

LOTS 21, 569 AND 1263 SIXTY EIGHT ROAD, BALDIVIS
ENVIRONMENTAL ASSESSMENT

Prepared for

ABN Baldivis Joint Venture
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1.0 INTRODUCTION

1.1 Background

ABN Group, on behalf of the land owners, has prepared a proposed structure plan for urban development on Lots 21, 569 and 1263 Sixty Eight Road, Baldivis (the subject land).

The subject land is approximately 44 ha in size and is located at the intersection of Sixty Eight Road and Baldivis Road about 12km south-east of the Rockingham city centre (Figure 1).

Lots 569 and 1263 are the site of a disused sand quarry that was formerly operated by Rocla Quarry Products. Figure 1 shows the extent of the quarry. Most of the quarry site is cleared apart from about 4.3ha of native vegetation left around the boundaries, consisting mostly of mature trees over grass.

Lot 21 was formerly used for rural-residential purposes but is now disused.

1.2 Proposed Development

Figure 2 shows the proposed structure plan for the subject land. The proposed development is primarily residential at densities ranging from R20 to R60. The structure plan also incorporates a high school site in the south-west and several areas of public open space.

1.3 Planning Context

The subject land is zoned Development under the City of Rockingham Town Planning Scheme No. 2 and Urban Deferred under the Metropolitan Region Scheme. Lots 569 and 1263 are identified as a Priority Sand Resource under the State government's Basic Raw Materials Policy (SPP 2.4).

2.0 KEY ENVIRONMENTAL FACTORS

2.1 Overview

The key environmental factors for the subject land have been identified as vegetation and fauna habitat. These have been addressed by way of clearing permit applications and offset agreements with the DER. At the time of submission, a clearing permit (no. 5422/1) had been issued for most of Lots 569, 1263 and the northern half of Lot 21. Details of the clearing application and offsets agreed with the DER are given in Section 2.4.

Other environmental factors relevant to the structure plan are landforms and soils, groundwater, surface water, contamination, acid sulphate soils and land uses. These are described below.

2.2 Physiography

2.2.1 Landforms and Soils

The subject land lies on the crest and eastern slopes of a moderately high Spearwood sand dune. From a high point of 38m AHD in the north-west, the site slopes generally easterly to a low point of 5m on the mid-eastern boundary. The natural surface slopes at between about 2.5% and 17%. The topography of Lots 569 and 1263 has been heavily modified by quarrying, with slopes within the quarried area currently ranging from 0% to over 100%.

The Geological Survey of Western Australia (Gozzard, 1983) maps all but the eastern edge of the subject land as sand derived from Tamala Limestone (Qts), with surface soils consisting of yellow and medium to coarse-grained sand overlying limestone pinnacles. The eastern edge of the site is mapped as Bassendean Sand (Qpb), with surface soils consisting of light grey-brown, fine to medium-grained sand.

2.2.2 Soil Permeability

Both the Spearwood and Bassendean sands have high permeability, making them well suited to infiltration of runoff. JDA carried out permeability tests at 0.3m depth in two locations in 2010, targeting the likely locations of infiltration basins. The results, based on three tests at each location, gave an average saturated hydraulic conductivity (Ksat) of 16 m/day, which is typical for these sands. Further details of the permeability testing are provided in the Local Water Management Strategy (JDA, 2013).

2.2.3 Acid Sulphate Soils

The Department of Environmental Regulation (DER) maps all but the eastern edge of the subject land as having a low to zero risk of actual or potential acid sulphate soils (ASS). The eastern edge (Bassendean sand) is mapped as having a low to moderate risk of ASS. The nearest mapped high ASS risk zone is a wetland more than 1,500m north-east of the subject land. Based on the DER mapping, no further assessment of ASS on the subject land is considered necessary.

2.3 **Hydrology**

2.3.1 Groundwater

Groundwater is present beneath the subject land at levels of about 2-3m AHD (5m – 36m below ground level). The subject land is located on the south-east corner of a local groundwater mound, the Stakehill Mound, from which the groundwater flows east towards the Serpentine River at a gradient of about 1:800. The height of the water table varies seasonally and between years by up to two metres, with a maximum in September-October and minimum in April-May.

The aquifer is recharged directly by infiltrating rainwater and by upward leakage from the underlying Leederville Formation.

2.3.2 Surface Water

There is no natural surface drainage on the subject land. The sandy soils allow rapid infiltration of rainfall, and surface runoff would occur only for short distances under extreme rainfall conditions. The nearest surface drainage is an artificial drain serving the Kwinana Freeway, approximately 500m to the east.

The major surface drainage feature in the local area is the Serpentine River, which flows north-south about 2km to the east of the subject land (Figure 3) before ultimately discharging into the Peel Inlet.

2.3.3 Wetlands

There are no wetlands or damplands within the subject land. The nearest wetland, as mapped by the DER, is a Multiple Use category palusplain located about 180m to the east.

2.3.4 Water Quality

There are no site-specific data available on groundwater quality beneath the subject land. The groundwater in the superficial formations in this area is expected to be fresh to slightly brackish, with salinity in the range of 1,000-1,500mg/L TDS.

2.3.5 Water Management

Management of stormwater drainage, groundwater and water quality on the subject land during and following development is dealt with in detail in the Local Water Management Strategy and subsequent Urban Water Management Plan.

2.4 **Vegetation**

2.4.1 Vegetation Type and Condition

Overview

Most of the subject land is cleared of native vegetation as a result of previous quarrying. The cleared area extends over about 84% of Lots 569 and 1263. Lot 21 has been parkland cleared in the north while the southern part is uncleared but degraded by past grazing and other disturbances.

The subject land vegetation is mapped by Heddle *et al.* (1980) as Karrakatta Complex – Central and South, described as “predominantly open forest of *E. gomphocephala* – *E. marginata* – *E. calophylla* and woodland of *E. marginata* – *Banksia* spp.”. Beard (1981) mapped the western third of the subject land as 998.1(e₄Mi): Tuart Woodland, the central third as 1001(e₄²Mi): Mixed Jarrah and Tuart Woodland, and the eastern third as 968.3(e₃Mi): Marri Woodland.

Lot 21

Consultant botanist Dr Arthur Weston surveyed Lot 21 in April 2008 and reported that the vegetation condition mostly ranged from Completely Degraded to Degraded, with smaller areas of Good to Very Good condition. Dr Weston found 19 native species and 55 introduced weeds on the lot.

Dr Weston noted that, given the less-than-ideal seasonal timing of the survey, the number of natives present could be twice the number observed. However, even a total of 38 native species over an 8ha site is considered to represent a relatively low level of biodiversity, which is in keeping with the overall degraded nature of the vegetation.

Dr Weston revisited the site in May 2011 to update his previous assessment and to search for possible habitat for Graceful Sunmoths on Lots 21, 569 and 1263. He found that the condition of the vegetation on Lot 21 had deteriorated since his previous visit due to further physical disturbance, increased weed invasion and death of native species.

Lot 21 supports three vegetation units:

- Tuart Woodland over Jarrah-Sheoak Low Woodland in Completely Degraded to Degraded condition (approx. 3.93ha).
- Alien trees and understorey in Completely Degraded to Degraded condition (approx. 0.19ha).
- Jarrah-Banksia Low Open Forest to Woodland in Completely Degraded to Very Good condition (approx. 1.5ha).
- Jarrah-Sheoak Low Woodland to Low Open Forest in Completely Degraded condition (approx. 0.84ha).
- Jarrah Low Open Forest in Completely Degraded to Good condition (approx. 1.4ha).

In addition there is approximately 0.45ha of totally cleared land, including the site of a former house.

Lots 569 and 1263

Native vegetation exists on Lots 569 and 1263 only in small pockets including a 1.5ha (approx.) area of Tuart and Jarrah canopy over grass in the north-west, less than 1ha of Jarrah and Marri canopy over grass on the eastern boundary and lines of trees (mostly Jarrah) along the northern and southern boundaries of the quarry. The vegetation condition of Lots 569 and 1263 is rated as Completely Degraded due to the absence of a native understorey.

Dr Weston's 2008 and 2011 reports are attached in Appendix A.

2.4.2 Rare and Significant Flora

The DER and WA Herbarium online databases list no Declared Rare Flora, Priority Flora or Threatened or Priority Ecological Communities within or close to the subject land; the closest record is a Priority 3 species recorded 3.3km to the east.

The databases hold records of three Declared Rare flora species and 18 Priority Flora species with recorded distributions that include the general Baldavis locality. Of these, eleven are wetland species and another eight occur generally low in the landscape close to wetlands. All of the listed species were searched for by Dr Weston during his field surveys; none were found. From this it is concluded that no rare or priority flora or ecological communities are present at the subject land.

2.4.3 Impacts and Management

The DER has issued a permit (no. 5422/1) to ABN Group to clear 9.2ha of native vegetation including the northern half of Lot 21 and most of Lots 569 and 1263, subject to offset planting to be undertaken by ABN. Excluded from the permit are the southern part of Lot 21 and the eastern edges of Lots 569 and 1263.

Clearing Permit 5422/1 was issued in return for an offset package including the planting of more than 1,500 Tuarts and understorey species in a degraded part of the Rockingham Lakes Regional Park, about 6km north-west of the subject land. The clearing permit issued by the DER is attached in Appendix B. The Planting Plan approved by the DER is attached in Appendix C.

The southern part of Lot 21, containing about 3.1ha of native vegetation (Jarrah-Banksia-Sheoak low woodland to low open forest), is intended as a State school site along with land to the west. It is expected that the Education Department will apply for a clearing permit for this land prior to developing the site.

Trees along the southern boundary of Lot 1263 and in the Sixty Eight Road reserve will be retained where possible commensurate with earthworks requirements.

The clearing of the eastern edges of Lots 569 and 1263, containing about 1.4ha of degraded native vegetation (mature Marri and Jarrah trees over grass), will be addressed as part of a subdivision application following the approval of the Structure Plan. The proponent will retain trees in the POS areas on the eastern edge, as shown in the Landscaping Master Plan submitted with the Structure Plan. The exact trees to be retained will depend upon detailed landscaping design and tree health assessments.

2.5 Fauna and Habitats

2.5.1 Overview

The degraded and largely cleared vegetation of the subject land would provide habitat for a very restricted range of fauna. The mature trees and Banksia woodland on the site offer feeding, roosting and potential nesting habitat for black cockatoos; this factor is examined in detail below.

2.5.2 Impacts and Management

Bamford Consulting Ecologists surveyed Lots 21, 569 and 1263 for potential black cockatoo feeding or breeding habitat in June 2011. Dr Bamford's report is attached in Appendix E.

Dr Bamford found approximately 165 potential black cockatoo nesting trees (>0.5m diameter at breast height), as defined by the Commonwealth Department of Environment (DSEWPC), within the area covered by Clearing Permit 5422/1. Most of these were Tuarts, located in the north of Lot 21 and the western edge of Lot 569. Bamford also found *Banksia attenuata* and *B. menziesii* at a density of about 144 trees per hectare across 3.7ha in the south of Lot 21, of which 0.56ha is within the area covered by Clearing Permit 5422/1. Based on the results of previous studies, 0.56ha of Banksia is considered sufficient to provide food for one black cockatoo for one year.

Dr Bamford carried out a second round of surveys in January 2012, consisting of two dusk searches for evidence of roosting or nesting in the current season. The survey found no evidence of nesting or roosting on the site, although one group of Carnaby's Black Cockatoos was seen moving through the Marri trees in the east of the site and evidence of feeding was found in this area. The report of the second round of surveys is attached in Appendix F.

Based on the results of the fauna surveys, ABN Group referred the proposed clearing of 9.2ha to the Commonwealth DSEWPC as a non-controlled action in August 2012. DSEWPC formally confirmed the non-controlled status of the proposal in September 2012. The advice from DSEWPC is attached in Appendix G.

The vegetation includes 126 trees, mostly Tuart, with diameter at breast height (DBH) of at least 0.5m. Of these, 31 trees (including 13 Tuart, 14 Jarrah and 3 Marri) have visible hollows or spouts that may be suitable as nesting sites for black cockatoos. Figure 4 and Table 1.1 show the affected trees.

As part of the conditions of Clearing Permit 5422/1, ABN Group has undertaken to plant 1040 Tuart trees, more than eight times the total number of trees removed and 33 times the number of potential breeding trees removed, as well as approximately 500 understorey species. The Department of Parks & Wildlife (DPAW) has approved a 2.5ha area of cleared land within the Rockingham Lakes Regional for replanting with Tuarts. A letter from the DPAW confirming this agreement is attached in Appendix C. The nursery stock for the planting is currently being raised by Men of the Trees in its Rockingham nursery and the planting will be undertaken in about June 2104. The Planting Plan approved by the DER is attached in Appendix C.

To offset the short-term loss of potential nesting sites, ABN Group has also installed ten "Cockatube" artificial nesting boxes in existing Tuart trees in and around the planting area. The Cockatubes were supplied and installed by Serpentine-Jarrahdale Landcare (SJLC). The locations of the Cockatubes and confirmation from SJLC of their installation are attached in Appendix H.

The impacts of clearing 3.1ha of potential Black Cockatoo feeding habitat in the south of Lot 21 will be addressed by the Education Department prior to its development of a school on that site. The impact of removing about 31 Marri and Jarrah trees on the eastern edges of Lots 569 and 1263 will be addressed at the subdivision application stage.

2.6 Land Use

2.6.1 Current and Previous Uses of the Site

Lots 569 and 1263 were the site of a sand quarry operated by Rocla Quarry Products from about 1999 until 2009. Prior to this, the land had been used for uncleared grazing

since at least the early 1960s, with a single residence, shed and dam in the south-east corner of Lot 1263 the only improvements during that time.

Lot 21 was used for unimproved grazing from the early 1960s until after 1985. Between 1985 and 1995 a residence and sheds were built near the centre of the lot and the northern part was parkland-cleared for grazing. The sheds were removed between 2006 and 2008 and the house was removed in 2013.

An easement containing the Parmelia Gas Pipeline and the Stirling Trunk Water Main crosses the north-east corner of Lot 569.

2.6.2 Soil Contamination

There is no documentary, visual or olfactory evidence of soil contamination on the subject land. Historical aerial photographs extending back to 1953 show no evidence of contamination or contaminating land uses. The subject land is not listed on the DER Contaminated Sites Database.

2.6.3 Surrounding Land Uses

The subject land is bounded to the east and north by rural land, to the south by rural-residential lots and to the west by uncleared land. The land to the east and south is zoned rural under the Metropolitan Region Scheme and the Rockingham Town Planning Scheme No. 2. The land to the north and west is zoned Urban under the MRS and Development under the TPS.

A small (3.5ha) market garden is located about 150m west of Lot 21. This operation is also within an urban zone and is abutted on its western boundary by new residential development. This indicates that the market garden is not regarded as a constraint to residential development in the vicinity.

2.7 **Aboriginal Heritage**

The DAA Aboriginal Sites Database lists no registered Aboriginal heritage sites on the subject land. A registered site associated with the Serpentine River (Site ID 3582) extends to within about 250m south of the subject but has no effect on the land.

An unregistered site, consisting of an artefact scatter, is recorded near the south-west corner of the subject land. This site is not registered or protected under the *Aboriginal Heritage Act 1972*. Its status suggests that the artefacts were recorded and removed when the site was discovered. It creates no constraint to development on the subject land.

3.0 CONCLUSION

The subject land presents few environmental constraints to development for urban use. Those that do exist relate mainly to the remaining vegetation, in particular its potential value as feeding and nesting habitat for black cockatoos. These factors have been addressed in part by means of clearing permits and applications and an agreed offset package with the DER.

4.0 REFERENCES

Beard J.S. (1981). *Vegetation Survey of Western Australia, Swan 1:1,000,000 Vegetation Series*. University of Western Australia Press.

Gozzard JR (1983). *1:50,000 Environmental Geology Series: Rockingham part Sheets 2033 III and 2033 II*. Geological Survey of Western Australia, Perth.

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

JDA Consultant Hydrologists (2013). *Lots 569 & 1263 Baldivis Road & Lot 21 Sixty Eight Road, Baldivis: District and Local Water Management Strategy*. Report No. J5522a prepared for ABN Group Pty Ltd, Perth.

Figures





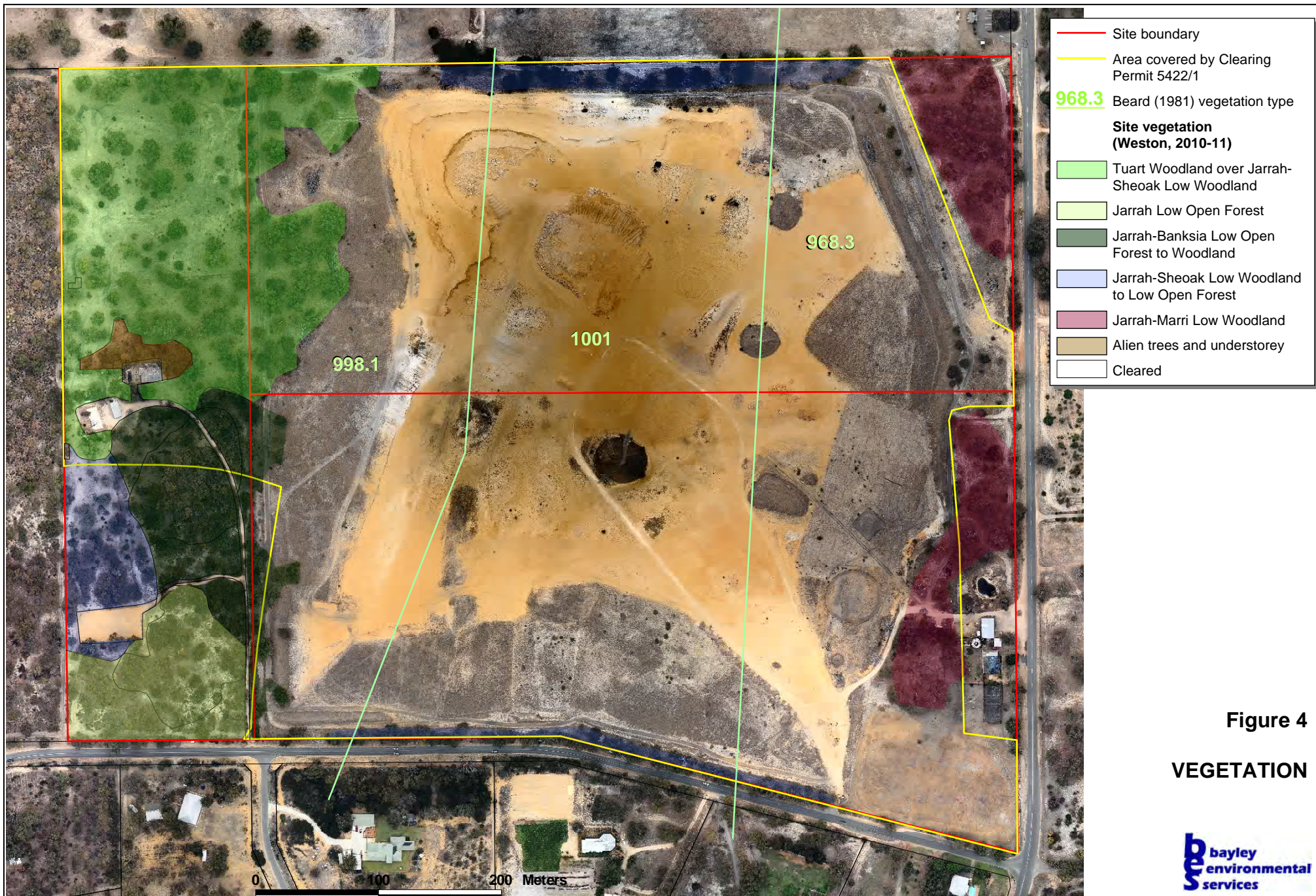
Figure 2

STRUCTURE PLAN



- Site boundary
- Topographic contour (1m)
- Groundwater contour (minimum – May 2003)
- Serpentine Main Drain
- **Geology (GSWA)**
- S7 Sand derived from Tamala Limestone (Qts)
- S8 Bassendean Sand (Qpb)
- S10 Thin Bassendean Sand over Guildford Formation (Qpb/Qpa)

Figure 3
PHYSIOGRAPHY



Appendix A

**Vegetation Reports
(Weston, 2008 & 2011)**

**RARE FLORA SEARCH AND VEGETATION SURVEY
LOT 21 SIXTY EIGHT ROAD
BALDIVIS

CITY OF ROCKINGHAM**

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SUMMARY

This report describes methods and presents results of searches for rare flora and of vegetation surveys in Lot 21 Sixty Eight Road, Baldivis. The principal objectives of the study were to search for Declared Rare and Priority Flora and other significant plants in the lot and to describe and/or map, in terms of structure, floristic community type and condition, the vegetation of the study area. An ancillary aim was the compilation of a list of species of vascular plants recorded during the study.

Vegetation

Lot 21 is in the Karrakatta Vegetation Complex – Central and South (49).

The four native vegetation units of the study area are:

- Tuart (*Eucalyptus gomphocephala*) Woodland to Open Woodland over Jarrah (*Eucalyptus marginata*) - Sheoak (*Allocasuarina fraseriana*) Low Woodland to Low Open Woodland T
- Jarrah (*Eucalyptus marginata*) - Sheoak (*Allocasuarina fraseriana*) Low Woodland to Low Open Forest (mainly Parkland Cleared) JS
- Jarrah (*Eucalyptus marginata*) - Banksia (*Banksia attenuata*) Low Open Forest to Low Woodland over *Hibbertia hypericoides* Low Shrubland JB
- Jarrah (*Eucalyptus marginata*) Low Open Forest J

The distributions of these vegetation units in Lot 21, and their condition assessments, are shown on Figure 3, the vegetation map.

One or two of the following four Floristic Community Types might have been represented in Lot 21 when the vegetation there was in better condition. None of them is a Threatened Ecological Community.

- FCT 21a Central *Banksia attenuata* – *Eucalyptus marginata* woodlands
- FCT 24 Northern Spearwood shrublands and woodlands
- FCT25 Southern *Eucalyptus gomphocephala* – *Agonis flexuosa* woodlands
- FCT28 Spearwood *Banksia attenuata* or *B. attenuata* – *Eucalyptus* woodlands

Flora

Approximately 74 taxa (species, subspecies and varieties) of vascular plants, both native and alien, were recorded in the Lot 21 study area and are listed in Table B1. Approximately 55 of the taxa recorded are established introduced weeds and 19, natives. It is estimated that the list contains less than 50% of the native species in the study area and at least 50% of the introduced species.

