> <i>Pterochaeta paniculata</i> <i>Trichocline spathulata</i> * <i>Ursinia anthemoides</i>

Family	Taxon
Asteraceae	<i>Waitzia suaveolens</i> subsp. <i>suaveolens</i>
Pittosporaceae	? <i>Marianthus coeruleopunctatus</i>
Apiaceae	<i>Xanthosia huegelii</i>

Appendix B

Sampling plot raw data

NB: Only taxa recorded within sampling plots included in table.

Taxon	Plot														
	1-1	1-2	1-3	1-4	1-5	1-6	1-7	1-8	1-9	1-10	2-1	2-2	2-3	2-4	2-5
<i>Glischrocaryon aureum</i>				0.1	0.1										
<i>Gompholobium knightianum</i>	0.1	0.1	0.1		0.1	0.1	0.1	0.1			0.1	0.1	0.1		
<i>Gompholobium marginatum</i>				0.1											
<i>Gompholobium preissii</i>											0.1	0.1	0.1		
<i>Gompholobium shuttleworthii</i>															
<i>Gonocarpus cordiger</i>		0.1			0.1	0.1					0.1	0.1			
<i>Goodenia coerulea</i>					0.1	0.1	0.1								
<i>Grevillea synapheae subsp. synapheae</i>	0.1	0.2	0.3	0.3	0.5	0.1	0.2				0.3	0.1			
<i>Haemodorum loratum</i> (P3)		0.5	0.4	0.2	0.4	0.5	0.3	0.4			0.3	0.2	0.2	0.3	
<i>Haemodorum paniculatum</i>	0.2														
<i>Haakea lissocarpa</i>	0.2	0.1	0.3			0.3	0.3	0.5			0.3	0.3	0.3		
<i>Haakea stenocarpa</i>	0.4														
<i>Hibbertia ?pilosa</i>					0.1										
<i>Hibbertia ?huegelii</i>						0.3	0.2				0.1	0.1			
<i>Hibbertia huegelii</i>	0.1	0.1		0.1	0.2								0.2		
<i>Hibbertia hypericoides</i>	0.3	0.2	8	3	20	10	3	0.2			0.3	0.2			
<i>Hibbertia lasiopus</i>	0.1	0.3	0.3	0.3	0.3	0.4	0.4	0.3			0.3	0.2	0.1		
<i>Hordeum leporinum</i>												0.1			
<i>Hovea chortzemifolia</i>	0.1		0.1					0.1							
<i>Hovea trisperma</i>		0.1			0.2	0.1									
<i>Hyalosperma cotula</i>					0.1										
<i>Hypocalymma angustifolium</i>							0.3								
<i>Hypocalymma xanthopetalum</i>											0.2				
<i>Hypochoeris glabra</i>								0.2				0.1			
<i>Isotoma hypocrateriformis</i>						0.1									
<i>Lagenophora huegelii</i>						0.1									
<i>Laxmannia ramosa subsp. ramosa</i>	0.1	0.1	0.1												
<i>Lechenaultia biloba</i>	0.1	0.2	0.1	0.2	0.3	0.1	0.2								
<i>Lepidosperma pubisquamum</i>	0.2	0.1	0.1	0.1	0.2	0.3	5	1			0.5	0.4	0.1		
<i>Leucopogon conostephioides</i>							0.3								
<i>Leucopogon nutans</i>					0.3	0.3									
<i>Levenhookia stipitata</i>		0.1					0.1				0.1				
<i>Lomandra caespitosa</i>	0.1														
<i>Lomandra hermaphrodita</i>	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1			0.1				
<i>Lomandra sericea</i>	0.1														
<i>Mesomelaena graciliceps</i>	0.5	0.3	0.1	0.2	0.2		0.4				0.3	0.4	0.3		
<i>Mesomelaena tetragona</i>	0.5	0.3	0.4	0.4		0.5		0.4			0.2	0.3	0.3		
<i>Monotaxis grandiflora var. grandiflora</i>	0.1					0.1	0.1								
<i>Neurachne alopecuroidea</i>	0.1	0.1	0.1	0.1	0.1	0.1	0.1				0.1	0.1			
<i>Opercularia vaginata</i>				0.1											
<i>Orthrosanthus laxus</i>					0.1										
<i>Patersonia juncea</i>			0.1	0.1											
<i>Petrophile striata</i>	0.1		0.3		0.2		0.3				0.3				