No significant species was recorded in Lot 21 during this study.

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**RARE FLORA SEARCH AND VEGETATION SURVEY
LOT 21 SIXTY EIGHT ROAD
BALDIVIS**

CITY OF ROCKINGHAM

1.0 INTRODUCTION

This report describes methods and presents results of a search for rare flora and a vegetation survey in Lot 21 Sixty Eight Road, Baldivis on 4 April 2008.

The search and survey were commissioned by Kristen Bennetts, RPS, in April 2008.

1.1 LOCATION

The study area is Lot 21, an 8.3 ha property on the north side of Sixty Eight Road adjacent to Lots 20, 569, 740 and 1263. Lots 569 and 1263, the Rocla current Baldivis operation, are between Lot 21 and Baldivis Road.

The location of Lot 21 is shown in Figure 1, Site Location.

1.2 OBJECTIVES

The principal objectives of this study are to:

- Provide descriptions of flora, floristic community types and vegetation units of the study area,
- Assess the health (condition) of the vegetation units,
- Determine the presence of Declared Rare Flora (DRF), endangered, priority and other significant species, Threatened Ecological Communities (TEC) and other significant vegetation units,
- Provide maps of the area showing vegetation units and condition and any DRF, TEC and other significant flora and vegetation, and
- Meet, so far as possible, the requirements of the Environmental Protection Authority's Guidance No. 51, *Terrestrial flora and vegetation surveys for Environmental Impact Assessment in Western Australia*, and Draft Guidance No. 33, *Environmental Guidance for Planning and Development. Part B. Biophysical Factors* (Environmental Protection Authority 2004 and Environmental Protection Authority 2005 p. 9).

1.3 LEVEL OF SURVEY

The EPA's *Guidance No. 51* (Environmental Protection Authority 2004) and *Draft Guidance No. 33* (Environmental Protection Authority 2005 p. 9) were used in the preparation of the report. As the anticipated scale and nature of the proposed development's impact on native

vegetation and flora in the study area will be high, a 3-stage Level 2 Detailed Survey, as described on Page 39 of *Guidance No. 51*, was, so far as possible, embarked upon.

A Level 2 survey consists of three or, in some situations and areas, four stages. The first two stages constitute a Level 1 survey. The required three stages of a Level 2 survey are:

- Background research or ‘desktop’ study,
- Reconnaissance survey, and
- Detailed survey.

The fourth Level 2 stage is Comprehensive survey, which involves surveying both the locality and parts of the local area at the same intensity as required in a detailed survey, but more structured, over a longer term and with multiple visits.

The third square bullet in the checklist on Page 9 of *Draft Guidance No. 33* lists eight categories of descriptions that should be in a Comprehensive vegetation and survey report.

2.0 METHODS

The study was undertaken in the following series of overlapping and interrelated stages:

- preparation for field work, including consultations, the gathering and collation of available information and interpretation of aerial photography,
- field work to record and collect flora, determine parameters, condition and distributions of vegetation units and search for significant flora,
- follow-up work, including pressing, drying and identification of plants recorded and collected during field work, and
- report preparation.

2.1 PREPARATION FOR FIELD WORK

Preparation for field work entailed:

- finding existing vegetation descriptions and maps and flora lists for the general area,
- provisional description, listing and mapping of vegetation of the study area, and
- preparing a table of significant flora to be searched for during field work.

Methods and representative sites for field work were initially chosen during this preparation stage.

2.1.1 Vegetation

Provisional description, listing, mapping and understanding of vegetation of the study area were based primarily upon interpretation of digital aerial photography provided by RPS.

Reports, publications and maps used in the provisional description, listing, mapping and understanding of vegetation of the study area include Beard (1979, 1980), Heddle *et al.* (1980), Gibson *et al.* (1994), Department of Environmental Protection (1996) and Keighery (1997).

2.1.2 Gibson Floristic Community Types of the Study Area

The most accurate way to determine which floristic community types are in a metropolitan region Swan Coastal Plain study area is to select, sample and analyse Gibson-type, 10 m by 10 m quadrats using the sampling and PATN analysis techniques described by Gibson *et al.* (1994), Keighery (1994) and Griffin (e.g. 2005). An essential component of these techniques is the compilation of a complete list of species of vascular plants for each quadrat based upon correctly identified plant specimens. This often requires sampling the quadrat more than once during peak periods of flowering and fruiting.

As April, when field work was done for this study, is not in one of these peak periods and as most of the vegetation in the study area is very disturbed, quadrats were not selected. It should be possible, however, according to Gibson (pers. comm.) and *Bush Forever* (2000, p. 487), to infer, at least tentatively, which floristic community types, at least of the original 43 described by Gibson *et al.* (1994), occur in a study area. Inferences of which FCTs occur in particular Bush Forever sites have been made from “information on the floristics of the area and the area’s geographic location” (*Bush Forever* 2000, p. 487).

More specifically, inferences can be made by comparing comprehensive lists of species, key species, aerial photography and other information from sites in a study area with:

1. the ‘Thirty Group Classification’ descriptions of floristic community types in Gibson *et al.* (1994, pp. 29-30, 37, 39-45),
2. the sorted two-way table in Gibson *et al.* (1994, Table 12: pp. 31-36), which shows species frequency by community type in Species Groups A through S,
3. the descriptions of community types and maps of locations of their sampling quadrats in Gibson *et al.* (1994, Appendix 1: pp. 74-159),
4. the Table 1 list in Keighery (1997) of floristic community types identified by Gibson *et al.* (1994) plus additional ones identified subsequently by the Department of Environmental Protection (1996 and, specifically, for the Perth Metropolitan Region, *Bush Forever* 2000, Volume 2, pp. 485-486),
5. geomorphologic and land system information about the study area and its vicinity in the 1:50,000 scale Environmental Geology Series maps (e.g. Gozzard 1983) and, to a lesser extent, in the Churchward and McArthur (1980) smaller scale maps,

6. lists of floristic community types, bushland areas and locations of sampling quadrats given in appendices of Gibson *et al.* (1994) and in Keighery (1997),
7. Bushland Plant Survey Recording Sheets for sampled quadrats in similar areas of bushland as near the study area as possible,
8. descriptions of Bush Forever sites in *Bush Forever* (2000, e.g. Site 376, Baldy Road Bushland, especially Lots 101 and 33 north of Church Road),
9. sampling quadrat sites of floristic community types recorded nearest the study area, and
10. relevant information in various reports and unpublished information available in the Department of Environment and Conservation.

It may also be useful to tabulate occurrences of each species in the quadrat sample list in each of 44 floristic community types and compare the totals.

Those of these comparisons that could be made, especially Items 1, 3, 5 and 8, were made.

2.1.3 Flora

Vegetation and flora reports covering nearby areas, though not the study area itself, were used to get an appreciation of the types and range of plants which might be found in the study area. These lists include Weston (2004, 2003).

2.1.4 Significant Flora

Table A1 lists Declared Rare Flora, Priority Flora and other significant flora with distributions that may include the general area. The table, and a description of the sources and methods used to compile it, are in Appendix A. The table gives information about conservation codes, distributions, localities, growth forms, habitats and flowering times for each taxon (species, subspecies) listed. During preparation of the table, herbarium specimens in the Western Australian Herbarium of taxa listed in the table were examined to gain familiarisation with their appearance, habitats, distribution and flowering times.

2.2 FIELD WORK

The field work was carried out on 4 April 2008 by botanist Arthur Weston, with assistance from J. Grehan.

Traverses were walked through the study area and dominant species and subjective estimates of vegetation structure and condition were recorded at representative sites.

The physiognomic system used for recording and classifying vegetation units and the six-point scale for assessing vegetation condition are described in Trudgen (1991), Keighery (1994) and Government of Western Australia (2000: *Bush Forever*, Volume 2, pp. 492-494). *Bush Forever* Tables summarising the system and the scale are reproduced in Appendix D.

Most plants were identified in the field, with help from various species lists and descriptions in floras. Voucher specimens of plants not readily identifiable in the field were collected and pressed for subsequent identification.

Searches for Declared Rare, Priority and other significant flora were made during the traverses walked through the property. The principal taxa searched for are those listed in Table A1, but other Declared Rare and Priority Flora and otherwise significant flora, especially those listed in Government of Western Australia (2000, Volume 2, Table 13) were also searched for.

2.3 AFTER FIELD WORK

Plant specimens collected during the field work were pressed, then dried in the Western Australian Herbarium in South Perth. The specimens were identified by checking them against a variety of keys and descriptions in floras and taxonomic works, only some of which are referred to in the report, by consulting other botanists, and, after fumigation, by comparing them with specimens in Herbarium collections.

During the process of identification and following it, the names of the plants identified were checked against the Table A1 list in Appendix A and other lists of significant flora, including the *Bush Forever* list of significant flora of the Perth Metropolitan Area (Government of Western Australia 2000, Volume 2, Table 13).

The provisional vegetation descriptions and boundaries were revised, refined and finalised, and the significance of vegetation units, vegetation complexes and floristic community types in the study area was assessed.

A vegetation map was drawn to show boundaries and condition of vegetation units in the study area, and the report was prepared.

3.0 RESULTS

This section presents the results of the field work, plant identifications, photo interpretation and other aspects of the study. The results are described in the following sections, taxa (species, subspecies and varieties) of vascular plants recorded during the study are listed in Appendix B and vegetation units and their condition are shown on Figure 3, the vegetation map.

3.1 PHYSICAL SETTING

3.1.1 Climate

The climate of the study area is temperate mediterranean, with warm dry summers and mild wet winters.

Perth's long term average annual rainfall is approximately 870 mm, with roughly 90% falling in the period between April and October. According to the Bureau of Meteorology (BOM) website, Perth had a drier than average March in 2008, but April 2008 was the wettest April on record.

Mean monthly temperatures range from a minimum of 10°C, in July, to a maximum of 25°C, in February. Daily minimums and maximums are, of course, much lower and higher, respectively. However, temperatures low enough for light frosts do occur, but only rarely.

3.1.2 Environmental Geology

The Rockingham environmental geology map sheet (Gozzard 1983) correlates geology, soils, geomorphology and other physical features of the study area on two maps, one at a scale of 1:100 000 and a larger one at a scale of 1:50 000.

The Rockingham sheet's 1:100 000 scale geomorphology map shows Lot 21 and its neighbouring lots as being on Spearwood Dune eolian surfaces (Ed), on slopes of 3° to 10°. This report's Figure 2 shows the topography of Lot 21.

The sheet's 1:50 000 scale environmental geology map shows Lot 21 and its neighbouring lots as being sand derived from Tamala Limestone (S₇, Qts).

3.2 VEGETATION

The vegetation of the study area is described below in terms of plant formations and associations of Beard (1979), vegetation complexes of Heddle *et al.* (1980), floristic community types of Gibson *et al.* (1994) and the system of structural units or vegetation units used for *Bush Forever* (Government of Western Australia 2000, pp. 46, 493; Keighery 1994).

3.2.1 Beard's Plant Formations and Associations

According to Beard's 1:250 000 scale vegetation map (Beard 1979), the study area is in tuart woodland (e₄Mi) near its eastern border with mixed jarrah and tuart woodland (e₄²Mi) and marri woodland (e₃Mi). The first two vegetation units belong to the Spearwood Vegetation System, with tuart favouring ridges and jarrah favouring depressions. The third unit belongs to the Bassendean Vegetation System, which Beard describes as being an intricate mosaic of vegetation.

3.2.2 Heddle's Vegetation Complexes

According to the 1:250 000 scale vegetation map by Heddle *et al.* (1980), the native vegetation complex potential of the study area is Karrakatta Complex – Central and South (49): “predominantly open forest of *E. gomphocephala* – *E. marginata* – *E. calophylla* and woodland of *E. marginata* – *Banksia* spp.”.

The study area is in the southern half of Complex 49 near the complex's eastern boundary with Complex 35 (Serpentine River Complex), which is on the east side of Baldivis Road.

3.2.3 Gibson Floristic Community Types of the Study Area

Comparisons of the Lot 21 location and observations made during field traverses there with information in sources listed in Section 2.1.2 Items 1, 3, 5 and 8 lead to the conclusion that the Floristic Community Types most likely to be represented in Lot 21 are FCT 24 and FCT 28. It is possible, but not likely, that FCT 21a or FCT 25 or both are represented there.

According to Gibson *et al.* (1994, p. 44) the Bassendean Dunes FCT 21a also includes unusual Spearwood sites.

The names of the four FCTs that might be in Lot 21 are:

| | |
|---------|---|
| FCT 21a | Central <i>Banksia attenuata</i> – <i>Eucalyptus marginata</i> woodlands |
| FCT 24 | Northern Spearwood shrublands and woodlands |
| FCT25 | Southern <i>Eucalyptus gomphocephala</i> – <i>Agonis flexuosa</i> woodlands |
| FCT28 | Spearwood <i>Banksia attenuata</i> or <i>B. attenuata</i> – <i>Eucalyptus</i> woodlands |

The conclusions for each of the four items, Items 1, 3, 5 and 8, are as follows.

1. The Floristic Community Types that could be represented in Lot 21 are FCT 21a and/or 28 and FCT 24 and/or 25.
3. Floristic Community Type 24 would probably be represented in Lot 21 if the Tuart vegetation there were not so degraded. One or more of FCTs 21a, 28 and 25 might also be there.
5. As the soils and landforms of Lot 21 are Spearwood and as there is no significant outcropping limestone there, the Lot's Floristic Community Types must be limited to one or more of FCTs 21a, 28, 24 and 25.
8. Inferred Floristic Community Types in Bush Forever Site 376, Baldivis Road Bushland, are FCT *21a and *28. Probably FCT 21a would be in the relatively low area on the east side of Baldivis Road and FCT 28 on the west side, especially Lots 101 and 33 north of Churcher Road. Lots 101 and 33 have the same environmental geology and range of slope as Lot 21.

3.2.4 Vegetation Units of the Study Area

The vegetation units of the Lot 21 study area are described in this section, and their distributions and assessments of condition in the study area are shown on Figure 3, the vegetation map. The Plates have photographs of stands of vegetation in Lot 21.

The vegetation descriptions and map in this report use the structural system of vegetation classification used by Trudgen and Keighery (1995) and for describing vegetation of Perth Bush Forever sites (Government of Western Australia 2000). It is the modification by Keighery (1994) of the Muir (1977), Specht *et al.* (1974) and Aplin (1979) systems of vegetation classification and is summarised in tabular form in Appendix D of this report.

Descriptions of vegetation units of the study area are given below, beginning with the unit with the tallest upper stratum, Tuart Woodland to Open Woodland. These units, and the letter-symbols used for them on the vegetation map, are:

Tuart (*Eucalyptus gomphocephala*) Woodland to Open Woodland over Jarrah (*Eucalyptus marginata*) - Sheoak (*Allocasuarina fraseriana*) Low Woodland to Low Open Woodland

T

All of the vegetation indicated on the map by the symbol 'T' is dominated by Tuart, mainly with an understorey or ground layer which is largely to entirely weedy and non-native.

The Tuart unit has a dominant stratum of Tuart trees over 10 m tall and, for the most part, with estimated densities of around 10%. In a few areas, however, the density is more, and in others less.

The principal dominants of this unit are *Eucalyptus gomphocephala*, *Eucalyptus marginata*, *Allocasuarina fraseriana* and *Macrozamia riedlei* and weedy grasses and other herbaceous plants. There are also a few *Banksia attenuata* trees, *Macarthuria australis*, *Hibbertia subvaginata* and *Bossiaea eriocarpa* shrubs and *Phlebocarya ciliata* and *Dasypogon*

bromeliifolius herbaceous plants. Other plants recorded in the vegetation unit are listed for Unit T in Appendix B.

The condition of most of this vegetation unit is assessed as Completely Degraded, with less than 10% assessed as Degraded.

Jarrah (*Eucalyptus marginata*) - Sheoak (*Allocasuarina fraseriana*) Low Woodland to Low Open Forest (mainly Parkland Cleared)

JS

Vegetation indicated on the map by the symbol 'JS' is dominated by Jarrah, Sheoak and, in some places, *Banksia attenuata*. It has an understorey or ground layer mainly of *Bromus diandrus* and other weeds or the ground is bare of vegetation.

The dominant stratum is under 10 m tall and, for the most part, has a cover of around 30%. In a few areas, however, the density is more, and in others less.

The principal dominants of this unit are *Eucalyptus marginata*, *Allocasuarina fraseriana* and *Banksia attenuata* and weedy grasses and other herbaceous plants. *Hibbertia hypericoides* and *Stirlingia latifolia* are the most common and conspicuous native plants. Other plants recorded in the vegetation unit are listed for Unit JS in Table B1.

The condition of this vegetation unit is assessed as Completely Degraded, to Degraded.

Jarrah (*Eucalyptus marginata*) - Banksia (*Banksia attenuata*) Low Open Forest to Low Woodland over *Hibbertia hypericoides* Low Shrubland

JB

Vegetation indicated on the map by the symbol 'JB' is dominated by Jarrah, *Banksia attenuata* and, in some places, *Banksia menziesii* and Sheoak. There are a few tall *Kunzea glabrescens* shrubs and small *Banksia grandis* trees in the understorey and a number of native species of smaller shrubs and herbaceous plants. *Hibbertia hypericoides* 10-30% (patchy) is the most common and conspicuous small shrub, and **Bromus diandrus* is the dominant patchy weedy grass. Other species recorded in the vegetation unit are listed for Unit JB in Table B1.

The dominant stratum is mostly under 10 m tall and, for the most part, has a cover of around 30% or more.

The condition of this vegetation unit is assessed as mainly Good, with some areas Very Good and others Degraded.

Jarrah (*Eucalyptus marginata*) Low Open Forest

J

Vegetation indicated on the map by the symbol 'J' is dominated by spindly regrowth Jarrah trees, with understories of patchy *Macrozamia riedlei* – *Acacia pulchella* – *Hibbertia hypericoides* Low Shrubland and *Conostylis ?aculeata* Open Herbland. Weedy grasses and other herbaceous plants are common. Other species recorded in the vegetation unit are listed for Unit J in Table B1.

The condition of this vegetation unit is assessed as approximately 50% Good and 50% Degraded.

Alien trees and understorey

A

On the northern and eastern sides of the house there is a low forest of planted *Ficus carica*, *Melia azedarach*, mulberry, loquat and other alien trees over a closed grassland of

Pennisetum clandestinum, *Cynodon dactylon* and *Stenotaphrum secundatum*, which were probably also planted.

Cleared of all vegetation

C

The house, a few small outbuildings, the driveway, a yellow sand pad and some other areas have been completely cleared of all vegetation.

3.2.5 Condition of Vegetation

Assessments of condition of the vegetation units described in the previous section are given below and are shown on Figure 3, the vegetation map. The scale used for the assessments is the six-point scale developed by Trudgen (1991) and Keighery (1994) and used in *Bush Forever* (Government of Western Australia 2000, Volume 2, pp. 48, 493). The six steps in the scale and the corresponding letters used on the map are: Pristine, Excellent, Very Good (VG), Good (G), Degraded (D) and Completely Degraded (CD). No vegetation in Pristine or Excellent condition was identified. The Figure 3 Condition Scale also has 'T', for areas from which all vegetation has been removed. More detailed definitions of the scale are in Appendix D of this report.

Differences in appearances of stands judged to be due solely to different stages in regeneration following burning were discounted when assessing condition. However, increased establishment of weeds resulting from the burning and abundance of dead large trees which appeared to have few or no replacements did influence the condition assessment.

It is estimated that none of the Lot 21 bushland is Pristine or Excellent, less than 10% is Very Good, 10% to 20% is Good, 20% to 30% is Degraded, and more than 50% is Completely Degraded. Some of the bushland has been burnt within the past year or so, trees were felled longer ago, and there is evidence that horses have grazed and browsed there.

There are annual alien grasses and other weeds in all vegetation in Lot 21, even in understorey in Jarrah-Banksia Low Open Forest to Woodland in best condition, but they are dense or conspicuous mainly along the main track and in other places which have been cleared, at least of understorey vegetation.

3.3 FLORA

No attempt was made to compile a comprehensive list of flora for the study area, but plants that were common, characteristic or possibly significant were noted during the study and are the basis for Appendix B's Table B1, a list of vascular plant flora recorded in the study area. .

Table B1 provides information about the life form of each taxon listed and indicates which are natives or weeds or have conservation significance.

Approximately 74 taxa (species, subspecies and varieties) of vascular plants, both native and alien, were recorded in the Lot 21 study area and are listed in Table B1. Approximately 55 of the taxa recorded are established introduced weeds and 19, natives. It is estimated that the list contains less than 50% of the native species in the study area and at least 50% of the introduced species.

It will be possible to add more species to the list and confirm names already on it after determinations and confirmation of identifications of specimens collected during the field work are completed.

3.3.1 Significant Flora

No Declared Rare or Priority Flora or other significant species was recorded during the study. And as no dampland or *Banksia ilicifolia* was found in or near Lot 21, it is unlikely that there is any habitat there for the Declared Rare spider orchid *Caladenia huegelii*.

4.0 LIMITATIONS

4.1 VEGETATION UNITS

A vegetation unit does not, unlike an individual plant, have a discrete boundary or limit; it is often a section of a continuum more or less arbitrarily defined by the presence of a suite of dominant or characteristic species, which, however, vary in their relative proportions through a stand.

These suites of species often, but not always, show up as distinctive patterns on aerial photographs. The patterns are, however, confused or altered, on the ground as well as on the photographs, by fire and post-fire succession and regeneration. The alterations extend to structure and species composition and may persist for several years, and they affect not only classification, description and mapping of vegetation units, they also complicate assessment of their condition.

Consequently, and especially when one distinctive structural vegetation type is divided into vegetation units defined by species which are different from each other although they appear similar, experts are likely to differ in their mapping and classification of stands. But they may be equally correct.

Furthermore, poor clarity, sharpness, distinctiveness and contrast of images in aerial photographs, especially digital ones, makes interpretation difficult.

Because, according to Trudgen and Keighery (1995, p. 18), the definition of vegetation types in *Banksia* woodlands can be particularly difficult, no attempt has been made here to divide the *Banksia* vegetation in the study area into two or more types.

4.3 FLORA

The number of species recorded in the study area could be increased significantly by doing field work in the spring and early summer.

4.4 SIGNIFICANT FLORA

No single rare flora survey, or even more than a single survey, can be expected to exclude the possibility that there are, in a study area, species of rare flora which were not found during the survey. This is partly because some species flower during one season while others flower at other times of the year. Furthermore, some species, such as the orchid *Diuris purdiei*, do not flower every year, and some species are not identifiable, or even visible, except for short periods before, during and after flowering, such as this *Diuris* and other orchids. In addition, there may be rare or otherwise significant species which have not previously been recorded anywhere near the area.

5.0 CONSERVATION SIGNIFICANCE

The Perth Bush Forever maps of regionally significant bushland (Government of Western Australia 2000) do not show any of the study area as being in or adjacent to a Bush Forever Site. The nearest Bush Forever Site is BFS 376, Baldivis Road Bushland, which is under 1 km south southeast of Lot 21.

5.1 SIGNIFICANCE OF VEGETATION

The significance of the vegetation of the study area in terms of plant formations and associations of Beard (1979), vegetation complexes of Heddle *et al.* (1980), floristic community types of Gibson *et al.* (1994) and the system of structural units, or vegetation units, used in *Bush Forever* (Government of Western Australia 2000; Keighery 1994) is described below.

In summary, and in general, the vegetation of Lot 21 has a conservation significance that is low due to its relatively Degraded and Completely Degraded condition, although relatively little of the types of vegetation found there remain, and little of what remains has been reserved.

5.1.1 Beard's Plant Formations and Associations

The 1:1 000 000 scale map by Beard (1980) shows tuart- jarrah woodland (e_4^2 Mi) as having an interrupted distribution from south of Moore River to the Leschenault Inlet and tuart woodland (e_4 Mi) as having an interrupted distribution from near Yanchep to north of Capel.

Beard and Sprenger (1984, p. 21 and Table 11) note that the 1:1 000 000 scale unit Unit 6, which combines e_4^2 Mi and e_4 Mi, occupied 1039 km² before European settlement but had been 90% cleared by 1984.

5.1.2 Vegetation Complexes of Heddle *et al.*

According to Government of Western Australia (2000, Volume 1, Table 4), the Karrakatta Complex – Central and South (49) originally covered 34,532 ha of the Swan Coastal Plain part of the Perth Metropolitan Region, and 18% of that, 6275 ha, remained. But, for the same reasons as those given by Environmental Protection Authority (1998, p. 12) for Southern River Complex figures, the percentage may now be much less than 18%.

In 2000, 1941 ha had some existing protection.

5.1.3 Floristic Community Types of Gibson *et al.* and Keighery

Two reports, by Gibson *et al.* (1994) and English and Blyth (1997), provide assessments of conservation significance and reservation status of the floristic community types described by Gibson *et al.*

FCT 25 is classified by Gibson *et al.* (1994) as Poorly reserved and Susceptible. It is not listed in the Threatened Ecological Community database (*Bush Forever* 2000, p. 41), but it has been proposed for listing. The Floristic Community Type 25 proposal was ranked by English and Blyth (1997) as 99.

FCTs 21a and 28 are classified by Gibson *et al.* (1994) as Well reserved and Low risk, and FCT 24 is classified as Well reserved and Susceptible.

5.1.4 Vegetation Units

An indication of local significance of native vegetation in Lot 21 can be inferred from inspection of aerial photography and from descriptions of Bush Forever Site 376 (Baldivis Road Bushland) in *Bush Forever* (2000, Volume 2, p. 286). Aerial photography suggests that the vegetation in Lot 20, on the west side of Lot 21, is similar to or the same as the vegetation in Lot 21 but in much better condition.

The *Bush Forever* descriptions suggest that the upland vegetation in Bush Forever Site 376 is also similar to that of Lot 21 and in better condition. Probably all of the vegetation units in Lot 21 are represented in Bush Forever Site 376, but in better condition.

5.2 SIGNIFICANCE OF FLORA

The study area's bushland does not appear to be particularly significant floristically, and no significant species were found in it.

6.0 ACKNOWLEDGEMENTS

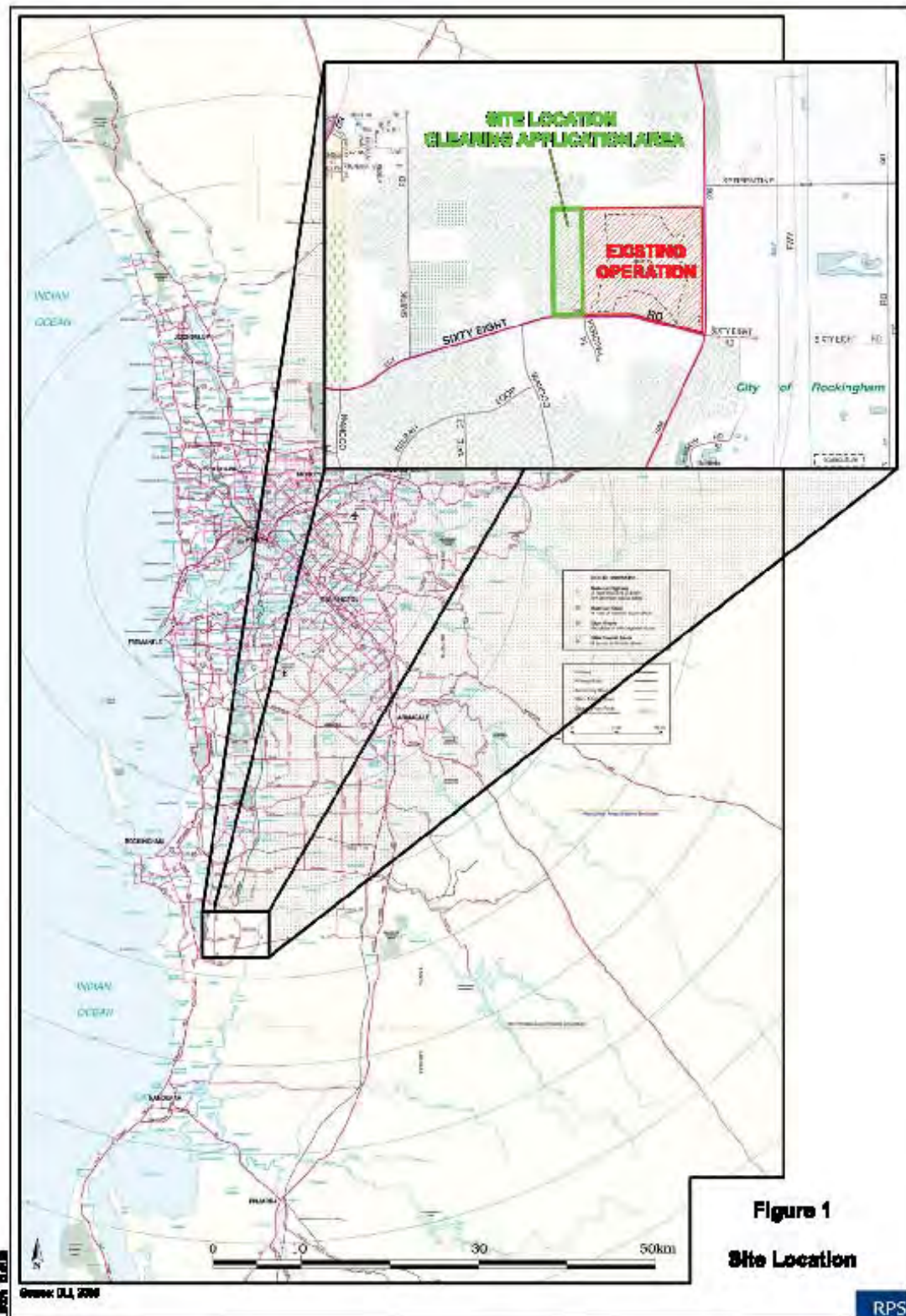
The assistance of Western Australian Herbarium staff and other botanists in helping to identify specimens is gratefully appreciated. Access to the Western Australian Herbarium collections was essential for carrying out the project and is also greatly appreciated.

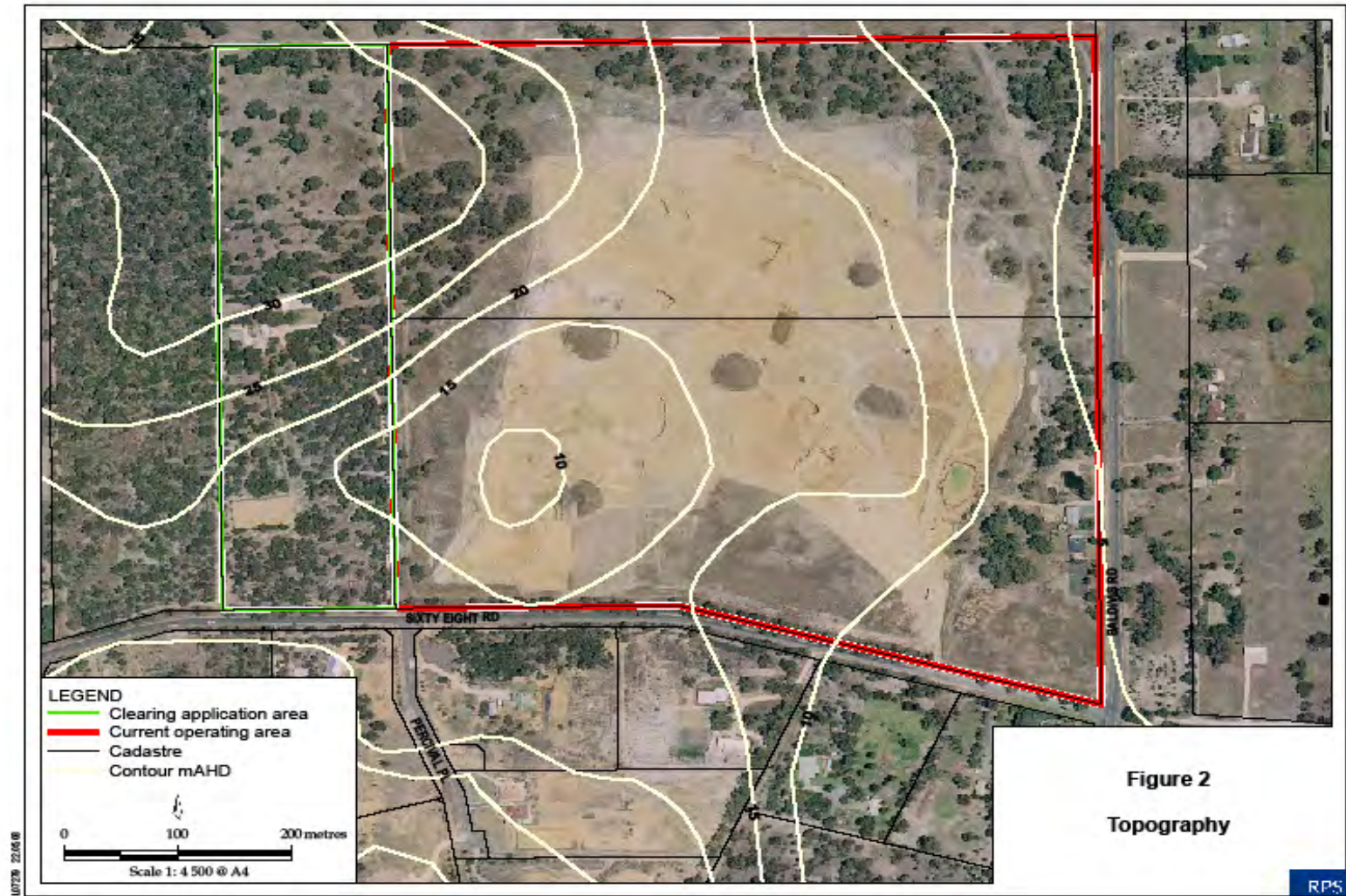
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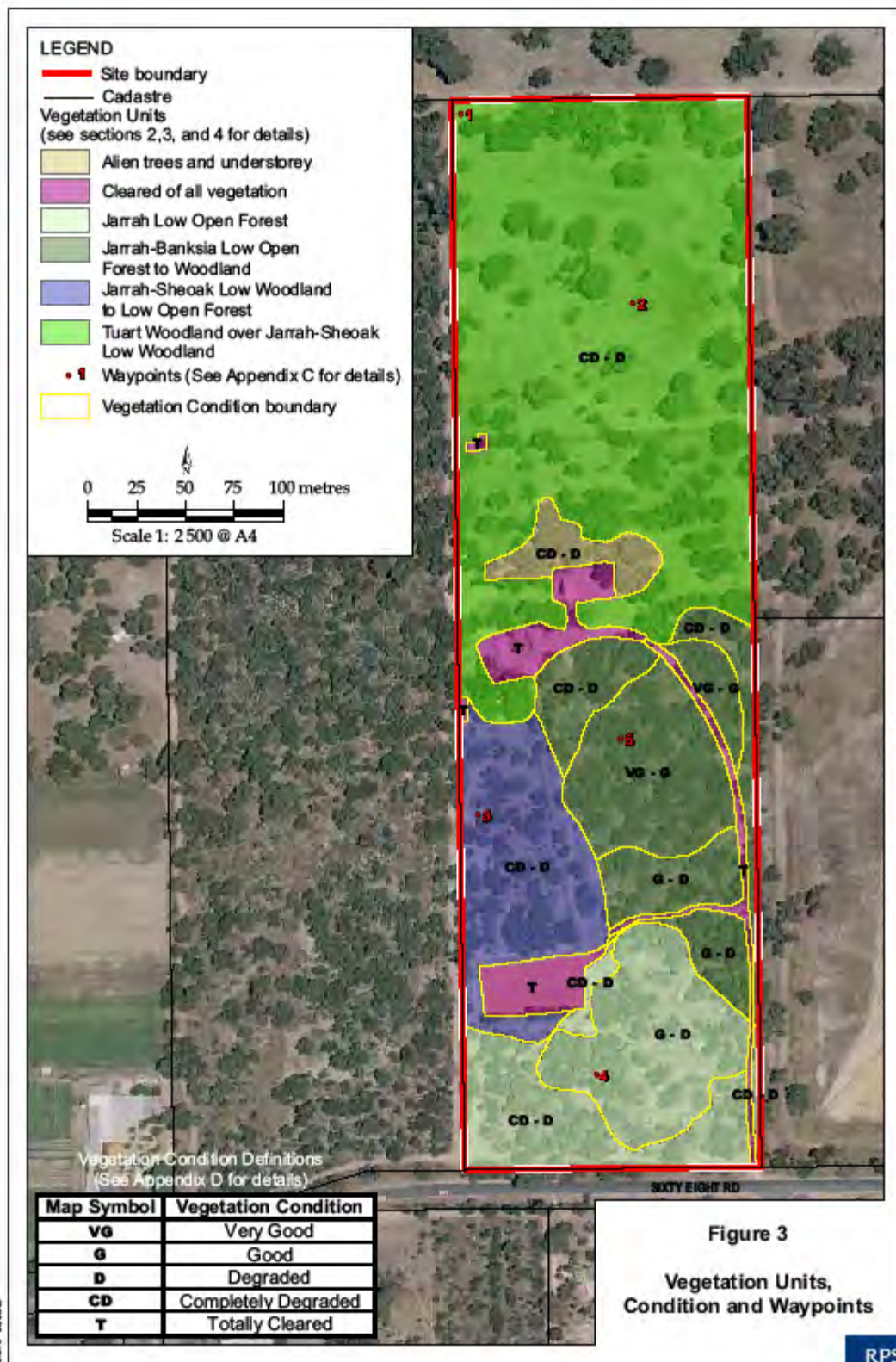




PLATE 1 Tuart Woodland to Open Woodland over Jarrah - Sheoak Low Woodland to Low Open Woodland [T]. Looking xx from Waypoint 1 (Photo ASW 07.XII.1-6A [F1000008])



PLATE 2 Jarrah - Sheoak Low Woodland to Low Open Forest [JS]. Looking xx from Waypoint 3 (Photo ASW 07.XII.1-11A [F1000003])



PLATE 3 Jarrah (*Eucalyptus marginata*) - Banksia (*Banksia attenuata*) Low Open Forest to Low Woodland over *Hibbertia hypericoides* Low Shrubland Looking xx from Waypoint 5 (Photo ASW 07.XII.1-13A [F1000001])

JB



PLATE 4 Jarrah (*Eucalyptus marginata*) Low Open Forest [J]. Looking xx from Waypoint 4 (Photo ASW 07.XII.1-12A [F1000002])

APPENDIX A

DECLARED RARE AND PRIORITY FLORA WITH DISTRIBUTIONS AND HABITATS WHICH MAY INCLUDE LOT 21 SIXTY EIGHT ROAD, BALDIVIS

Introduction

Table A1 lists taxa (species, subspecies and varieties) of Declared Rare (DRF) and Priority (P) Flora which have been recorded up to 10 km from Lot 21 Sixty Eight Road. The taxa listed in the table are the principal taxa searched for in Lot 21 in April 2008, but not the only ones. The searcher had to be prepared to recognise significant taxa that are not conservation-coded and to find taxa which are listed in Atkins (2008) but have not previously been recorded anywhere within many kilometres of Lot 21.

The table also provides some information about conservation codes, distributions, locality records, growth forms, habitats and flowering times for these taxa. This information is not always comprehensive, but information about habitat is at least indicative and should help in assessing how likely rare flora is to occur in Lot 21 and where.

The table was compiled from the results of searches of three databases for DRF and P flora carried out by the Species and Communities Branch of Department of Environment and Conservation (DEC) in March 2008. These three DEC databases are *Western Australian Herbarium Specimen* (WAHERB), *Threatened (Declared Rare) Flora* (Summary of Threatened Flora Data) and *Declared Rare and Priority Flora List*. The parameters requested for the searches are:

- the *Declared Rare and Priority Flora List* database for the locations: Baldivis, Wellard, Karnup, Stake Hill, Mandurah Hill
- the *Western Australian Herbarium Specimen* database for records in the rectangle defined by the coordinates 32°16' - 32°28' S and 115°43' - 115°55' E and
- the *Threatened (Declared Rare) Flora* database for records in the rectangle defined by the coordinates 32°16' - 32°28' S and 115°43' - 115°55' E.

The 21 results of the searches comprise 0 *Declared Rare and Priority Flora List* taxa, 19 *Western Australian Herbarium Specimen* taxa and 12 *Threatened (Declared Rare) Flora* taxa. Eleven of the 21 taxa occur in seasonal wetlands, and another eight are often, usually or always low in the landscape, on seasonally saturated soils or close to seasonal wetlands.

The printouts also provided some information about conservation codes, localities and distributions, habitats and flowering times. Additional information in the table was obtained from examination of herbarium specimens and their labels in the Western Australian Herbarium, consultations with other botanists, and information in Atkins (2008), Paczkowska and Chapman (2000), Marchant *et al.* (1987), Brown *et al.* (1998), Hoffman and Brown (1998), FloraBase (2008) and relevant parts of the *Flora of Australia* and *How to Know Western Australian Wildflowers*.

Conservation Codes Definitions

Department of Environment and Conservation definitions of the Conservation Codes (Atkins 2008) in Table A1 are:

- R: Declared Rare 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, and have been gazetted as such.
- 1: Priority One – Poorly Known Taxa
Taxa which are known from one or a few (generally <5) populations which are under threat, . . . Such taxa are under consideration for declaration as ‘rare flora’, but are in urgent need of further survey.
- 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 (i.e. not currently endangered). Such taxa are under consideration for declaration as ‘rare flora’, but are in urgent need of further survey.
- 3: Priority Three – Poorly Known Taxa
Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), . . . Such taxa are under consideration for declaration as ‘rare flora’, but are in need of further survey.
- 4: Priority Four – Rare Taxa
Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

The need for further survey of poorly known taxa is prioritised into the Priority 1, 2 and 3 categories depending on the perceived urgency for determining the conservation status of those taxa, as indicated by the apparent degree of threat to the taxa based on current information.