Taxon	Plot														
	1-1	1-2	1-3	1-4	1-5	1-6	1-7	1-8	1-9	1-10	2-1	2-2	2-3	2-4	2-5
<i>Petrorhagia dubia</i>															
<i>Phyllothea spicata</i>			0.3	0.2	0.3	0.1	0.3	0.1							
<i>Pimelea spectabilis</i>	0.1					0.3						0.2			
<i>Pterostylis recurva</i>			0.1												
<i>Ptilotus esquamatus</i>			0.1			0.1									
<i>Ptilotus manglesii</i>			0.1			0.1					0.1	0.1			
<i>Romulea rosea</i>	0.1														
<i>Rytidosperma setaceum</i>		0.1	0.1	0.1	0.1	0.1		0.1			0.1		0.1		
<i>Santalum acuminatum</i>				0.5											
<i>Scaevola glandulifera</i>			0.1		0.1		0.1								
<i>Sphaerolobium medium</i>			0.1								0.1	0.1	0.1		
<i>Stylidium amoenum</i> var. ? <i>caulescens</i>											0.1				
<i>Stylidium diuroides</i> subsp. <i>diuroides</i>	0.1	0.1	0.1	0.1	0.1	0.1	0.1								
<i>Stylidium hispidum</i>	0.1	0.1	0.1	0.1	0.1		0.1								
<i>Styphelia tenuiflora</i>	0.2												0.2		
<i>Tetaria octandra</i>	0.5	0.1	1	0.4	0.4	0.2	0.4	0.2			0.3	0.2			
<i>Tetradlea nuda</i>			0.1				0.4								
<i>Thysanotus sparteus</i>	0.1	0.1	0.1	0.1			0.1	0.1			0.1		0.1		
<i>Thysanotus thyrsoides</i>	0.1	0.1	0.1	0.1											
<i>Trichocline spathulata</i>	0.1	0.1	0.1	0.1	0.1							0.1	0.1		
<i>Tripterococcus brunonis</i>	0.1	0.1	0.1	0.1	0.1	0.1									
<i>Tricoryne elatior</i>															
<i>Ursinia anthemoides</i>	0.1	0.1	0.1	0.1				0.1			0.1	0.1	0.1		
<i>Tricoryne humilis</i>															
<i>Trymalium angustifolium</i>					0.1		0.1				0.1	0.1	0.1		
<i>Waitzia suaveolens</i> subsp. <i>suaveolens</i>				0.1							0.1	0.1	0.1		
<i>Xanthorrhoea preissii</i>	10	5	1	6	5	3	4	2			12	5			
<i>Xanthosthia huegelii</i>	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1			0.1	0.1	0.1		