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Table A1
Declared Rare and Priority Flora to Search For
Declared Rare and Priority Flora Recorded in the Broader Vicinity of Lot 21 Sixty Eight Road, Baldivis

| WA-HERB | Thr. Flora | Taxon | Cons. Code | Fam-ily | Distribution / Localities | Flowering period | Form | Habitat and Notes |
|---------|------------|---|------------|---------|--|------------------|------------|--|
| 3 | 2 | Acacia benthamii | 2 | 163 | Southern River, Yanchep, Wanneroo, Kings Park, Baldivis | Aug-Sep | ShMT | Sandy soil, often clayey or over clay, and on lower slopes |
| 1 | 1 | Acacia lasiocarpa var. bracteolata long peduncle variant (GJK 5026) | 1 | 163 | N Dandalup, Mundijong, Gosnells, Jandakot, Lowlands | May, Aug | ShM | Grey or black sand over clay, swampy areas, winter wet lowlands. |
| 1 | 2 | Aponogeton hexatepalus | 4 | 025 | Perth, Pinjarra, Capel, Bunbury, Boyanup, Nannup, Mundijong | Aug-Sep | He aquatic | Seasonal wetlands |
| 1 | - | Boronia juncea subsp. juncea | 1 | 175 | Myalup, Wellard | Apr | Sh | Winter-wet sand to sandy loam in paperbark woodland, often with <i>Astartea scoparia</i> and <i>Centella asiatica</i> . |
| - | 5 | Caladenia huegelii | R | 066 | Perth-Capel | Aug-Oct | He | Large, few-flowered spider orchid w. large labellum that is dark red (& white) and has long fringing hairs that are usually white and often divided at tip; leaves & stem w. long thin spreading hairs at base. Sandy soils in banksia and eucalypt woodlands and open forests which are, usually, low in the landscape and, near Perth, usually have <i>Dasypogon bromeliifolius</i> and <i>Phlebocarya ciliata</i> . |
| 2 | - | Cardamine paucijuga | 2 | 273 | Ludlow, Lake Muir | Aug-Nov | He | Mixed <i>Mealeuca</i> Tall Shrubland; winter wet-damp flats; calcareous clay over limestone |
| 1 | 1 | Cyathochaeta teretifolia | 3 | 032 | Muchea-Denbarker, Margaret River, Casuarina | Nov-Dec | Se | Seasonally wet creeks and swamps, often with paperbarks, eucalypts, <i>Homalospermum</i> and <i>Agonis</i> trees or tall shrubs |
| 4 | 5 | Dillwynia dillwynioides | 3 | 165 | Pinjarra, Yunderup, Perth, Gingin | Aug-Oct | ShM | Sandy soils, winter-wet depressions |
| 1 | 1 | Dodonia hackettiana | 4 | 207 | Wattleup, Thompson Lake, Kings Park, Jandakot, Bibra Lake-The Spectacles, Gingin | Jul-Oct | TS-ShT | Often on limestone or in margins of wetlands. |
| - | 6 | Drakaea elastica | R | 066 | Gingin-Busselton, Lake Guraga | Oct-Nov | He | On deep sand low in the landscape, usually under spearwood and banksias adjoining winter-wet swamps. [Hammer orchid w prominent |

| | | | | | | | | |
|---|---|---|---|------|---|----------------------|-------|---|
| | | | | | | | | hairy section in its upper labellum & distinctively shiny, bright green, heart-shaped leaf which is flat on the ground.] |
| 1 | - | <i>Eryngium pinnatifidum</i> subsp. <i>palustre</i> ms | 3 | 281 | Gingin – Serpentine, Mandurah, Capel, Arrowsmith | Sep-Nov | He | Melaleuca shrublands and low open vegetation on winter-wet sandy-clay flats. |
| 1 | - | <i>Eucalyptus rudis</i> subsp. <i>cratyantha</i> | 4 | 273 | Yallingup-Busselton, Mandurah | Jul-Sep | T | Loam, flats, hillsides. |
| 1 | - | <i>Goodenia filiformis</i> | 3 | 341 | 'Millbrook, Albany, Hassel Hwy, Gingilup Swamp | Late Oct - early Feb | He | Sandy soils; winter-wet depressions. [Erect to ascending, slender, perennial herb, leaves linear-terete, entire.] |
| 4 | - | <i>Jacksonia sericea</i> sens. lat. ¹ | 4 | 165 | Perth-Mandurah-Pinjarra, Neerabup NPK, Canning Vale | Dec-Feb | ShS | Sandy soil in woodlands, often calcareous and often low in the landscape. [Decumbent to prostrate, mainly summer-flowering, seldom spiny, multi-stemmed subshrub < 0.3 m tall; standard orange; pod pedicels recurved.] |
| 1 | 1 | <i>Johnsonia pubescens</i> subsp. <i>cygnorum</i> (= <i>J. aff pubescens</i> , = <i>J. sp. A</i> Perth in part) | 2 | 054F | Serpentine, Cardup NR, Lowlands, Nambeelup, Mundijong | Sep-Nov | He | Low-lying sandy flats which are, generally, winter wet; <i>Banksia-jarrah</i> open low woodland to scrubs and heath, often with <i>Kunzea recurva</i> , <i>K. glabrescens</i> or <i>Pericaymma ellipticum</i> . [Bracts white w green centre; tepals greenish-white.] |
| 1 | 1 | <i>Lasiopetalum membranaceum</i> | 3 | 223 | 'Yalgorup, Capel, Dwellingup, Yandup, Australind, Dawesville, Yanchep | Oct-Nov (Sep-Dec) | ShS | Sand over limestone often with tuart and banksia. [Leaves cordate.] |
| 2 | - | <i>Parsonsia dianophleba</i> | 4 | 304 | Murray River, Coolup | Jan-Jun/Sep | V | Alluvial soils along rivers |
| 1 | 1 | <i>Schoenus capillifolius</i> | 2 | 032 | 'Upper Swan, Kenwick, Waterloo, Beauford River, Beverley, Goomalling, Carousel Swamp, Pearce, Waroona | Sep-Nov | Se | Semi-aquatic on brown mud in claypans. [tufted annual ca. 5 cm tall; flowers green.] |
| 1 | - | <i>Stachystemon</i> sp. Keysbrook | 1 | 185 | 'Keysbrook, Whiteman | Oct | ShS | Lower dune slope in <i>Banksia attenuata</i> – <i>B. menziesii</i> – <i>B. ilicifolia</i> Low Open Forest. |
| 5 | 3 | <i>Stylidium longitubum</i> | 3 | 343 | Upper Swan-Busselton, Arthur River, Jandakot | Nov | He | Grey sandy clay over clay; winter wet flats; <i>Melaleuca viminea</i> shrubland |
| 1 | - | <i>Synaphea</i> sp. Serpentine | R | 090 | 'Serpentine, Mundijong, Byford, | Aug-Nov | H/ShS | Red brown loam in Pinjarra Plain sumpland. |

¹ *Jacksonia gracillima* ms is similar to *Jacksonia sericea*, but it is more erect than prostrate and has thin, rigid, pungent branchlets, especially towards the base of the shrub; it mainly flowers in October and November, is generally in damper areas than *J. sericea* and resembles a short *J. furcellata* more than a tall *J. sericea*. Though it has a wider distribution than *J. sericea* – it occurs between Bayswater and Capel – it is probably less well conserved and should be regarded as significant. *J. gracillima* is a newly recognised and described species; in the past plants of it were often identified as *J. sericea* or *J. furcellata* (Chappill pers. comm. 2005).

| | | | | | | | | |
|--|--|--|--|--|---------|--|--|--|
| | | | | | Yarloop | | | |
|--|--|--|--|--|---------|--|--|--|

Abbreviations used in table: Columns 1, 2: in DEC database search results: WAHERB - *Western Australian Herbarium Specimen* database; Thr. Flora - *Threatened (Declared Rare) Flora* database.

Column 3: Taxon – Species, subspecies or variety. Column 4: Cons. Code: R – Declared Rare Flora; 1, 2, 3, 4 – Priority code numbers.

Column 5: Family – numbers used in Western Australian Herbarium for families; e.g. 066 is Orchidaceae, and 163 is Mimosaceae.

Column 6. Distribution / Localities

Column 7. Flowering Period

Column 8: Form [of plant]: He – herbaceous plant; Se – sedge; Sh – shrub. Height of shrubs: S – short; M – mid height (ca. 0.5-1-2 m); T – tall; V - vine.

Column 9. Habitat and Notes

APPENDIX B

Flora of Lot 21 Sixty Eight Road, Baldivis

Introduction

Table B1 lists approximately 74 taxa (species, subspecies and varieties) of vascular plants recorded in the Lot 21 study area. Approximately 55 of the taxa recorded are established introduced weeds and 19, natives. It is estimated that the list contains less than 50% of the native species in the study area and at least 50% of the introduced species.

No significant species was recorded during the study.

No attempt was made to compile a comprehensive list of flora for the study area, but plants that were common, characteristic or possibly significant were noted during the study and are the basis for Table B1.

It will be possible to add more species to the list and confirm names already on it after determinations and confirmation of identifications of specimens collected during the field work are completed.

Table B1
Flora of Lot 21 Sixty Eight Road, Baldivis

Column 1 groups the taxa (taxon: species, subspecies, variety) recorded by families, which are listed phylogenetically. The taxa are listed alphabetically within families.

Column 2 indicates whether the taxon is native (N) or an alien (W for Weed) and, if native, if it is a significant taxon.

Column 3 indicates the life form of each taxon.

Columns 4-7 indicate which native vegetation unit(s) the taxon was recorded in.

Column 8 is the Notes column, in which taxonomic synonyms are indicated.

LEGEND

* Alien, introduced, weed (preceding taxon name in Column 1b)

N?n positive (+/-) identification to genus but identification to species uncertain
 ?Nn identification to genus (and species) uncertain

W Alien, introduced, weed

N Native

HE Herbaceous plant

SH Shrub

TR,T Tree

VI Vine (in a broad sense)

T, JS, JB, J Vegetation Units

Table B1
Flora of Lot 21 Sixty Eight Road, Baldvis

| Taxon Name | | Status | Form | T | JS | JB | J | Notes |
|--------------------------------------|--------------------------|--------|-------|---|----|----|---|---|
| Family: Aizoaceae (110) | | | | | | | | |
| * | Carpobrotus edulis | W | SH | x | | | | |
| Family: Anthericaceae (054F) | | | | | | | | |
| | Corynotheca micrantha | N | SH/HE | x | | x | | |
| | Dichopogon capillipes | N | HE | x | | x | | |
| | Thysanotus ?arenarius | N | HE | | | x | | |
| | Tricoryne elatior | N | HE | | | x | | |
| Family: Araceae (035) | | | | | | | | |
| * | Zantedeschia aethiopica | W | HE | | | | | 1 plant in lowest part of Lot 21, E of entrance rd. |
| Family: Asteraceae (345) | | | | | | | | |
| * | Arctotheca calendula | W | HE | | x | | | |
| * | Hypochaeris glabra | W | HE | | | x | | |
| * | Hypochaeris radicata | W | HE | x | | x | | |
| Family: Casuarinaceae (070) | | | | | | | | |
| | Allocasuarina fraseriana | N | TR | x | x | | | |
| Family: Colchicaceae (054J) | | | | | | | | |
| | Burchardia umbellata | N | HE | | | x | | |
| Family: Cyperaceae (032) | | | | | | | | |
| | Lepidosperma ?squamatum | N | SE | x | | x | | |
| | Lepidosperma ?tenue | N | SE | | | x | | |
| | Mesomelaena pseudostygia | N | SE | | | x | | |
| Family: Dasypogonaceae (054C) | | | | | | | | |
| | Acanthocarpus preissii | N | SH/HE | x | | | | |
| | Dasypogon bromeliifolius | N | HE | x | | x | | |
| | Lomandra ?caespitosa | N | HE | x | | | | |
| | Lomandra sp. | N | HE | | | x | | |
| Family: Dilleniaceae (226) | | | | | | | | |
| | Hibbertia ?huegelii | N | SH | | | x | | |
| | Hibbertia hypericoides | N | SH | | x | x | x | |
| | Hibbertia ?racemosa | N | SH | x | | | | |
| Family: Droseraceae (143) | | | | | | | | |
| | Drosera ?erythrorhiza | N | HE | | | x | | |
| Family: Epacridaceae (288) | | | | | | | | |
| | ?Conostephium pendulum | N | SH | | | x | | |
| | Leucopogon spp. | N | SH | | | x | | |
| Family: Euphorbiaceae (185) | | | | | | | | |
| * | Euphorbia terracina | W | HE | | x | | | |
| | Phyllanthus calycinus | N | SH | | | x | | |
| Family: Geraniaceae (167) | | | | | | | | |
| * | Erodium sp. | W | HE | x | | | | |
| Family: Goodeniaceae (341) | | | | | | | | |
| | ?Dampiera linearis | N | HE | | | x | | |
| Family: Haemodoraceae (055) | | | | | | | | |
| | Conostylis ?aculeata | N | HE | | | | x | |
| | Conostylis ?setigera | N | HE | | | x | | |
| | Haemodorum ?laxum | N | HE | | | x | | |

| Taxon Name | | Status | Form | T | JS | JB | J | Notes |
|-------------------------------------|--------------------------|--------|-------|---|----|----|---|-----------------------|
| | Haemodorum spicatum | N | HE | x | | | | |
| | Phlebocarya ciliata | N | HE | x | | x | | |
| Family: Iridaceae (060) | | | | | | | | |
| * | Romulea rosea | W | HE | | | | | |
| Family: Loranthaceae (097) | | | | | | | | |
| | Nuytsia floribunda | N | TR | | | | | |
| Family: Mimosaceae (163) | | | | | | | | |
| * | Acacia longifolia | W | SH/TR | | | | | |
| | Acacia pulchella | N | SH | | x | x | | |
| Family: Molluginaceae (110A) | | | | | | | | |
| | Macarthuria australis | N | HE/SH | x | | x | | |
| Family: Myrtaceae (273) | | | | | | | | |
| | Agonis flexuosa | N | TR | x | | | | |
| | Eucalyptus gomphocephala | N | TR | x | | | | |
| | Eucalyptus marginata | N | TR | | | | | |
| | Kunzea glabrescens | N | SH | | | | | |
| Family: Orchidaceae (066) | | | | | | | | |
| * | Disa bracteata | W | HE | | | x | | =Monadenia bracteata |
| Family: Orobanchaceae (320) | | | | | | | | |
| * | Orobanche minor | N | HE | x | | | | |
| Family: Papilionaceae (165) | | | | | | | | |
| | Bossiaea eriocarpa | N | SH | | | x | | |
| | Daviesia sp. | N | SH | | | x | | |
| | Daviesia ?triflora | N | SH | | | x | | |
| | Hardenbergia comptoniana | N | VI | x | | | | |
| | Jacksonia furcellata | N | SH | | | x | | |
| Family: Phormiaceae (054E) | | | | | | | | |
| | Dianella revoluta | N | HE | | x | x | | |
| Family: Pittosporaceae (152) | | | | | | | | |
| | Billardiera heterophylla | N | VI | | | x | | = Sollya heterophylla |
| Family: Poaceae (031) | | | | | | | | |
| * | Avena fatua | W | GR | | | x | | |
| * | Bromus diandrus | W | GR | | | | | |
| * | Briza maxima | W | GR | x | | x | | |
| * | Ehrharta calycina | W | GR | x | | | | |
| * | Ehrharta longiflora | N | GR | x | | x | | |
| * | Pennisetum clandestinum | W | GR | | | | | |
| Family: Proteaceae (090) | | | | | | | | |
| | Adenanthos cygnorum | N | SH | | | | | |
| | Banksia attenuata | N | TR | x | x | x | | |
| | Banksia grandis | N | TR | | | x | | |
| | Banksia menziesii | N | TR | x | | | | |
| | Conospermum sp. | N | SH | | | | | |
| | Stirlingia latifolia | N | SH | | | | | |
| | Xylomelum occidentale | N | TR | x | | | x | |
| Family: Restionaceae (039) | | | | | | | | |
| | Desmodcladus flexuosus | N | SE | x | | x | | =Loxocarya flexuosus |
| | Hypolaena exsulca | N | SE | | | x | | |
| | Lyginia ?imberbis | N | SE | x | | x | | |
| | Restionaceae sp. | N | SE | | | x | | 1 sp |
| Family: Rubiaceae (331) | | | | | | | | |
| | Opercularia ?hispidula | N | HE | x | | | | |

| Taxon Name | | Status | Form | T | JS | JB | J | Notes |
|--|-----------------------|--------|------|---|----|----|---|-------|
| Family: Scrophulariaceae (316) | | | | | | | | |
| * | Dischisma arenarium | W | HE | x | x | | | |
| Family: Solanaceae (315) | | | | | | | | |
| * | Solanum ?nigrum | W | SH | | x | | | |
| * | Solanum linnaeanum | W | SH | x | | | | |
| Family: Stackhousiaceae (202) | | | | | | | | |
| Family: Thymelaeaceae (263) | | | | | | | | |
| | Pimelea sp. | N | SH | x | | x | | |
| Family: Xanthorrhoeaceae (054D) | | | | | | | | |
| | Xanthorrhoea preissii | N | SH | | | | | |
| Family: Zamiaceae (016A) | | | | | | | | |
| | Macrozamia riedlei | N | Sh | x | | x | x | |

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APPENDIX C

Waypoints

| Waypoint GDA 50 H | Photo No. ASW 07.XII.1 | Photo Direc- tion | Map Symbol | Eastings (mE) | Northings (mN) | + / - m | Date read (& marked) | Description |
|-------------------------|---------------------------------|-------------------------|---------------|------------------|-------------------|------------|-------------------------|---|
| -- | 07 | SE | 1 | 0389080 | 6419430 | -- | 4 Apr '08 | Tuart >10(>15) m, patchy 10-30(>30)% Jarrah-Sheoak(- <i>Banksia attenuata</i>) <10 m, ~10(-30)% <i>Macrozamia riedlei</i> <(-~)1 m, ~10% <i>Ehrharta calycina</i> , <i>Dischisma arenarium</i> , <i>Romulea rosea</i> & other weeds Condition D-CD |
| 447 | 08,10,11 | ~E | 2 | 0389168 | 6419333 | 4.5 | 4 Apr '08 | ~20 plants of <i>Macarthuria australis</i> , 1 of <i>Phlebocarya ciliata</i> and 3 of <i>Dasypogon bromeliifolius</i> in herbland/grassland of weeds (in Tuart Open Woodland) near highest point in Lot 21 Condition CD |
| 448 | 12 S | S | 3 | 0389089 | 6419071 | 7.0 | 4 Apr '08 | Jarrah-Sheoak(- <i>Banksia attenuata</i>) <10 m, ~30% Understorey mainly weeds or bare. The native shrubs are mainly <i>Hibbertia hypericoides</i> and <i>Stirlingia latifolia</i> . Condition CD-D |
| 449 | 13 W | W | 4 | 0389149 | 6418938 | ? | 4 Apr '08 | Jarrah <10 m, >>30% <i>Macrozamia riedlei</i> – <i>Acacia pulchella</i> – <i>Hibbertia hypericoides</i> mainly <1 m, 10-30% <i>Conostylis ?aculeata</i> 10-30% Condition ~50% G, ~50% D |
| 450 | 14 ~S | ~S | 5 | 0389162 | 6419110 | 9 | 4 Apr '08 | Jarrah (~<10 m) - <i>Banksia attenuata</i> (<10 m) <->30% <i>Hibbertia hypericoides</i> 10-30% (patchy) * <i>Bromus diandrus</i> patchy weedy grass Condition (VG-)G(-D) |

ASW 25/05/08

APPENDIX D

Vegetation Structure Classes and Condition Scale Tables

Vegetation Structure Classes (Layers)

These vegetation structure classes are the ones defined and used in *Bush Forever* (2000, Volume 2, Table 11 and p. 493) to describe vegetation in Bush Forever sites, (except that a bracketed name refers to a dominant that has fewer plants and provides significantly less cover than others). ‘Sedges’ are in Table 11 but not on p. 493.

| Life Form/ Height Class | Canopy Cover (percentage) | | | |
|----------------------------|---------------------------|-----------------|----------------------|---------------------------|
| | 100% - 70% | 70% - 30% | 30% - 10% | 10% - 2% |
| Trees 10-30m | Closed Forest | Open Forest | Woodland | Open Woodland |
| Trees < 10m | Low Closed Forest | Low Open Forest | Low Woodland | Low Open Woodland |
| Shrub Mallee | Closed Shrub Mallee | Shrub Mallee | Open Shrub Mallee | Very Open Shrub Mallee |
| Shrubs > 2m | Closed Tall Scrub | Tall Open Scrub | Tall Shrubland | Tall Open Shrubland |
| Shrubs 1-2m | Closed Heath | Open Heath | Shrubland | Open Shrubland |
| Shrubs < 1m | Closed Low Heath | Open Low Heath | Low Shrubland | Low Open Shrubland |
| Grasses | Closed Grassland | Grassland | Open Grassland | Very Open Grassland |
| Herbs | Closed Herbland | Herbland | Open Herbland | Very Open Herbland |
| Sedges | Closed Sedgeland | Sedgeland | Open Sedgeland | Very Open Sedgeland |

Vegetation Condition Scale

This condition scale is the one used in *Bush Forever* (2000, Volume 2, Table 12 and p. 494) to describe condition of vegetation in Bush Forever sites.

| | | |
|----|---------------------|--|
| P | Pristine | No obvious signs of disturbance |
| E | Excellent | Vegetation structure intact, disturbance affecting individual species [plants?]; weeds are non-aggressive species |
| VG | Very Good | Vegetation structure altered; obvious signs of disturbance |
| G | Good | Vegetation structure significantly altered by very obvious signs of multiple disturbance; basic vegetation structure or ability to regenerate it is retained |
| D | Degraded | Basic vegetation structure severely impacted by disturbance; scope for regeneration but not to a state approaching good (sic) condition without intensive management |
| CD | Completely Degraded | Vegetation structure not intact; the area completely or almost completely without native species (‘parkland cleared’). |
| T | Totally Cleared | Cleared of all plants |

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~~~~~  
16 June 2011

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Dear Phil,

**SEARCH FOR *LOMANDRA HERMAPHRODITA* PLANTS  
IN LOTS 21, 569 AND 1263 SIXTY EIGHT ROAD, BALDIVIS**

I searched twenty-seven 2m by 2m sites and a two metre (or more) wide area around each site in the approximately 8-ha Lot 21 on 29 and 30 May for *Lomandra hermaphrodita* plants. I found none, not in, around or between the sites.

Comparisons of your aerial photos with the RPS contoured orthophoto in my 2008 report show that the quarry was extended a little since 2008 and more trees around it were cleared. Not much seems to have been done to Lot 21, though its vegetation is more degraded and weedy, and the house is unoccupied and derelict. There is one occupied house on Baldivis Road north of Sixty eight Road.

I now assess the condition of the Lot 21 vegetation one grade lower/poorer than I did in 2008 (due to more weeds and fewer natives) and would probably describe the vegetation as one step more open (due to change in assessment, not to change in vegetation structure).

I also searched for the *Lomandra* in Lots 569 and 1263. Since the vegetation there was even more degraded than on Lot 21 and with fewer *Banksia* trees, I searched without sites. The trees on the northern part of the western side of the quarry are mainly Tuart; the trees elsewhere around the quarry are mainly Jarrah.

In Lots 569 and 1263 there is no Coastal Heathland or Banksia Woodland, the only two Graceful Sun-moth habitats listed in the DEC's *Survey guidelines for the Graceful sun-moth (Synemon gratiosa) & site habitat assessments, Version 1.2*.

The attached figure shows the locations of the twenty seven 4 m<sup>2</sup> + sites in Lot 21 and the vegetated areas in Lots 21, 569 and 1263.

Regards,

Arthur Weston



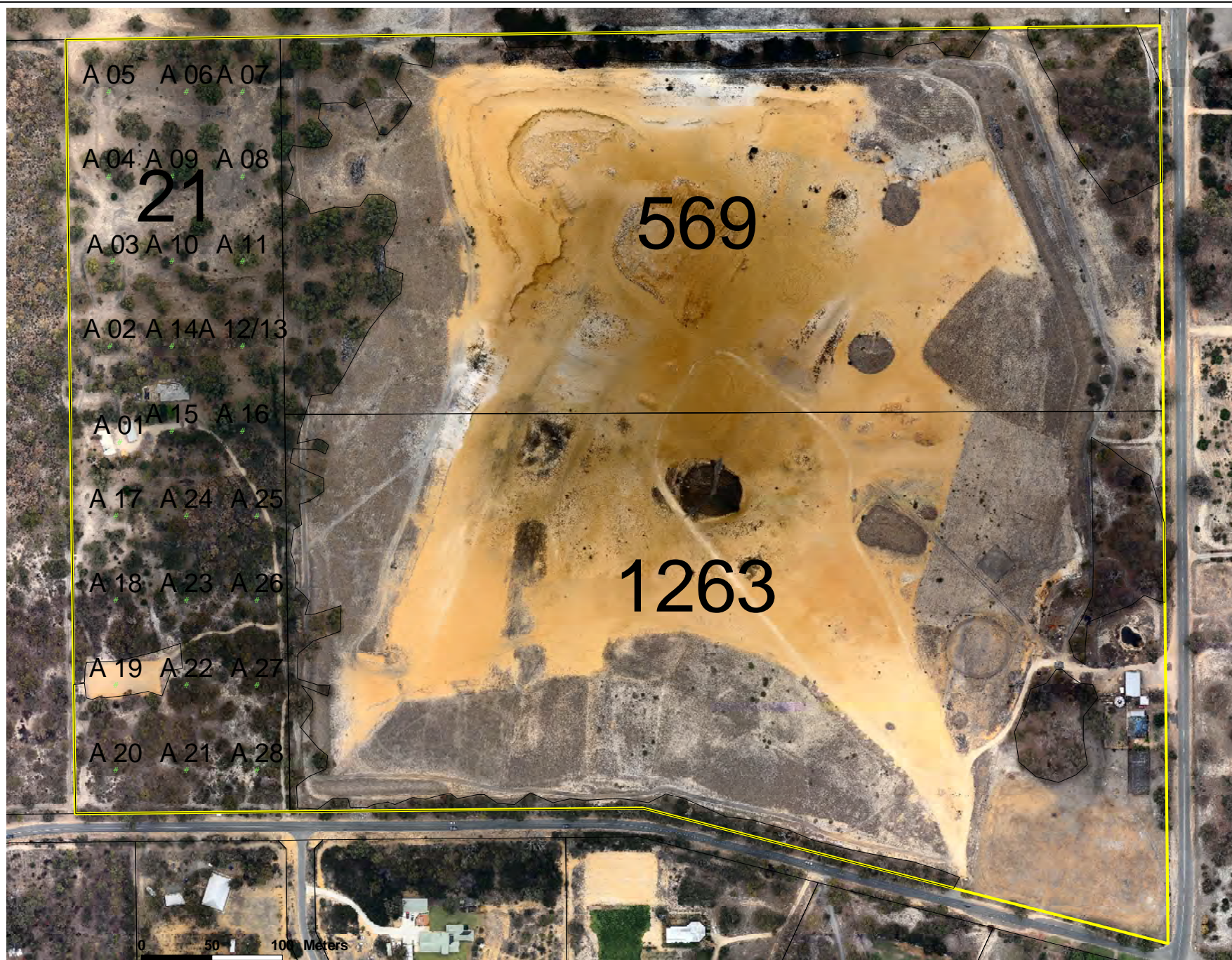


Figure 1  
LOMANDRA  
SEARCH  
TRANSECTS

# **Appendix B**

**Clearing Permit 5422/1**





## **CLEARING PERMIT**

*Granted under section 51E of the Environmental Protection Act 1986*

### **PERMIT DETAILS**

Area Permit Number: 5422/1

File Number: 2012/008990-1

Duration of Permit: From 28 December 2013 to 28 December 2019

### **PERMIT HOLDER**

ABN Consolidated Holdings Pty Ltd

### **LAND ON WHICH CLEARING IS TO BE DONE**

Lot 21 on Plan 8420 (Baldivis)

Lot 569 on Deposited Plan 152941 (Baldivis)

Lot 1263 on Deposited Plan 152941 (Baldivis)

### **AUTHORISED ACTIVITY**

The Permit Holder shall not clear more than 9.2 hectares of native vegetation within the area cross hatched yellow on attached Plan 5422/1a.

### **CONDITIONS**

#### **1. Offset - Rehabilitation**

In relation to the areas cross hatched red on attached Plan 5422/1b the Permit Holder must implement and adhere to the ABN Group Pty Ltd Offset Planting Plan, attached as Appendix A to this permit.

#### **2. Records must be kept**

The Permit Holder must maintain the following records in relation to the *revegetation* and *rehabilitation* of areas pursuant to condition 1:

- (a) the location of any areas *revegetated* and *rehabilitated*, recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994 (GDA94), expressing the geographical coordinates in Eastings and Northings or decimal degrees;
- (b) a description of the *revegetation* and *rehabilitation* activities undertaken; and
- (c) the size of the area *revegetated* and *rehabilitated* (in hectares).

#### **3. Reporting**

- (a) The Permit Holder must provide to the CEO on or before 30 June of each year, a written report:
  - (i) of records required under condition 2 of this Permit; and
  - (ii) concerning activities done by the Permit Holder under this Permit between 1 January to 31 December of the preceding calendar year.
- (b) If no clearing authorised under this Permit was undertaken between 1 January to 31 December of the preceding calendar year, 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 28 September 2019, the Permit Holder must provide to the CEO a written report of records required under condition 2 of this Permit where these records have not already been provided under condition 3(a) of this Permit.

## DEFINITIONS

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

**rehabilitate/ed/ion** means actively managing an area containing native vegetation in order to improve the ecological function of that area;

**revegetate/ed/ion** means the re-establishment of a cover of *local provenance* native vegetation in an area using methods such as natural *regeneration*, *direct seeding* and/or *planting*, so that the species composition, structure and density is similar to pre-clearing vegetation types in that area; and

**direct seeding** means a method of re-establishing vegetation through the establishment of a seed bed and the introduction of seeds of the desired plant species;

**planting** means the re-establishment of vegetation by creating favourable soil conditions and planting seedlings of the desired species;

**regenerate/ed/ion** means re-establishment of vegetation from in situ seed banks and propagating material (such as lignotubers, bulbs, rhizomes) contained either within the topsoil or seed-bearing mulch;

**local provenance** means native vegetation seeds and propagating material from natural sources within 20 kilometres and the same Interim Biogeographic Regionalisation for Australia (IBRA) subregion of the area cleared.



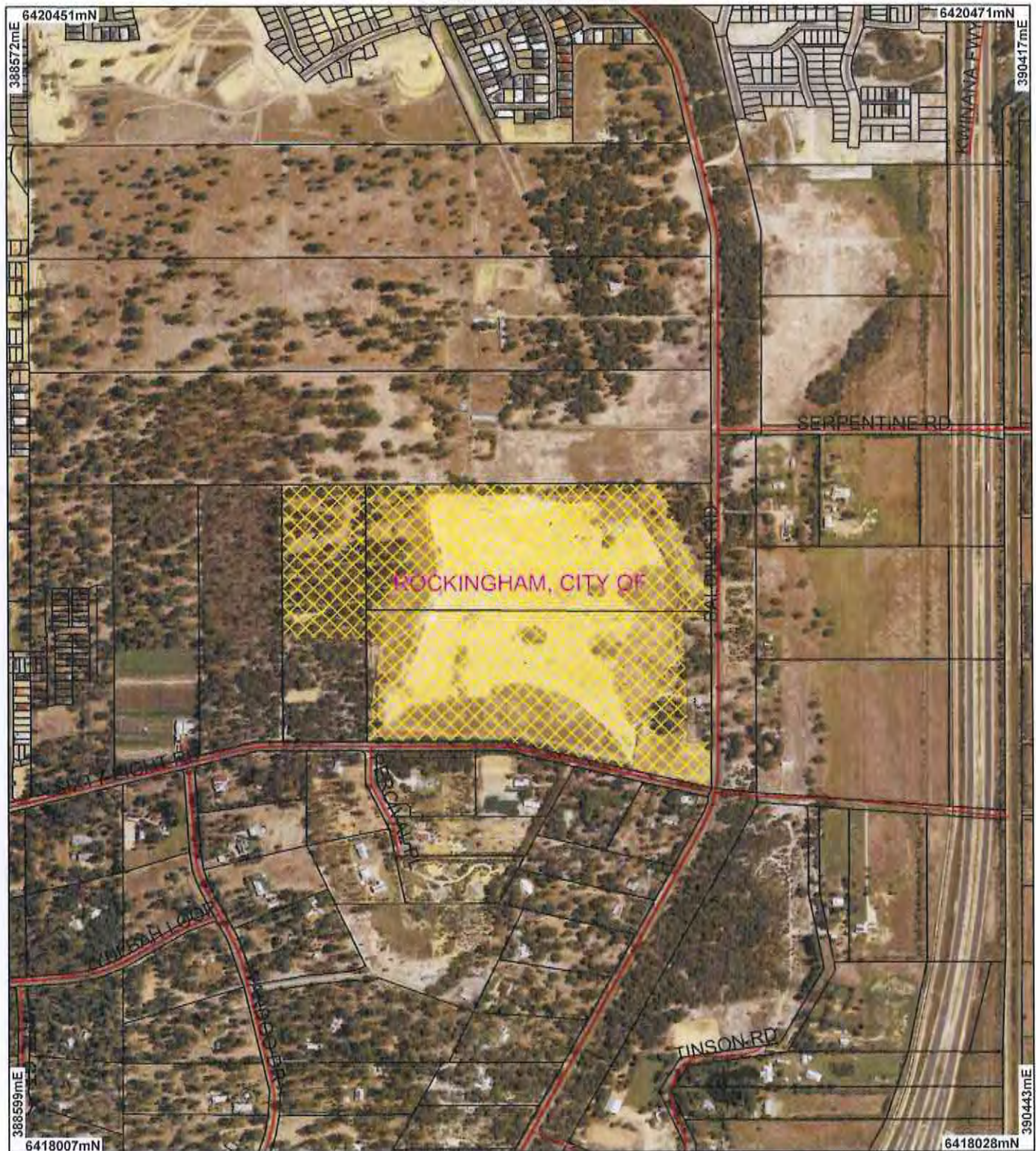
M Warnock  
MANAGER  
NATIVE VEGETATION CONSERVATION BRANCH

*Officer delegated under Section 20  
of the Environmental Protection Act 1986*

28 November 2013

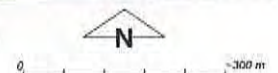


# Plan 5422/1a



## LEGEND

- Road Centrelines
- Clearing Instruments
- Areas Approved to Clear
- Cadastre
- Perth Metropolitan Area Central 15cm Orthomosaic - Landgate 2012
- Local Government Authorities



Scale 1:10823

(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* Date 28/11/13

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 acknowledged by the agency acronym in the legend.



Government of Western Australia  
Department of Environment Regulation

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\* Project Data is denoted by asterisk. This data has not been quality assured. Please contact map author for details.

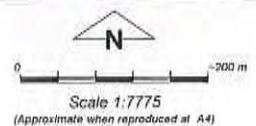


# Plan 5422/1b



## LEGEND

- ✓ Road Centrelines
- Local Government Authorities
- Clearing Instruments
- Areas Subject to Conditions
- Cadastre
- Perth Metropolitan Area
- Central 15cm Orthomosaic - Landgate 2012



Geocentric Datum Australia 1994  
Note: the data in this map have not been projected. This may result in geometric distortion or measurement inaccuracies.

*accident* Date 28/11/13  
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 acknowledged by the agency acronym in the legend.



Government of Western Australia  
Department of Environment Regulation

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\* Project Data is denoted by asterisk. This data has not been quality assured. Please contact map author for details.



# Clearing Permit Decision Report

## 1. Application details

### 1.1. Permit application details

Permit application No.: 5422/1  
Permit type: Area Permit

### 1.2. Proponent details

Proponent's name: ABN Consolidated Holdings Pty Ltd

### 1.3. Property details

Property: LOT 21 ON PLAN 8420 (House No. 392 SIXTY EIGHT BALDIVIS 6171)  
LOT 1263 ON PLAN 152941 (House No. 974 BALDIVIS BALDIVIS 6171)  
LOT 569 ON PLAN 152941 (House No. 968 BALDIVIS BALDIVIS 6171)  
City of Rockingham

Local Government Area:

Colloquial name:

### 1.4. Application

| Clearing Area (ha) | No. Trees | Method of Clearing | For the purpose of:         |
|--------------------|-----------|--------------------|-----------------------------|
| 9.2                |           | Mechanical Removal | Stockpile / Bulk earthworks |

### 1.5. Decision on application

Decision on Permit Application: Grant  
Decision Date: 28 November 2013

## 2. Site Information

### 2.1. Existing environment and information

#### 2.1.1. Description of the native vegetation under application

| Vegetation Description                                                                                                                                                                                                                                                              | Clearing Description                                                                                                                                                           | Vegetation Condition                                                                                                 | Comment                                                                                                                                                                                                                                                                             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mapped Beard vegetation association 968: Medium woodland; jarrah, marri & wandoo (Shepherd et al, 2001).                                                                                                                                                                            | Clearing 9.2 hectares of native vegetation within Lot 21, Lot 1263 and Lot 569, Baldivis, City of Rockingham, for the purpose of bulk earthworks for future urban development. | Degraded: Structure severely disturbed; regeneration to good condition requires intensive management (Keighery 1994) | The vegetation under application consists of Marri, Jarrah and Tuart trees with no middle storey and a ground cover of weeds (predominately Veldt Grass).                                                                                                                           |
| Mapped Beard vegetation association 1001: Medium very sparse woodland; jarrah, with low woodland; banksia & casuarina (Shepherd et al, 2001).                                                                                                                                       |                                                                                                                                                                                | To                                                                                                                   | The application area has previously been used as an old sand quarry that is no longer in use. The area under application also appears to be subject to past disturbances as the application area is very open with trees sparsely spread out over the application area (DEC, 2013). |
| Mapped Beard vegetation association 998: Medium woodland; tuart (Shepherd et al, 2001).                                                                                                                                                                                             |                                                                                                                                                                                | Completely Degraded: No longer intact; completely/almost completely without native species (Keighery 1994)           | The vegetation under application is in a degraded to completely degraded (Keighery, 1994) condition (DEC, 2013).                                                                                                                                                                    |
| Mattiske vegetation Karrakatta Complex - Central And/South: Predominantly open forest of Eucalyptus gomphocephala (Tuart) - Eucalyptus marginata (Jarrah) - Corymbia calophylla (Marri) and woodland of Eucalyptus marginata (Jarrah) - Banksia species (Mattiske and Havel, 1998). |                                                                                                                                                                                |                                                                                                                      | The condition of the vegetation under application was obtained from a site inspection undertaken by the former Department of Environment and Conservation (DEC) on the 31 January 2013.                                                                                             |



### 3. Assessment of application against clearing principles

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

##### Comments

##### **Proposal is not likely to be at variance to this Principle**

The application is to clear 9.2 hectares of native vegetation within a clearing footprint of 38.5 hectares for the purpose of bulk earth works for future urban development. The application footprint comprises of Marri, Jarrah and Tuart trees over a ground cover of weeds (DEC, 2013). The vegetation under application is in a degraded to completely degraded (Keighery, 1994) condition (DEC, 2013) and has been subject to past disturbances from activities such as sand extraction.

Several priority flora have been recorded within 10 kilometres of the area under application. Of the identified priority flora, none has been mapped occurring within the same soil or vegetation associations/complexes as the application area. Additionally, the vegetation under application is in a degraded to completely degraded (Keighery, 1994) condition (DEC, 2013) and is not likely to provide suitable habitat for the known priority flora species.

A previous flora survey was undertaken of Lot 21 by RPS in April 2008. The survey recorded 74 taxa species, 55 introduced weed species and 19 native. Of the recorded native species none were listed as priority of rare flora. The vegetation under application was considered to be in a very good to completely degraded (Keighery, 1994) condition (RPS, 2008). Approximately 3.3 hectares of Lot 21 is not within the current application. The vegetation under application within Lot 21 is in a degraded to completely degraded (Keighery, 1994) condition (DEC, 2013).

Given that the vegetation under application is in a degraded to completely degraded (Keighery, 1994) condition (DEC, 2013), it is considered that the clearing area does not comprise of a high level of biological diversity.

The application is not likely to be at variance to this principle.

##### Methodology

##### References:

- DEC (2013)
- Keighery (1994)
- RPS (2008)
- GIS Database:
  - SAC Bio datasets accessed January 2013

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

##### Comments

##### **Proposal is at variance to this Principle**

Several fauna species of conservation significance have been recorded within a 10 kilometre radius of the application area including Carnaby's cockatoo (*Calyptorhynchus latirostris*) and Forest Red-tailed black-cockatoo (*Calyptorhynchus banksii*).

A site inspection undertaken by the former DEC identified the vegetation under application to be Marri, Jarrah and Tuart trees over a ground cover of weeds. Of the identified trees, five were observed as having medium to large hollows that could potentially be suitable for breeding purposes for both cockatoo species.

The development of nesting hollows is a dynamic process and so the existing nesting hollows are important as well as the maintenance of healthy trees to allow for the development of future hollows. Clearing and subsequent land degradation has eliminated most of the breeding habitat for black cockatoos. These birds require old trees with large hollows in which to nest, which may take many decades for trees planted now to become suitable. Competition for nesting hollows by increasing numbers of galahs, western corellas and non native honey bees is significant (Burbridge 2004).

Bamford Consulting Ecologists (2011) undertook a Black-cockatoo tree survey within Lots 21, 569 and 1263. All three lots are within the application area, however approximately 3.3 hectares of Lot 21 is not under application. The survey identified 175 potential nesting trees with 41 of these containing obvious hollows and/or spouts. Most of the identified trees were recorded within Lot 21, with several containing large hollows, although no evidence of nesting was recorded (Bamford Consulting Ecologists, 2011). Additionally the survey identified the southern section of Lot 21 comprises of Banksia woodland, thus foraging habitat for Black-cockatoo species. This area has not been included within the current application. The adjacent vegetation on the western side of Lot 21 also comprises of Banksia woodland.

Given the presence of hollows suitable for nesting within the applied area and the presence of foraging habitat for Black-cockatoos in the southern section of Lot 21 and the adjacent property, the clearing as proposed, will impact on Black-cockatoos.

The application is at variance to this principle.

To offset the residual impacts identified above the applicant has committed to the rehabilitation of 2.5 hectares within the Rockingham Lakes Regional Park, in accordance with the ABN Group Pty Ltd PT Lot 21 and Lots 569 and 1263, Sixty Eight Road, Baldivis Offset Planting Plan. The offset involves the planting of 1040 Tuart

- seedlings and 520 understorey plants.
- Methodology** References:
- Bamford Consulting Ecologists (2011)
  - Burbridge (2004)
  - DEC (2013)

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

- Comments** **Proposal is not likely to be at variance to this Principle**
- Three species of rare flora have been recorded within 10 kilometres of the application, all three species are orchids. Of the recorded rare flora, none have been mapped as occurring on the same soil or vegetation associations/complexes as the application area. Additionally, the vegetation under application is in a degraded to completely degraded (Keighery, 1994) condition (DEC, 2013) and is not likely to provide suitable habitat for the known orchid species.

Considering the above, the application is not likely to be at variance to this principle.

- Methodology** References:
- DEC (2013)
  - Keighery (1994)
- GIS Database:
- SAC Bio datasets accessed January 2013

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

- Comments** **Proposal is not likely to be at variance to this Principle**
- The closest threatened ecological community (TEC) mapped to the area under application is Endangered TEC Swan Coastal Plain 19b, Woodlands over sedgeland in Holocene dune swales of the southern Swan Coastal Plain. The TEC has been recorded approximately 4.5 kilometres away from the applied area.

The vegetation under application comprises predominately of Jarrah, Marri and Tuart trees with no middle story and a ground cover of weeds. The condition (DEC, 2013) of the vegetation under application is degraded to completely degraded (Keighery, 1994).

Considering that the vegetation under application is not a representation of the nearby TEC, nor is the clearing as proposed likely to impact on the TEC, the application is not likely to be at variance to this principle.

- Methodology** References:
- DEC (2013)
  - Keighery (1994)
- GIS Database:
- SAC Bio datasets accessed January 2013

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

- Comments** **Proposal may be at variance to this Principle**
- The area under application is represented by Beard Vegetation Associations 968, 998 and 1001 which have 7, 38 and 25 percent respectively of their pre-European vegetation remaining. The application area is also represented by Heddle Vegetation Complex, Karakatta Complex Central and South which has 26 percent of its pre-European vegetation remaining.

The National Objectives and Targets for Biodiversity Conservation include a target that prevents the clearance of ecological communities with an extent below 30 percent of that present pre-European settlement (Commonwealth of Australia, 2001). Two of the mapped Beard vegetation associations associated with the area under application are below the 30 percent threshold, as is the mapped Heddle vegetation complex. However, the Environmental Protection Authority (EPA) recognises the Perth Metropolitan Region as a constrained area, which provides for the reduction of vegetation complexes to a minimum of 10 per cent of the pre-European extent (EPA, 2006).

The application is within an extensively cleared landscape with approximately 20 percent of native vegetation remaining within a 10 kilometres radius of the applied area. Additionally, Beard Vegetation Association 968 falls below the 10 per cent threshold within a constrained area. Given the above and that the application contains medium to large hollows that would be suitable for breeding purposes for cockatoo species, the vegetation under application is considered significant as a remnant in an extensive cleared area.

The application may be at variance to this principle.