Appendix C

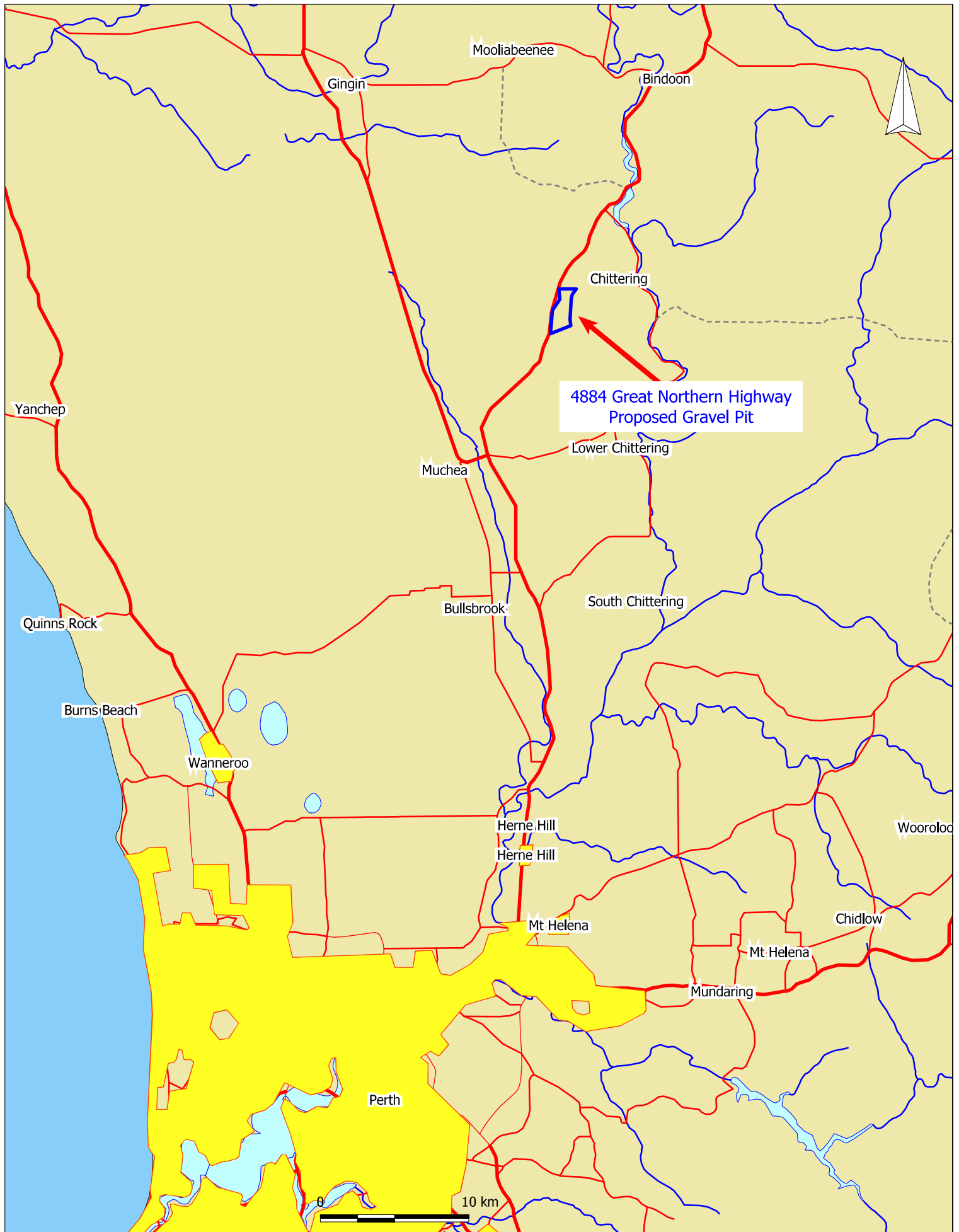
Sampling Plot Environmental Data and Vegetation Structural Data

Plot	Date	Latitude	Longitude	Easting	Northing	UTM Zone	Aspect (classes)
1-1	31/10/2019	-31.4751325	116.0539493	410133.2966	6517352.117	50	W
1-2	31/10/2019	-31.4741131	116.0547593	410209.2695	6517465.77	50	NW
1-3	31/10/2019	-31.4749982	116.05599	410327.0256	6517368.672	50	NW
1-4	31/10/2019	-31.4730655	116.0573132	410450.8832	6517583.974	50	NW
1-5	31/10/2019	-31.4730403	116.0588596	410597.7632	6517588.028	50	N
1-6	1/11/2019	-31.4742792	116.0578724	410505.1608	6517449.903	50	SE
1-7	1/11/2019	-31.4762288	116.0559916	410328.3511	6517232.274	50	N/A
1-8	1/11/2019	-31.4778304	116.0556445	410296.9065	6517054.468	50	N/A
1-9	1/11/2019	-31.4791017	116.0549932	410236.2515	6516913.024	50	N/A
1-10	1/11/2019	-31.4769462	116.0544202	410179.7624	6517151.471	50	N/A
2-1	1/11/2019	-31.48797	116.0493276	409706.5869	6515925.408	50	S
2-2	1/11/2019	-31.489156	116.0493322	409708.1632	6515793.955	50	SW
2-3	1/11/2019	-31.4871999	116.0472994	409513.202	6516009.095	50	W
2-4	1/11/2019	-31.4848319	116.0491163	409683.5018	6516273.063	50	NNW
2-5	1/11/2019	-31.485171	116.0484281	409618.4588	6516234.91	50	N/A