To offset the residual impacts identified above the applicant has committed to the rehabilitation of 2.5 hectares within the Rockingham Lakes Regional Park, in accordance with the ABN Group Pty Ltd PT Lot 21 and Lots 569

and 1263, Sixty Eight Road, Baldivis Offset Planting Plan. The offset involves the planting of 1040 Tuart seedlings and 520 understorey plants.

|                                                                     | Pre-European<br>(ha) | Current Extent<br>(ha) | Remaining<br>(%) | Extent in DEC Managed Lands<br>(%) |
|---------------------------------------------------------------------|----------------------|------------------------|------------------|------------------------------------|
| IBRA Bioregion                                                      |                      |                        |                  |                                    |
| Swan Coastal Plain                                                  | 1,501,209            | 587,832                | 39.16            | 34.79                              |
| Shire                                                               |                      |                        |                  |                                    |
| City of Rockingham                                                  | 26,335               | 8,018                  | 30.4             | 10.14                              |
| Beard Vegetation Association in Bioregion                           |                      |                        |                  |                                    |
| 998                                                                 | 50,867               | 19,372                 | 38.09            | 40.97                              |
| 968                                                                 | 136,188              | 9,798                  | 7.19             | 15.86                              |
| 1001                                                                | 57,410               | 14,151                 | 24.65            | 5.66                               |
| Hedde Vegetation Complex<br>Karrakatta Complex Central<br>and South | 49,735               | 12,788                 | 25.7             | 5.86                               |

**Methodology** References:  
- Commonwealth of Australia (2001)  
- DEC (2013)  
- EPA (2006)  
- Keighery (1994)  
GIS Databases:  
Pre-European Vegetation

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

**Comments** **Proposal is not likely to be at variance to this Principle**  
The closest water course/body to the area under application is an unnamed multiple use wetland mapped approximately 200 metres east of the area under application.  
A site inspection of the application area identified that the vegetation under application consists predominately of Jarrah, Marri and Tuart trees over a ground cover of weeds (DEC, 2013). The vegetation under application is not growing in association with the nearby multiple use wetland or any other water course.  
The application is not likely to be at variance to this principle.

**Methodology** References:  
- DEC (2013)  
GIS Database:  
- Hydrography, linear

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

**Comments** **Proposal is not likely to be at variance to this Principle**  
The area under application is mapped as soil type JK9 which is described as undulating dune landscape with some steep dune slopes and underlain by aeolianite at depth: chief soils are brown sands (Northcote et al 1960 - 1968).  
A large proportion of the area under application was once a quarry of which sand was extracted from, thus the area under application is consequently suffering from land degradation in the form of wind erosion. Considering this and that the vegetation under application is in a degraded to completely degraded (Keighery, 1994) condition (DEC, 2013), it is unlikely that the clearing, as proposed will significantly further increase the amount of land degradation.  
The application is not likely to be at variance to this principle.

**Methodology** References;  
- DEC (2013)  
- Keighery (1994)  
- Northcote et al (1960-68)



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

**Comments Proposal is not likely to be at variance to this Principle**

The closest conservation area to the application footprint is Bush Forever site 376. The boundary of the Bush Forever site and the application area are approximately 50 metres apart. The closest section of the application footprint to Bush Forever site 376 comprises of very little native vegetation, additionally the areas are separated by a road.

Considering the above, it is not likely that the application will impact on Bush Forever site 376. Therefore the application is not likely to be at variance to this principle.

**Methodology** GIS Databases;  
- Bushforever

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

**Comments Proposal is not likely to be at variance to this Principle**

The closest water course/body to the area under application is an unnamed multiple use wetland mapped approximately 200 metres east of the area under application.

The groundwater salinity has been recorded at 1000-3000 mg/L which is considered to be moderately saline. There is an inherent risk of impacts to groundwater quality following the removal of deep-rooted native vegetation as ground water levels are subject to rises in these areas. However, given the degraded to completely degraded (Keighery, 1994) condition (DER, 2013) and historic extraction activities within the vicinity of the applied area, the proposed clearing of 9.2 hectares of native vegetation within a 38.5 hectare footprint is unlikely to significantly affect ground water quality.

The clearing as proposed is not likely to significantly impact upon the quality of surface or underground water. The application is not likely to be at variance to this principle.

**Methodology** References;  
- DEC (2013)  
- Keighery (1994)  
GIS Database:  
- Hydrography, linear  
- Groundwater salinity, statewide

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

**Comments Proposal is not likely to be at variance to this Principle**

The proposed clearing of 9.2 hectares of native vegetation (the majority of which area trees) in a degraded to completely degraded (Keighery, 1994) condition (DEC, 2013), over an area comprising of 38.2 hectares is not likely to cause flooding.

The application is not likely to be at variance to this principle.

**Methodology** References;  
- DEC (2013)  
- Keighery (1994)  
GIS Database:  
- Hydrography, linear

**Planning instrument, Native Title, Previous EPA decision or other matter.**

**Comments**

The area under application is within an area subject to the Environmental Protection (Peel Inlet-Harvey Estuary) Policy 1992 (EPP). The Environmental Protection Authority (EPA) considers the implementation of Statement of Planning Policy 2.1 (SPP 2.1) by local authorities through their relevant planning schemes to be the most applicable way to move forward with the application.

The area under application is within the Stakehill groundwater area, Outridge subarea. The resource is currently fully allocated and new applications to take groundwater are likely to be refused (DoW, 2013). The applicant has already submitted an application for a groundwater licence for dust suppression and irrigation purposes associated with these properties. If the applicant requires any more water than what has already been applied for, they will need to seek an alternate source (DoW, 2013).

The City of Rockingham (2013) advises that they have no objections to the application to clear native vegetation.

The area under application is zoned as 'Development' under the Town Planning Scheme and - Urban Deferred under the Metropolitan Regional Scheme.

The clearing, as proposed, was referred to the then Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) which determined the proposed clearing as not a controlled action, therefore the application does not require further assessment and approval under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

To offset the residual impacts identified above the applicant has committed to the rehabilitation of 2.5 hectares within the Rockingham Lakes Regional Park, in accordance with the ABN Group Pty Ltd PT Lot 21 and Lots 569 and 1263, Sixty Eight Road, Baldivis Offset Planting Plan. The offset involves the planting of 1040 Tuart seedlings and 520 understorey plants.

The proposed offset area, being the Rockingham Lakes Regional Park, is currently managed by Department of Parks and Wildlife (DPaW) which have given the applicant authorisation to undertake the offset within the property subject to conditions imposed by DPaW (DPaW, 2013).

The applicant commits to install 10 cockatubes (artificial nesting boxes) within the Rockingham Lakes Regional Park. The installation will be undertaken by the Serpentine - Jarrahdale Landcare Group.

- Methodology**    **References:**
- City of Rockingham (2013)
  - DoW (2013)
  - DPaW (2013)
  - EPA (2013)

#### 4. References

- Bamford Consulting Ecologists (2011) Black-Cockatoo Nest Tree Survey, Sixty Eight Road, Baldivis, June 2011 (DEC Ref:A582749)
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- Commonwealth of Australia (2001) National Objectives and Targets for Biodiversity Conservation 2001-2005, Canberra.
- DEC (2013) Site Inspection Report for Clearing Permit Application CPS 5422/1, Lot 21, 569 and 152941, Sixty Eight Road, Baldivis. Site inspection undertaken 31 January 2013. Department of Environment and Conservation, Western Australia (TRIM Ref. Doc:A605781).
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- EPA (2013) Advice received in relation to Clearing Permit Application CPS 5422/1 - Environmental Protection (Peel Inlet-Harvey Estuary) Policy 1992 (EPP) (DEC Ref:A595877)
- EPA (2006) Guidance for the Assessment of Environmental Factors - Level of Assessment for Proposals Affecting Natural Areas Within the System 6 Region and Swan Coastal Plain Portion of the System 1 Region. Guidance Statement No 10. Environmental Protection Authority, Western Australia.
- Government of Western Australia (2011); 2011 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report). WA Department of Environment and Conservation, Perth.
- Keighery, B.J. (1994) Bushland Plant Survey: A Guide to Plant Community Survey for the Community. Wildflower Society of WA (Inc). Nedlands, Western Australia.
- Mattiske, E.M. and Havel, J.J. (1998) Vegetation Complexes of the South-west Forest Region of Western Australia. Maps and report prepared as part of the Regional Forest Agreement, Western Australia for the Department of Conservation and Land Management and Environment Australia.
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- RPS (2008) Rare Flora Search and Vegetation Survey. Lot 21 Sixty Eight Road, Baldivis. Additional information within Clearing Permit Application CPS 5422/1 (DEC Ref:A582749)
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CPS 5422/1

## Appendix A

Offset Planting Plan

# **Appendix C**

## **Approved Planting Plan**

**PT LOT 21 AND LOTS 569 AND 1263  
SIXTY EIGHT ROAD, BALDIVIS  
OFFSET PLANTING PLAN**

**Prepared for**

**ABN Group Pty Ltd**  
133 Hasler Rd  
OSBORNE PARK 6017

Report No. J11009b  
26 September 2013

**BAYLEY ENVIRONMENTAL SERVICES**  
30 Thomas Street  
SOUTH FREMANTLE WA 6162

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## 1.0 INTRODUCTION

### 1.1 Background

ABN Group Pty Ltd is applying for a permit to clear 9.2ha of native vegetation on Pt Lot 21 and Lots 569 and 1263 Sixty Eight Road, Baldivis. The vegetation includes 126 trees, mostly Tuart, with diameter at breast height (DBH) of at least 0.5m (Bamford, 2011). Of these, 31 trees (including 13 Tuart, 14 Jarrah and 3 Marri) have visible hollows or spouts that may be suitable as nesting sites for black cockatoos. Figure 1 and Table 1.1 show the affected trees.

As part of its clearing proposal, ABN Group has undertaken to plant 1040 Tuart trees, more than eight times the total number of trees removed and 33 times the number of potential breeding trees removed. The Department of Parks & Wildlife (DPAW) has identified a 2.5ha area of cleared land within the Rockingham Lakes Regional Park that is available and suitable for replanting with Tuarts. A letter from the DPAW confirming this agreement is attached in Appendix A.

### 1.2 Objectives

The overall objective of this planting programme is to offset the potential variance to two Clearing Principles as defined under the *Environmental Protection Act 1986*, which state that native vegetation should not be cleared if:

- “(b) it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia; or
- (e) it is significant as a remnant of native vegetation in an area that has been extensively cleared”.

The DEC considered that the proposed clearing was likely to be at variance to Principle (b) due to the presence of trees with potential as black cockatoo breeding sites.

The DEC's Preliminary Assessment Report (14/3/2013) noted that the application area supported three Beard Vegetation Associations: 968, 998 and 1001, of which Association 968 (Jarrah, Marri, Wandoo woodland) has approximately 7.2% of its original extent in the Swan Coastal Plain bioregion remaining. On this basis, the DEC advised that the proposed clearing may be at variance to Principle (e). Figure 1 shows the Beard vegetation mapping over the clearing area.

Association 968 occurs only in the east of the site, where it is represented by about 0.5ha of scattered Jarrah and Marri trees over grass and weeds. Three Marri and two Jarrah trees in this area have potential as cockatoo nesting trees.



The proposed planting will replace the number of trees lost in the clearing many times over. Over the long term, as these trees reach senescence, they will provide significantly more breeding sites than have been lost in the clearing. In the short term, the establishment of artificial nesting boxes on and/or around the site (under separate agreement) will provide interim nesting sites.

The vegetation in and around the planting site is mapped as Beard Association 3048 (coastal shrubland/scrub heath), although the dominance of Tuart suggests that it should instead be mapped as Association 998.1 (Tuart woodland), which is mapped a short distance to the east. Thus the proposed planting will directly replace the loss of this vegetation association in the clearing area. Although it will not directly replace the lost Association 968, it will satisfy the stated intent of Clearing Principle (e), which refers to extensive clearing overall rather than of particular vegetation types.

**Table 1.1 Potential Nesting Trees in Clearing Area**

| <i>Species</i> | <i>DBH (mm)</i> | <i>State</i> | <i>Features</i>     | <i>Easting</i> | <i>Northing</i> |
|----------------|-----------------|--------------|---------------------|----------------|-----------------|
| Tuart          | 1200            | Alive        | Hollows, dead limbs | 389080         | 6419367         |
| Tuart          | 1115            | Alive        | Hollows, dead limbs | 389182         | 6419414         |
| Tuart          | 1270            | Alive        | Hollows             | 389212         | 6419419         |
| Tuart          | 1400            | Alive        | Hollow              | 389228         | 6419291         |
| Tuart          | 1400            | Alive        | Several hollows     | 389223         | 6419211         |
| Jarra          | 1300            | Alive        | Hollow              | 389222         | 6419050         |
| Jarra          | 1500            | Alive        | Hollow              | 389228         | 6419014         |
| Jarra          | 1600            | Alive        | Hollow              | 389236         | 6418954         |
| Jarra          | 1200            | Alive        | Hollows             | 389226         | 6418919         |
| Jarra          | 1000            | Alive        | Hollows             | 389114         | 6419134         |
| Tuart          | 1600            | Alive        | Hollow              | 389280         | 6419314         |
| Jarra          | 1500            | Alive        | Hollows             | 389259         | 6419411         |
| Jarra          | 700             | Alive        | Hollow              | 389435         | 6419426         |
| Jarra          | 650             | Alive        | Hollow              | 389440         | 6419424         |
| Marri          | 1400            | Dead         | Hollows             | 389806         | 6419043         |
| Jarra          | 1400            | Alive        | Dead limbs          | 389429         | 6418901         |
| Tuart          | 1200            | Alive        | Spout               | 389114         | 6419460         |
| Jarra          | 750             | Dead         | Spout               | 389111         | 6419443         |
| Tuart          | 1000            | Alive        | Spout               | 389121         | 6419448         |
| Tuart          | 1100            | Alive        | Spout               | 389166         | 6419420         |
| Tuart          | 1100            | Alive        | Spout               | 389162         | 6419431         |
| Tuart          | 1400            | Alive        | Spout               | 389204         | 6419286         |
| Jarra          | 750             | Alive        | Spout               | 389197         | 6419268         |
| Tuart          | 1900            | Alive        | Hollows and spouts  | 389178         | 6419223         |
| Tuart          | 800             | Alive        | Spout               | 389156         | 6419145         |
| Jarra          | 900             | Alive        | Spout               | 389173         | 6418994         |
| Jarra          | 1500            | Dead         | Spout               | 389236         | 6419331         |
| Jarra          | 1200            | Dead         | Spouts              | 389238         | 6419323         |
| Jarra          | 1800            | Alive        | Spouts              | 389471         | 6419445         |
| Jarra          | 1300            | Alive        | Spouts              | 389485         | 6419426         |
| Jarra          | 950             | Alive        | Spouts              | 389773         | 6419417         |
| Jarra          | 500             | Dead         | Spout               | 389842         | 6419438         |
| Marri          | 1100            | Alive        | Spout               | 389857         | 6419438         |
| Marri          | 600             | Alive        | Spout               | 389842         | 6419427         |
| Marri          | 900             | Alive        | Spouts              | 389823         | 6419395         |
| Jarra          | 1500            | Dead         | Hollows and spouts  | 389841         | 6419344         |
| Jarra          | 1400            | Dead         | Hollows and spouts  | 389856         | 6419110         |
| Marri          | 800             | Alive        | Spout               | 389774         | 6418922         |
| Jarra          | 1200            | Dead         | Spout               | 389753         | 6418927         |
| Jarra          | 1100            | Dead         | Spout               | 389762         | 6418976         |
| Marri          | 1200            | Alive        | Spouts              | 389778         | 6418979         |
| Marri          | 900             | Alive        | Spouts              | 389778         | 6418971         |

## 2.0 SITE DESCRIPTION

### 2.1 Location and Tenure

The proposed planting site is located in the Rockingham Lakes Regional Park, about 800m south-west of Lake Cooloongup and about 6.3km north-west of the proposed clearing area. Figure 2 shows the location and layout of the planting site.

The planting site has an area of about 2.5ha and is owned freehold by the WAPC and managed by the Department of Parks and Wildlife in accordance with a management agreement under the *Conservation and Land Management Act 1984*.

### 2.2 Existing Vegetation

The planting site is mostly devoid of native vegetation. The cover consists mainly of invasive weeds. A few mature Tuart trees are present. Some regrowth is occurring around the margins. Dense sapling regrowth (0.5 – 5m spacing) is present beneath many of the mature Tuarts, although most of these are unlikely to survive to maturity. There are also thickets and scattered individuals of *Acacia rostellifera* and dense growths of *Xanthorrhoea preissii* around the planting site. The vegetation condition in the planting site is Completely Degraded to Cleared.

Hedde *et al.* (1980) mapped the planting site as 55 – Karrakatta Complex – Central and South. Beard (1981) mapped the area as Association 3048 (coastal shrubland/scrub heath), although the dominance of Tuart suggests that it should instead be mapped as Association 998.1 (Tuart woodland), which is mapped a short distance to the east.

Syrinx (2006) mapped native vegetation and weeds in the Rockingham Lakes Regional Park, including the planting site. The Syrinx survey included only one 10m x 10m plot in the Tuart Woodland vegetation type, located about 600m south-west of the planting site. Syrinx listed 18 native species from this plot.

Bayley Environmental Services surveyed the vegetation of the planting site and surrounds (within 500m) in July 2013, recording all species observed. Table 2.1 lists the species found.

**Table 2.1 Flora Species List – Planting Site and Surrounds**

|                                  |                          |
|----------------------------------|--------------------------|
| <i>Acacia pulchella</i>          | Prickly Moses            |
| <i>Acacia rostellifera</i>       | Summer-scented Wattle    |
| <i>Acacia saligna</i>            | Orange Wattle            |
| <i>Acanthocarpus preissii</i>    | Prickle Lily             |
| * <i>Brassica tournefortii</i>   | Mediterranean Turnip     |
| <i>Clematis linearifolia</i>     | Old Man's Beard          |
| <i>Eucalyptus ?gomphocephala</i> | Tuart                    |
| * <i>Euphorbia terracina</i>     | Geraldton Carnation Weed |
| <i>Gahnia trifida</i>            | Coast Saw-sedge          |
| * <i>Geranium molle</i>          | Dove's Foot Cranesbill   |
| <i>Geranium solanderi</i>        | Native Geranium          |
| <i>Hardenbergia comptoniana</i>  | Native Wisteria          |
| <i>Jacksonia furcellata</i>      | Grey Stinkwood           |
| <i>Kennedia prostrata</i>        | Running Postman          |
| <i>Lepidosperma pubisquameum</i> | A saw-sedge              |
| <i>Leucopogon parviflorus</i>    | Coast Beard-heath        |
| <i>Lomandra maritima</i>         | Coastal Mat-rush         |
| <i>Myoporum insulare</i>         | Blueberry Tree           |
| <i>Nitraria billardiarei</i>     | Nitre Bush               |
| *? <i>Oenothera ?drummondii</i>  | Beach Evening Primrose   |
| <i>Opercularia hispidula</i>     | Hispid Stinkweed         |
| <i>Phyllanthus calycinus</i>     | False Boronia            |
| * <i>Poaceae</i> sp.             | A grass                  |
| <i>Rhagodia baccata baccata</i>  | Berry Saltbush           |
| <i>Rhagodia baccata dioica</i>   | Sea Berry Saltbush       |
| * <i>Romulea rosea</i>           | Guildford Grass          |
| <i>Spyridium globulosum</i>      | Basket Bush              |
| <i>Templetonia retusa</i>        | Cockies Tongue           |
| * <i>Trachyandra divaricata</i>  | Dune Onion Weed          |
| * <i>Trifolium</i> sp.           | A clover                 |

### 2.3 Unexploded Ordnance

The Rockingham Lakes area was used as a live firing range by the Army during World War II. Unexploded ordnance (UXO) including artillery shells, mortars and small arms rounds is known to exist in the area. A comprehensive search undertaken by the Warnbro Clearance Project in the 1980s found UXO on the edge of the live firing range about 0.5km south and west of the planting site.

The planting site itself was the headquarters and main camp for the firing range, as well as the site of an artillery battery, so it is unlikely to have been targeted, but UXO may have been lost or disposed there. If ammunition were disposed there it would likely have been buried at least one metre deep.

FESA has advised that, if planting is carried out by hand tools (e.g. hand auger) and ground disturbance is limited to a depth of 200mm, the risk of disturbing UXO will be very minimal. Vehicle traffic (including water trucks) will also present minimal risk. The advice from FESA is attached in Appendix B. Based on this advice, no further investigation of UXO is proposed. FESA has provided a protocol (attached in Appendix C) that will be followed in the event that any UXO is discovered or suspected during the planting.

### **3.0 PLANTING PLAN**

#### **3.1 Implementation**

The planting will be undertaken by a professional rehabilitation specialist contracted to ABN Group. Whichever contractor is chosen will be accredited with the Revegetation Industry Association of Western Australia or equivalent.

#### **3.2 Site Preparation**

Site preparation will consist of spot weed control using an appropriate herbicide such as Roundup Biactive® over a 2m diameter around each planting location. The weed control will be undertaken at the appropriate time for each species, at least one month before the planting. Due to the proximity of the site to the Rockingham Lakes, no residual herbicides will be used.

Given the sandy soils of the site, no ripping or other soil preparation will be required before planting.

#### **3.3 Species Selection and Source**

Tuart will be the primary species used in the planting. Understorey species will be included in the planting to maximise the sustainability and the habitat value of the planting. These will be a mixture of species drawn from the local species listed in Table 2.1.

All plants will be supplied as nursery tube stock from Men of the Trees (Rockingham Branch), which collects seed from Lake Cooloongup. The exact understorey species grown will depend upon the species in fruit at the time of the seed collection. Should certain species not be available, further nursery tube stock may be grown from seed collected within 500m of the planting site.

#### **3.4 Planting Density**

Planting will be undertaken at a 4m spacing, giving a density of 625 seedlings per hectare and a total of about 1,562 seedlings over the 2.5ha planting site. The seedlings will be planted at a rate of two Tuarts for each one other species, giving a total of about 1,040 Tuarts and 520 other species across the site.

This planting density will allow for considerable self-thinning of Tuarts by the time they reach maturity. The density of large (>1m DBH) Tuarts in the vicinity of the planting site is about one tree per 20m to 50m; however smaller Tuarts may be as little as 5m apart,



and seedling regrowth beneath mature Tuarts may be as close as 0.5m. The proposed planting therefore mimics the density of natural recruitment.

Tuarts may also be planted in treeless areas around the central planting site. Other species will be planted only within the central planting site.

### **3.5 Timing of Planting**

The planting will be undertaken in about June 2014 after the first significant winter rains. Pre-planting weed control will occur about one month before planting.

### **3.6 Planting Method**

A hand auger will be used to drill a hole 200mm deep and 50mm wide for each seedling. Each seedling will be planted with a slow-release native plant fertiliser pill.

### **3.7 Protection of Seedlings**

Mesh tree guards will be placed around each seedling to protect them from grazing by rabbits and kangaroos. The Tuart seedlings are unlikely to be targeted by kangaroos as the essential oils they contain are harmful to kangaroos' digestion and are normally avoided (ABC Science, 2013). The juvenile native plants present in the area show little evidence of grazing by kangaroos, which appear to favour the irrigated grass of the nearby Rockingham Golf Course.

## **4.0 POST-PLANTING MAINTENANCE**

### **4.1 Weed Control**

Follow-up weed treatments using an appropriate herbicide applied by hand sprayer or wand will be undertaken in August-September 2014 and 2015.

### **4.2 Watering**

If necessary, the seedlings will be watered up to monthly during the first summer (January–April) after planting in order to ensure the required survival. The occurrence, frequency and duration of watering will depend upon the severity of the summer.

Watering, if required, will be carried out by a truck or trailer mounted tanker. FESA has advised that such traffic will present no significant risk of disturbance to any UXO.

### **4.3 Monitoring**

The condition of the mesh tree guards will be monitored every two months for the first two years after planting. Any guards that become displaced or damaged will be repositioned or replaced.

The success of the plantings will be monitored annually for five years after the completion of the planting programme. For the first two years this will be undertaken by the planting contractor; thereafter it may be done by the planting contractor or by a botanist contracted by ABN Group.

The monitoring will be undertaken by means of two fixed transects, one running the length of the planting site (285m) and the other running across the widest part of the site (165m), as shown on Figure 2. The identity, height, width and health of all plants intersecting the transects will be recorded, giving data on species composition, cover and structure. Photographs will be taken at fixed points on each transect. Comparison between monitoring dates will provide data on survival rates.

The results of each round of monitoring will be reported to the DER and the Regional Parks Unit of DPAW.

#### **4.4 Success Criteria**

The planting density is designed to allow for 25% attrition of seedlings. Success of the planting will therefore defined as at least 75% survival of all species planted after five years.

#### **4.5 Contingencies**

If at any time within five years after planting, monitoring shows that the survival rate of any planted species is approaching or below 75%, infill plantings of the same species will be undertaken. If low survival appears to be affecting a particular species then, subject to DPAW agreement, an alternative local species may be used for the infill planting for the remainder of the five-year maintenance period.

## 5.0 IMPLEMENTATION SCHEDULE

ABN Group will undertake and fund the revegetation work described in this plan. Following planting, ABN Group will monitor and maintain the revegetation for five years, undertaking infill planting as necessary to achieve the completion criterion.

After five years, assuming the completion criteria as set out in this report have been achieved, ABN will hand the rehabilitation over to the DPAW, which will assume responsibility for future management.

Table 5.1 summarises the schedule of implementation of the plan.

**Table 5.1 Implementation Schedule**

| <i>Date</i>    | <i>Activity</i>                                             |
|----------------|-------------------------------------------------------------|
| April-May 2014 | Pre-planting weed control with knockdown herbicide.         |
| June 2014      | Plant seedlings, install tree guards.                       |
| September 2014 | Weed inspection and control if required.                    |
| January 2015   | Water seedlings (if no significant rain in preceding month) |
| February 2015  | Water seedlings (if no significant rain in preceding month) |
| March 2015     | Water seedlings (if no significant rain in preceding month) |
| April 2015     | Water seedlings (if no significant rain in preceding month) |
| June 2015      | Monitor transects, report results to DER and DPAW.          |
| June 2015      | Infill planting if necessary.                               |
| September 2015 | Weed inspection and control if required.                    |
| June 2016      | Monitor transects, report results to DER and DPAW.          |
| June 2016      | Infill planting if necessary.                               |
| June 2017      | Monitor transects, report results to DER and DPAW.          |
| June 2017      | Infill planting if necessary.                               |
| June 2018      | Monitor transects, report results to DER and DPAW.          |
| June 2018      | Infill planting if necessary.                               |
| June 2019      | Monitor transects, final report results to DER and DPAW.    |
| June 2019      | Handover to DPAW (if completion criteria met).              |

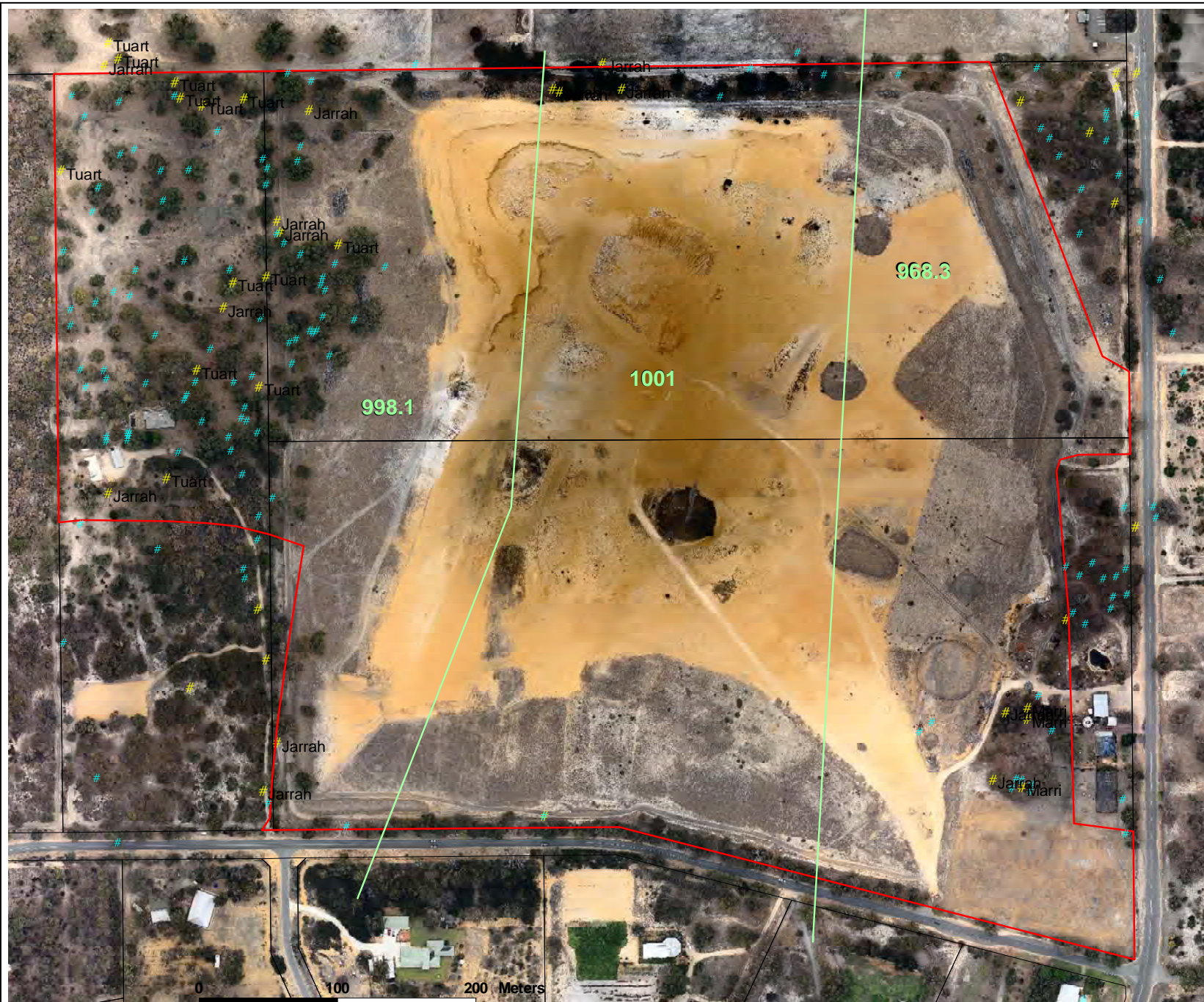
---

## 6.0 REFERENCES

- ABC Science (2013). *Kangaroos Turn Up Noses at Gum Leaves*.  
<http://www.abc.net.au/science/articles/2004/02/25/1052204.htm>
- Beard J.S. (1981). *Vegetation Survey of Western Australia, Swan 1:1,000,000 Vegetation Series*. University of Western Australia Press.
- Heddle E.M., Loneragan O.W. and Havel J.J. (1980). Vegetation Complexes of the Darling System, Western Australia. *In: Atlas of Natural Resources Darling System, Western Australia*. Department of Conservation and Environment, Perth.
- Syrinx (2006). *Rockingham Lakes Regional Park Weed Species and Rehabilitation Plan*. Report prepared for Department of Environment & Conservation, Perth.

# Figures





- Clearing permit application area
- Tree >0.5m with hollows or spouts
- Tree >0.5m without hollows or spouts
- Beard (1981) vegetation association

**Figure 1**  
**PROPOSED  
CLEARING**



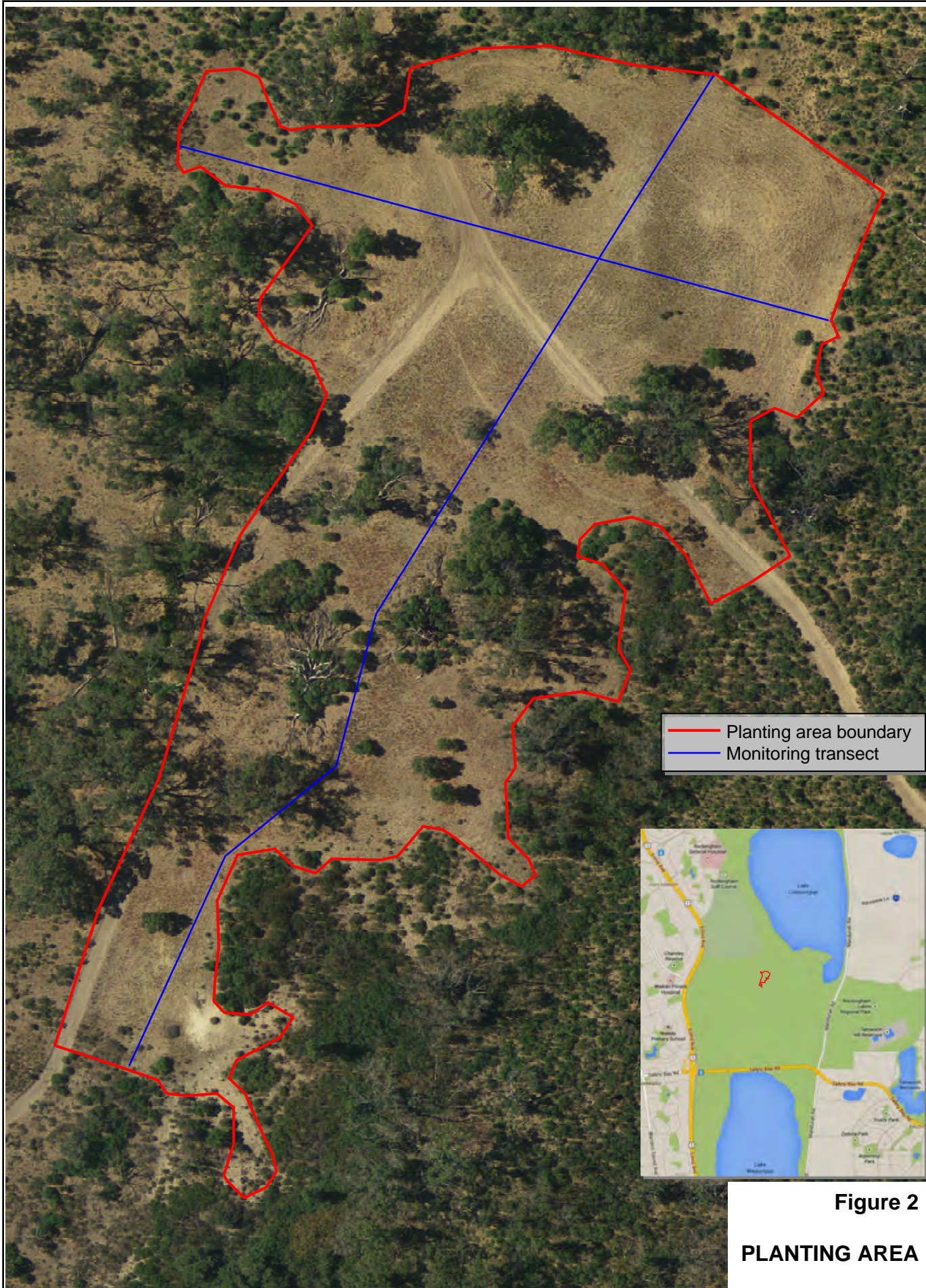


Figure 2  
PLANTING AREA

# **Appendix A**

## **DPAW Agreement to Planting Site**



**From:** [Prideaux, Catherine](#)  
**To:** [Damien Giudici](#)  
**Cc:** [Evans, Renee](#); [Campbell, Robert](#); [Jenkins, Derek](#); [bayley@iinet.net.au](mailto:bayley@iinet.net.au)  
**Subject:** RE: Revegetation of portion of Lot 0 on Plan 1118 north of Safety Bay Rd within Lake Cooloolungup  
**Date:** Wednesday, 24 July 2013 1:05:01 PM  
**Attachments:** [image003.png](#)  
[LCS-4.3A.pdf](#)  
[RORP2006\\_FINAL.pdf](#)

---

Hi Damien

I have discussed the proposal with Renee Evans (Acting Manager, Regional Parks Unit) and can confirm that DPaW agrees in principle to the planting of tuart trees within a degraded portion of Rockingham Lakes Regional Park as an offset for bulk earthworks and future urban development in Baldivis (CPS 5422/1). The Regional Parks Unit would appreciate being able to provide comments on and endorsement of a revegetation plan for the site, prior to DER approval. I understand that this is being prepared by Phil Bayley.

Please note that the agreement relating to the portion of Lot 0 on Plan 1118 lasts for a minimum of 6 months from the date of this email or until such time as DPaW may be approached by another proponent for a tuart rehabilitation site as part of an offset agreement.

The attached plan of vegetation community types shows that the degraded vegetation portion is likely to have comprised *Eucalyptus gomphocephala* open woodland. Also, please find attached a Weed Species and Rehabilitation Plan for Rockingham Lakes Regional Park that was prepared as a tool for planning weed control and rehabilitation projects in the regional park. This version of the document contains the text only, the weed maps are stored separately as they are such large files. The most useful part for your purposes is Section 5: Revegetation Guidelines. The revegetation guidelines table illustrates the composition of the various community types; the dominant species and additional species of the community is listed on page 66. Page 84 lists further species typical of Rockingham Lakes Regional Park, according to dryland vegetation community type. DPaW recommends this document is used to compile a species list for the rehabilitation site.

DPaW advises that the optimum planting density for tuart woodlands 200 – 500 stems per hectare (ha) so you should be able to plant 1300 trees within the proposed 2.7 ha site. DPaW's preference however is for the offset to include the planting of understorey species to prevent a monoculture from forming in the regional park. This would mean fewer tuart stems per hectare but the balance of stems to be made up with understorey species. There would be scope to plant additional tuarts within this part of Rockingham Lakes Regional Park to make up the 1300 balance. Agreement to rehabilitation of the *Eucalyptus gomphocephala* open woodland community type would need to be given by DER's Native Vegetation Conservation Branch (NVCB) in relation to approval of CPS 5422/1.

So that a good environmental outcome could reasonably be expected to be achieved from the rehabilitation, additional fencing would be required to protect the plants from kangaroos. The fence should be alongside the fire tracks so that access is not restricted. The requirement is for a 5 year rehabilitation plan and as well as the components outlined in DER's letter of 4 July 2013, the rehabilitation plan should also outline the how the risk of unexploded ordnance in the area is to be addressed, soil preparation, weed control, infill planting, success criteria and

monitoring that would be required.

After speaking with Derek Jenkins of DER, you also need to clarify where the Serpentine-Jarrahdale Landcare group are to install cockatubes because this has not been made clear to DPaW or DER at this stage. Derek has requested written evidence of agreement from the landcare group.

Please do not hesitate to contact me with any queries. I look forward to hearing from you.

Kind regards  
Catherine

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***Catherine Prideaux***

Planning Officer  
Regional Parks Unit, Swan Region  
Dept of Parks and Wildlife (DPaW)  
PO Box 1167  
Bentley Delivery Centre  
BENTLEY WA 6983  
Ph: 9219 9294



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# **Appendix B**

## **FESA Advice on UXO**



**From:** ARNOLD Andrew [<mailto:Andrew.Arnold@dfes.wa.gov.au>]  
**Sent:** Friday, 21 June 2013 11:15 AM  
**To:** Jackie Hams  
**Cc:** AUSTIC Merv  
**Subject:** RE: maps of areas of interest

Hi Jackie,

As previously discussed, this clearing was the site of the Australian Army Head Quarters and main camp area for the former Rockingham Artillery Range training area, WWII. As such, it is highly unlikely that the site and immediate surrounds would have been targeted or impacted during training scenarios by artillery, mortar or other weapons systems, however, there may still be a slight possibility that ammunition or other produce stored at the site during occupation could remain abandoned and buried on or close to this site. Our records indicate that no UXO were found on or close to this site when the area was assessed by way of a surface inspection and limited shallow detector (+/- 300mm) survey in the early 1980's by the former Warnbro Clearance Project, however, my records confirm that actual UXO were found at the start of the impact/targets areas within ½ kilometre south and west of this site.

In regards to the possibility that ordnance may have been buried at this site, when abandoned ordnance and or other hazardous material is wilfully buried, it is generally done by the military at reasonable depth below the surface to avoid future disturbance, and in this case, given the very soft soil conditions of the site, it is highly likely that if any such material was to be present, it should have been buried in pockets or pits at least 1m + below the surface.

In this regard, if the intention of your rehabilitation seeding programme is to subject this site to deep augur, excavation or ripping by mechanical means in order to plant tuart saplings and other species of understory seedlings, it would be highly recommended that a formal "deep" sensing UXO detector survey be conducted on the rehabilitation areas prior to any soil disturbance activity. As the site is in excess of 2.7ha overall, any such survey would have to be undertaken by one of the available Defence accredited, Commercial UXO Search Companies, which could amount to significant cost to your programme. I am more than happy to prepare a Scope of Works should you choose to take this option, but am unable to assist any further with a localised survey at this scale.

However, if the planting method is shallow scrapings with minimal digging @ less than 200mm with hand tools only, then the risk of being exposed to any remnant UXO hazards would be extremely minimal, (no guarantee however) and it is my opinion that no detector surveys should therefore be necessary.

I am more than happy for you to run with this option.

Also I did a bit of a review of Landgate's historical and recent aerial mosaics to see how the site has been used post war and it is apparent that there has been regular surface disturbance on the site, mainly being fenced off and used as a stock yard through to the early 1970s, camping etc through the 80's and 90's and in 2010, appears to have been recently slashed, probably to keep the weeds and fuel load down in case of fire.



2010

What was also noted was that the waterhole just south of the site appears to be a billabong only in the 53 and 65 mosaics, so my info that the water hole was cleared out by the Army may be wrong, but still probable that they used the billabong for water.





1

965

It is also noted that the depression with the sand pile next to it in the clearing was dug out as a water hole around the same time as the other one sometime in the late 60's, early 70's, so was definitely not there when the Army occupied the area.



1974

I have a couple of urgent tasks to get on with at the moment, but will email you again next week to provide you with a basic management plan outlining the process that must be followed in the event that a known or suspected UXO be located on this or any other of your work sites.

Have a great weekend.

Regards,

**Andrew Arnold**

Unexploded Ordnance Liaison Officer  
Operations Support & Capability  
EM & Hazard Planning

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# **Appendix C**

## **UXO Protocol**



UXO Services 600-01-01

## **WARNING CONCERNING UNEXPLODED ORDNANCE (UXO)**

1. In most cases in Western Australia, any unexploded ordnance (UXO) likely to be found is of the form that is designed to kill or to maim. In most circumstances, it is very difficult for an untrained person to be able to determine if a UXO or a suspected UXO is dangerous or if it is harmless. All such objects must therefore be treated as dangerous unless or until proven otherwise.
2. UXO is ammunition, explosives and pyrotechnics such as artillery shells, mortar bombs, flares, TNT, gelignite and grenades of military origin that did not fully function when used or which was intentionally or inadvertently abandoned. Much of the UXO pollution in the State results from training during World War II and can still be dangerous for many decades, if not centuries, later.
3. Explosive ordnance to be found in non-training areas, such as storage and disposal sites, would not normally have been initiated or fired but it is, nevertheless, inherently dangerous, and is generally treated as UXO.
4. UXO may be found on or below the soil surface. Of the small percentage of artillery projectiles, mortars and aerial bombs which did not explode on impact, some will have penetrated the soil. In stable soil conditions, most of these are likely to be found within two metres of the natural ground surface with density increasing towards the surface. In unstable soil conditions, (for example in active sand dunes), UXO may lie at depths beyond the capacity of contemporary detecting equipment to locate.
5. There are no known cases of UXO exploding involuntarily. However, UXO can and have exploded in the following circumstances:
  - a. Movement/vibration (eg. when handled or being transported by vehicle);
  - b. Wilful tampering (eg. by a souvenir collector attempting to separate the components of the UXO);
  - c. Mechanical disturbance (eg. when ploughing, digging or cultivating); and
  - d. Increase in temperature (eg. bush fires).
6. If a UXO or suspected UXO is located, the following procedure should be adopted:
  - a. Do not disturb the site of the suspected UXO;
  - b. Without disturbing the immediate vicinity, clearly mark the site of the UXO;
  - c. Notify the Western Australia Police Service of the circumstances by the fastest possible means; and
  - d. Maintain a presence near the site until advised to the contrary by a member of the Western Australia Police Service or a member of the Defence Forces.