Plot	Placement strategy	Plot Shape	Plot Size (m2)	Plot Width (m)	Plot Length (m)	Stand Age	Slope
1-1	Preferential	Quadrat	100	10	10	>3	1
1-2	Preferential	Quadrat	100	10	10	>3	1
1-3	Preferential	Quadrat	100	10	10	>3	1
1-4	Preferential	Quadrat	100	10	10	>3	2
1-5	Preferential	Quadrat	100	10	10	>3	2
1-6	Preferential	Quadrat	100	10	10	>3	1
1-7	Preferential	Quadrat	100	10	10	>3	0
1-8	Preferential	Quadrat	100	10	10	>3	0
1-9	Preferential	Recce	N/A	N/A	N/A	>3	0
1-10	Preferential	Recce	N/A	N/A	N/A	>3	0
2-1	Preferential	Quadrat	100	10	10	>3	1
2-2	Preferential	Quadrat	100	10	10	>3	1
2-3	Preferential	Quadrat	100	10	10	>3	6
2-4	Preferential	Recce	N/A	N/A	N/A	>3	7
2-5	Preferential	Recce	N/A	N/A	N/A	>3	N/A

Plot	Bare Ground (%)	Bare Rock (%)	Litter (%)	Landform	Soil Colour	Soil Texture	Rock Type
1-1	40	10	20	Crest	Grey	Gravelly loamy sand	laterite
1-2	40	10	30	Crest	Grey	Gravelly loamy sand	laterite
1-3	3	5	35	Crest	Yellow	Gravelly loamy sand	laterite
1-4	30	5	40	Crest	Brown	Gravelly sandy loam	laterite
1-5	25	2	25	Crest	Dark brown	Gravelly sandy clay	N/A
1-6	15	3	40	Crest	Grey	Clayey sand	laterite
1-7	15	5	50	Crest	Dark grey	Clayey sand	laterite
1-8	10	2	65	Crest	Grey	Loamy sand	laterite
1-9	5	3	85	Crest	Grey	Loamy sand	laterite
1-10	20	5	60	Crest	Grey	Loamy sand	laterite
2-1	5	4	65	Crest	Grey	Loamy sand	laterite
2-2	5	8	60	Crest	Grey	Loamy sand	laterite
2-3	15	35	30	Upper slope	Brown	Loam	laterite
2-4	30	5	15	Upper slope breakaway	Brown	Gravelly loam	laterite
2-5	5	10	40	breakaway	Brown	Loam	laterite

Plot	Vegetation Condition	Cover Trees (%)	Cover Shrubs (%)	Cover Ground Layer (%)	Remarks
1-1	Very good	10	10	10	
1-2	Very good	15	10	5	Regrowth
1-3	Very good	10	30	25	Regrowth
1-4	Very good	15	10	5	Regrowth
1-5	Very good	10	30	15	Regrowth; windrows
1-6	Very good	10	30	15	Regrowth
1-7	Very good	25	10	30	Regrowth
1-8	Good	25	5	10	Regrowth; some stumps - ?logged
1-9	Degraded	30	2	2	Few natives in understorey
1-10	Completely Degraded	N/A	N/A	N/A	
2-1	Very good	20	15	15	?historic logging
2-2	Very good	20	5	15	?historic logging; even sized trees
2-3	Very good	20	5	5	
2-4	Very good	N/A	N/A	N/A	
2-5	Good	N/A	N/A	N/A	Disturbed from rocks pushed up



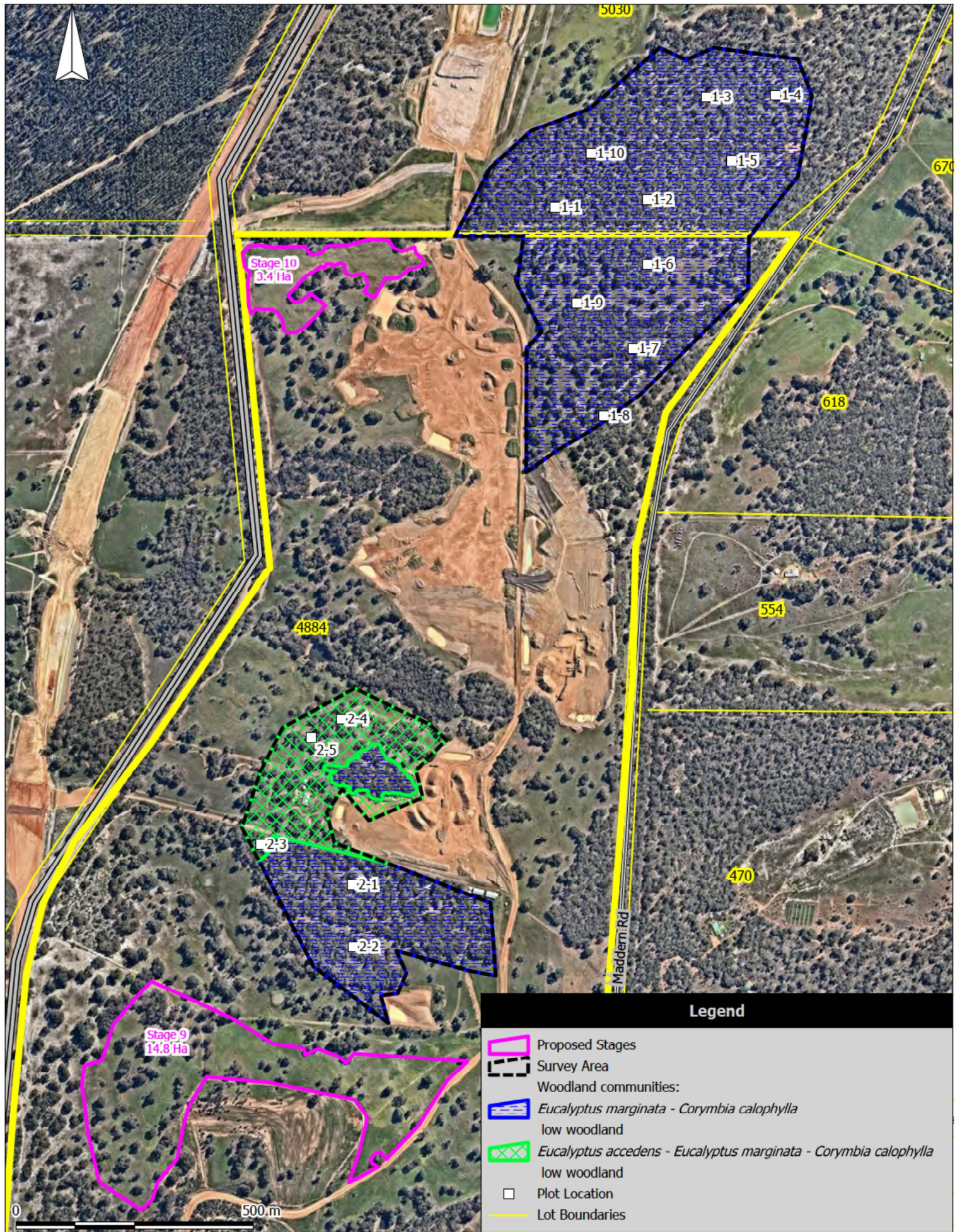
4884 Great Northern Highway
Proposed Gravel Pit

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




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 Projection: Australia MGA94 (50)

Client: B & J Catalano
 Project: Gravel Extraction
 Location: 4884 Great Northern Highway Chittering

Figure 1:
Locality Plan



Legend

-  Proposed Stages
-  Survey Area
- Woodland communities:
-  *Eucalyptus marginata* - *Corymbia calophylla*
low woodland
-  *Eucalyptus accedens* - *Eucalyptus marginata* - *Corymbia calophylla*
low woodland
-  Plot Location
-  Lot Boundaries

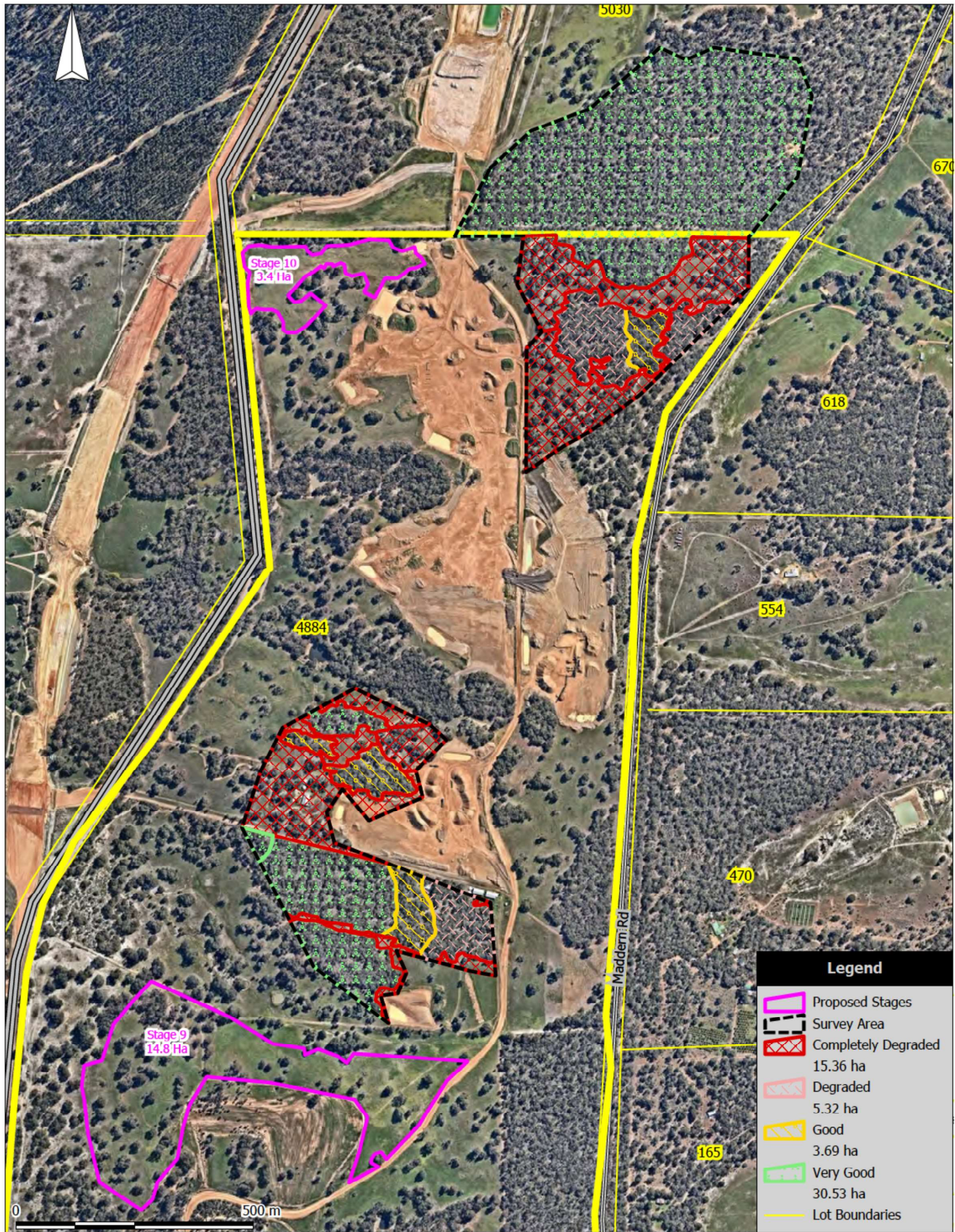
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Scale: 1:10000
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Air Photo Source: Nearmap Sep 2019
Datum: GDA94
Projection: Australia MGA94 (50)

Client: B & J Catalano
Project: Gravel Extraction
Location: 4884 Great Northern Hwy
Chittering

**Figure 2:
Plant Communities**



Legend	
	Proposed Stages
	Survey Area
	Completely Degraded 15.36 ha
	Degraded 5.32 ha
	Good 3.69 ha
	Very Good 30.53 ha
	Lot Boundaries

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Figure 3:
Vegetation Condition