# **Appendix D**

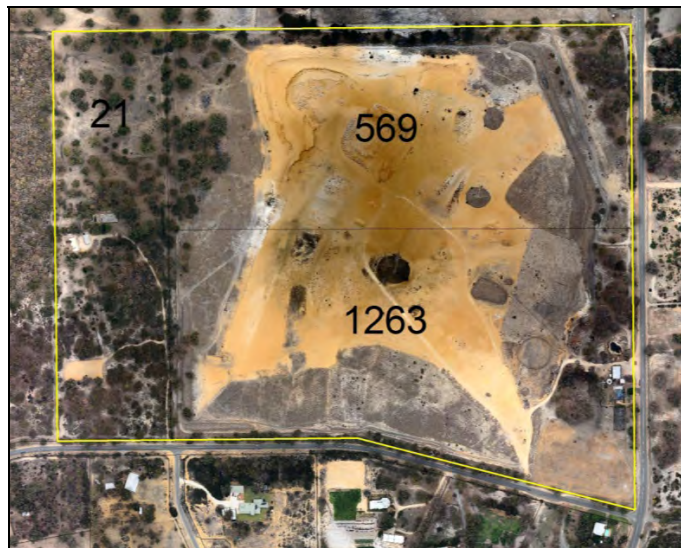
**Fauna Report  
(Bamford, 2011)**



# **Black-Cockatoo Nest Tree Survey**

Sixty Eight Road, Baldivis

June 2011



Aerial view of study site

Prepared for: Bayley Environmental Services

30 Thomas Street,  
South Fremantle, WA, 6162

Prepared by: Natalia Huang and Mike Bamford

Bamford Consulting Ecologists  
23 Plover Way,  
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30 June 2011

## EXECUTIVE SUMMARY

Bamford Consulting Ecologists was commissioned by Bayley Environmental Services to conduct a Black-Cockatoo tree survey on approximately 38 ha of proposed development land on Lots 21, 569 and 1263 Sixty Eight Road, Baldivis. The three species of black-cockatoos (Carnaby's, Baudin's and Forest Red-tailed Black-Cockatoo) are expected to occur within the region and are threatened under state and federal legislation. The site was visited on 6<sup>th</sup> June 2011. The study objectives were to:

- 1) identify and record the locations of nesting or potential nesting trees for the Carnaby's, Baudin's and Forest Red-tailed Black-Cockatoos (*Calyptorhynchus latirostris*, *C. baudinii* and *C. banksii naso* respectively);
- 2) record the density of additional suitable foraging habitat such as Banksias; and
- 3) search for evidence of foraging by Black-Cockatoos.

A total of 175 potential nesting trees (Tuart, Jarrah and Marri) was recorded at the site; 41 of these had obvious hollows and/or spouts. The potential nesting trees were mostly located on Lot 21 and along the eastern part of the site. Several of these trees had large hollows, although no evidence of nesting was recorded.

The main foraging habitat on the site was Banksia woodland located within the southern part of Lot 21. Based on the presence of approximately 144 trees per ha, 54 cones per tree and the literature, this patch of Banksia woodland may provide enough food resource for up to 5.81 Black-Cockatoos per year. No foraging evidence was recorded, although it is likely that Black-Cockatoos forage within the site as suitable habitat is present and foraging evidence has been recorded nearby. Twelve Carnaby's Black-Cockatoo and one Red-tailed Black-Cockatoo were recorded flying over the site during the survey.

# 1 INTRODUCTION

## 1.1 Overview

Bamford Consulting Ecologists was commissioned by Bayley Environmental Services to conduct a survey for potential nest trees of Black-Cockatoos on proposed development land in Baldivis. The ~38 ha area of land is located at Lots 21, 560 and 1263 Sixty Eight Road, Baldivis. Remnant vegetation, including large trees, is mostly restricted to Lot 21, with some remnant vegetation along the outside boundaries of a disused sand quarry on Lots 569 and 1263. Remnant vegetation comprises ~15 ha of the site. The study objectives were to:

- 1) identify and record the locations of nesting or potential nesting trees for the Carnaby's, Baudin's and Forest Red-tailed Black-Cockatoos (*Calyptorhynchus latirostris*, *C. baudinii* and *C. banksii naso* respectively);
- 2) record the density of additional suitable foraging habitat such as Banksias and estimate flower production of site; and
- 3) search for evidence of foraging by Black-Cockatoos.

## 1.2 Description of the Black-Cockatoos

The Carnaby's Black-Cockatoo and Baudin's Black-Cockatoo are listed as Endangered under the EPBC Act 1999 and the Forest Red-tailed Black-Cockatoo is listed as Vulnerable under the EPBC Act 1999. All three species of cockatoo are listed under Schedule 1 of the Wildlife Conservation Act 1950.

The Carnaby's Black-Cockatoo is restricted to the south-west of Western Australia and occurs throughout the wheatbelt, Swan Coastal Plain and southern coast. While breeding mostly occurs in the wheatbelt, the reduction in suitable habitat has meant that the species now also breeds in the eucalypt forests on the Swan Coastal Plain (DSEWPac 2011). There are small resident populations on the Plain, around Bunbury and "probably at Baldivis" (DSEWPac 2011). It feeds mainly on seeds of eucalypt and other plants, such as Banksia, and on nectar, fruit and insect larvae (DSEWPac 2011). The Baudin's Black-Cockatoo is restricted to the extreme south-

west of Western Australia from Albany to Mundaring, with breeding occurring in the south of their range to as far north as Harvey (DSEWPaC 2011), although with some reports from the Darling Scarp near Perth (WA Museum). It feeds mainly on seeds of eucalypts and other plants, and insect larvae (DSEWPaC 2011). It is unlikely to occur on the coastal plain in the vicinity of the study site, but may be an occasional visitor. The Forest Red-tailed Black-Cockatoo occurs across the south-west from Albany to Perth and has been recorded on the Swan Coastal Plain foraging and breeding (DSEWPaC 2011). It feeds mainly on seeds from Marri and Jarrah fruits (DSEWPaC 2011).

## **2 METHODS**

### **2.1 Potential nesting trees**

The study site was visited on 6<sup>th</sup> June 2011 by Ms Natalia Huang (B.Sc. Hons.) and Mr Cameron Everard (B.Sc.). Nesting or potential nesting trees were recorded by systematically walking through the lots and recording locations of trees with a diameter at breast height (DBH) of at least *ca.*500mm. Information collected on each tree included: GPS coordinates, DBH (mm), species, dead/alive, and presence of hollows or spouts. Evidence of foraging, such as chewed Marri fruit, was recorded where sighted.

### **2.2 Food resource estimate**

Two 25m by 25m quadrats were established to obtain an estimated density of Banksia trees in suitable foraging habitat in the site. All Banksia trees within each quadrat were counted. The number of inflorescences (flower heads) produced in the most recent season was counted for two individuals of each dominant Banksia species (*Banksia attenuata* and *B. menziesii*). This is a common method to provide an indication of this season's production of cones at the site and therefore potential annual food source for Black-Cockatoos.

### 3 RESULTS

#### 3.1 Potential nesting trees

A total of 175 potential nesting trees was recorded on the site, comprising Jarrah (n=49), Marri (n=40) and Tuart (n=85) (approximately 11.7 trees per ha of remnant vegetation). These are indicated on Figure 1; GPS locations and details of each tree are given in Appendix 1. Of these, 41 had obvious hollows and/or spouts. Note that there may have been hollows or spouts present on the remaining trees which were not visible from the ground. The DBH of trees recorded ranged from 500 to 1900mm, with 59 trees of DBH equal to or greater than 1000mm (approximately 34% of total number of trees; see Appendix 1). Several of these trees already represent suitable nest trees due to the presence of large hollows. Potential nest trees were widely distributed across remnant vegetation across the site, with fewer located in the southwest of the site where *Banksia* species were more common (in the area south of the main track on Lot 21 where *Banksia* quadrats were placed; see Figure 1).

#### 3.2 Food resource estimate

The two quadrats sampled for *Banksia* trees were located within the southwest of the site, on Lot 21 (Figure 1). This area represented the only patch of *Banksia* woodland on the site. The dominant *Banksia* species (in order of dominance) were *B. attenuata* and *B. menziesii*, with some individuals of *B. sessilis* present. Each quadrat recorded five and 13 *Banksia* trees respectively; these quadrats were located in what was probably the thickest part of *Banksia* woodland on the site. This translated to an average of 144 trees per ha in this area of *Banksia* woodland. This area of *Banksia* woodland is a small part of the site at approximately 3 ha; condition of the *Banksia* trees ranged from good to degraded with several dead trees present. Throughout the remainder of the site, individual *Banksia* trees were scattered at approximately 7.1 trees per ha of remnant vegetation.

The number of flowers of each *B. attenuata* surveyed was 98 and 68; the number of flowers of each *B. menziesii* surveyed was 30 and 20. As it is sometimes difficult to distinguish flower heads between recent seasons, this number is considered generous. Assuming the amount of food resource in both Banksia species is equal, the average number of flowers in each dominant Banksia species is 54 flowers (and therefore 54 potential cones) per tree.

Cooper *et al.* (2002) calculated that approximately 11 *B. attenuata* cones provide sufficient food to support one Carnaby's Black-Cockatoo for one day (or 4015 cones per year). Within the patch of Banksia woodland at the site, the estimated density of trees is 144 trees/ha and the average annual flower production is 54 flowers/tree. Based on the above assumptions, the site contains a potential food resource for approximately 5.81 cockatoos per year (1.94 cockatoos per ha per year). However, this estimate is considered generous as the quadrats were located in the thickest part of the Banksia woodland.

On the Swan Coastal Plain, *B. attenuata*, *B. menziesii*, Jarrah and Marri are some of the most important native food sources for the Carnaby's Black-Cockatoo (Shah 2006). The blossoms of the Tuart may also be an important food source for the Carnaby's Black-Cockatoo (Shah 2006). It is likely that Black-Cockatoos use the site for foraging, perhaps infrequently, as foraging evidence has been found in several nearby sites in Baldivis (N. Huang, pers. comm.).

### **3.3 Opportunistic observations**

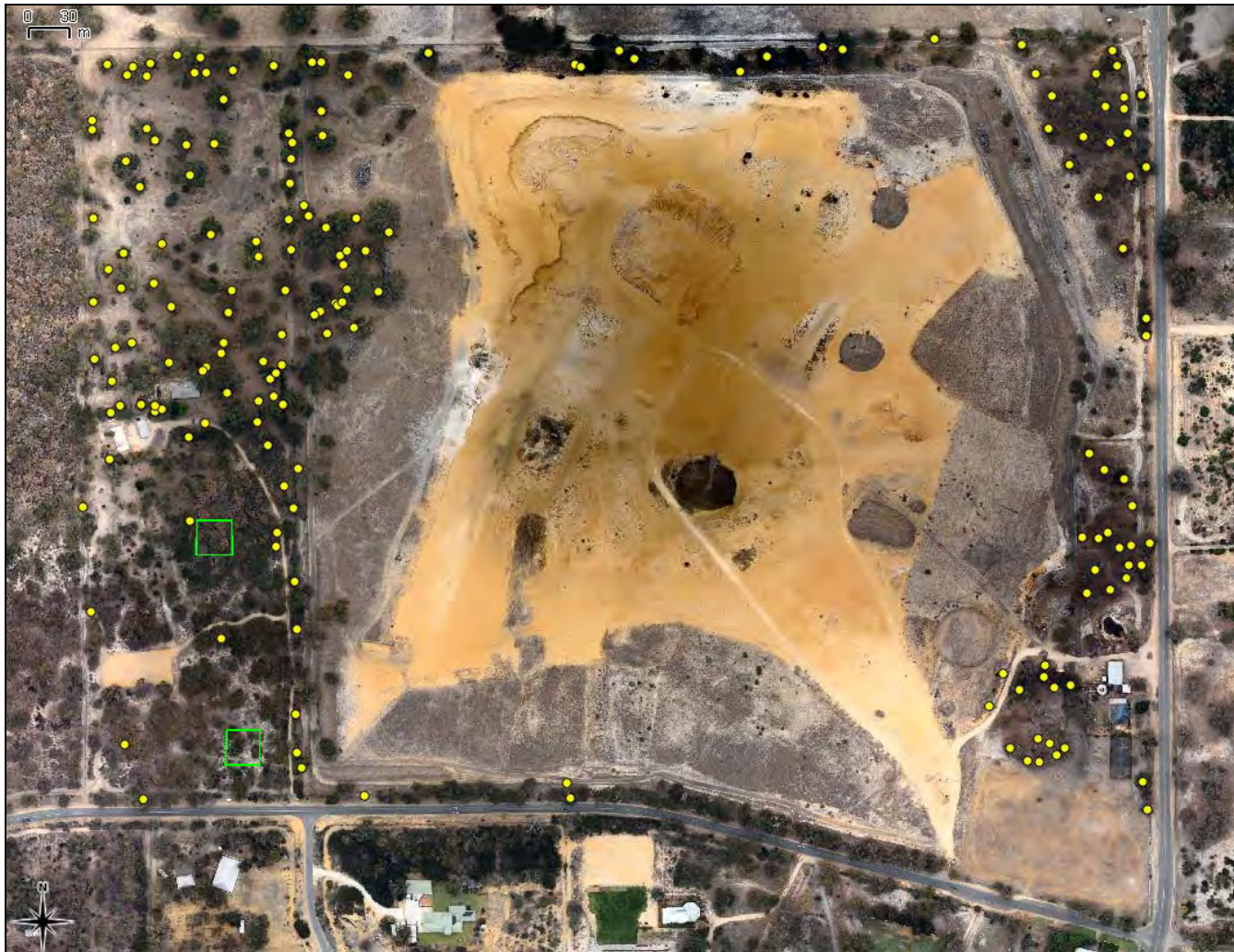
Twelve Carnaby's Black-Cockatoos and one Red-tailed Black-Cockatoo were observed flying overhead during the survey. While no cockatoos were observed foraging in the site, sightings of birds foraging in Banksia trees have been observed in nearby sites in Baldivis (N. Huang, pers. obs.). Other species recorded are common in the area, including the Splendid Fairy-wren, Red Wattlebird, Australian Shelduck, Galah, Australian Ringneck, Laughing Kookaburra, Elegant Parrot, Weebill, Australian Raven and Australian Magpie.

## **4 SUMMARY**

The site contains suitable potential nesting trees for Black-Cockatoos, with the majority of these located on Lot 21 and along the eastern part of the site. Several of these already represent suitable nest trees and may have been used previously, although no evidence of nesting was recorded. The number of potential nesting trees on the Swan Coastal Plain has been declining. In particular, nesting trees within the Baldivis area have declined with recent residential development and remaining potential nesting trees may be important for the conservation of the cockatoos.

The main food resource for Black-Cockatoos on the site was in the southwestern part of the site within a small patch of Banksia woodland. While this patch was recorded as potentially supporting up to 5.8 cockatoos per year, many of the trees were degraded and this number is likely to be lower. Nearby suitable foraging habitat is present in the form of a relatively larger section of Banksia woodland in the private property to the west of Lot 21.





**Figure 1. Location of potential nesting trees recorded at the study site (yellow dots). Banksia quadrats are indicated in green. (QGIS 2011)**

## REFERENCES

- Cooper, C.E., Withers, P.C., Mawson, P.R., Bradshaw, S.D., Prince, J. and Robertson, H. (2002) Metabolic ecology of cockatoos in the south-west of Western Australia. *Australian Journal of Zoology*, **50**, 67-76.
- (DSEWPaC) Department of Sustainability, Environment, Water, Population and Communities (2011). *Calyptorhynchus latirostris*, *C. baudinii* and *C. banksii naso* in Species Profile and Threats Database, Department of Sustainability, Environment, Water, Population and Communities, Canberra. Available from: <http://www.environment.gov.au/sprat>. Accessed Wed, 2 Mar 2011 15:09:49 +1100.
- Shah, B. (2006) *Conservation of Carnaby's Black-Cockatoo on the Swan Coastal Plain, Western Australia* Project Report, Birds Australia Western Australia, Perth.

## APPENDIX

### Appendix 1. Details and GPS coordinates of potential nesting trees recorded at Lots 21, 569 and 1263 Sixty Eight Road, Baldivis.

| No. | Tree sp. | Size (DBH in mm) | Alive/Dead | Hollows/Spouts      | Easting | Northing | Sightings |
|-----|----------|------------------|------------|---------------------|---------|----------|-----------|
| 1   | Tuart    | 630              | Alive      | Nil                 | 389098  | 6419211  |           |
| 2   | Tuart    | 610              | Alive      | Nil                 | 389094  | 6419224  |           |
| 3   | Jarraah  | 830              | Alive      | Nil                 | 389087  | 6419267  |           |
| 4   | Tuart    | 520              | Alive      | Nil                 | 389087  | 6419256  |           |
| 5   | Tuart    | 570              | Alive      | Nil                 | 389105  | 6419272  |           |
| 6   | Tuart    | 640              | Alive      | Nil                 | 389082  | 6419309  |           |
| 7   | Tuart    | 620              | Alive      | Nil                 | 389103  | 6419338  |           |
| 8   | Tuart    | 920              | Alive      | Nil                 | 389107  | 6419355  |           |
| 9   | Tuart    | 1200             | Alive      | hollows, dead limbs | 389080  | 6419367  |           |
| 10  | Tuart    | 690              | Alive      | Nil                 | 389097  | 6419407  |           |
| 11  | Tuart    | 520              | Alive      | Nil                 | 389088  | 6419422  |           |
| 12  | Tuart    | 1115             | Alive      | hollows, dead limbs | 389182  | 6419414  |           |
| 13  | Tuart    | 1270             | Alive      | hollows             | 389212  | 6419419  |           |
| 14  | Tuart    | 700              | Alive      | Nil                 | 389226  | 6419376  | 1 x CaBC  |
| 15  | Tuart    | 610              | Alive      | Nil                 | 389229  | 6419369  |           |
| 16  | Tuart    | 590              | Alive      | Nil                 | 389228  | 6419357  |           |
| 17  | Tuart    | 1100             | Alive      | Nil                 | 389236  | 6419322  |           |
| 18  | Tuart    | 1400             | Alive      | Hollow              | 389228  | 6419291  |           |
| 19  | Jarraah  | 1100             | Alive      | Nil                 | 389224  | 6419261  |           |
| 20  | Tuart    | 950              | Alive      | Nil                 | 389205  | 6419215  |           |
| 21  | Tuart    | 630              | Alive      | Nil                 | 389218  | 6419219  |           |
| 22  | Tuart    | 1400             | Alive      | Several hollows     | 389223  | 6419211  |           |
| 23  | Tuart    | 750              | Alive      | Nil                 | 389213  | 6419196  |           |
| 24  | Tuart    | 540              | Alive      | Nil                 | 389214  | 6419187  |           |
| 25  | Tuart    | 780              | Alive      | Nil                 | 389210  | 6419189  |           |
| 26  | Tuart    | 680              | Alive      | Nil                 | 389222  | 6419178  |           |
| 27  | Jarraah  | 840              | Alive      | Nil                 | 389211  | 6419148  |           |
| 28  | Jarraah  | 820              | Alive      | Nil                 | 389223  | 6419118  |           |
| 29  | Jarraah  | 1300             | Alive      | Nil                 | 389233  | 6419131  |           |
| 30  | Sheoak   | 900              | Alive      | Nil                 | 389222  | 6419101  |           |
| 31  | Jarraah  | 910              | Alive      | Nil                 | 389212  | 6419080  |           |
| 32  | Jarraah  | 850              | Alive      | Nil                 | 389213  | 6419073  |           |

| No. | Tree sp. | Size<br>(DBH in<br>mm) | Alive/Dead | Hollows/Spouts | Easting | Northing | Sightings |
|-----|----------|------------------------|------------|----------------|---------|----------|-----------|
| 33  | Jarrah   | 1300                   | Alive      | Hollow         | 389222  | 6419050  |           |
| 34  | Jarrah   | 1500                   | Alive      | Hollow         | 389228  | 6419014  |           |
| 35  | Jarrah   | 1600                   | Alive      | Hollow         | 389236  | 6418954  |           |
| 36  | Jarrah   | 1200                   | Alive      | Hollows        | 389226  | 6418919  |           |
| 37  | Jarrah   | 660                    | Alive      | Nil            | 389230  | 6418911  |           |
| 38  | Jarrah   | 760                    | Alive      | Nil            | 389106  | 6418929  | 2 x CaBC  |
| 39  | Jarrah   | 900                    | Alive      | Nil            | 389082  | 6419026  | 7 x CaBC  |
| 40  | Tuart    | 1400                   | Alive      | Nil            | 389094  | 6419112  |           |
| 41  | Jarrah   | 1000                   | Alive      | Hollows        | 389114  | 6419134  |           |
| 42  | Jarrah   | 950                    | Dead       | Nil            | 389247  | 6419228  |           |
| 43  | Tuart    | 650                    | Alive      | Nil            | 389274  | 6419234  |           |
| 44  | Tuart    | 800                    | Alive      | Nil            | 389260  | 6419252  |           |
| 45  | Tuart    | 750                    | Alive      | Nil            | 389262  | 6419250  |           |
| 46  | Tuart    | 1400                   | Alive      | Nil            | 389292  | 6419260  |           |
| 47  | Tuart    | 1100                   | Alive      | Nil            | 389268  | 6419285  |           |
| 48  | Tuart    | 850                    | Alive      | Nil            | 389278  | 6419300  |           |
| 49  | Tuart    | 1600                   | Alive      | Hollow         | 389280  | 6419314  |           |
| 50  | Jarrah   | 1500                   | Alive      | Hollows        | 389259  | 6419411  |           |
| 51  | Jarrah   | 700                    | Alive      | Hollow         | 389435  | 6419426  |           |
| 52  | Jarrah   | 650                    | Alive      | Hollow         | 389440  | 6419424  |           |
| 53  | Jarrah   | 800                    | Alive      | Nil            | 389556  | 6419421  |           |
| 54  | Jarrah   | 1200                   | Alive      | Nil            | 389631  | 6419437  |           |
| 55  | Jarrah   | 800                    | Alive      | Nil            | 389785  | 6419442  |           |
| 56  | Marri    | 1000                   | Dying      | Nil            | 389788  | 6419398  |           |
| 57  | Marri    | 900                    | Alive      | Nil            | 389794  | 6419391  |           |
| 58  | Marri    | 600                    | Alive      | Nil            | 389801  | 6419378  |           |
| 59  | Marri    | 700                    | Dead       | Nil            | 389817  | 6419354  |           |
| 60  | Marri    | 700                    | Alive      | Nil            | 389816  | 6419322  |           |
| 61  | Marri    | 1300                   | Alive      | Nil            | 389825  | 6419084  |           |
| 62  | Marri    | 1000                   | Alive      | Nil            | 389816  | 6419075  |           |
| 63  | Marri    | 1400                   | Dead       | Hollows        | 389806  | 6419043  |           |
| 64  | Marri    | 750                    | Alive      | Nil            | 389811  | 6419048  |           |
| 65  | Marri    | 1200                   | Alive      | Nil            | 389820  | 6419040  |           |
| 66  | Marri    | 750                    | Alive      | Nil            | 389849  | 6418888  |           |
| 67  | Jarrah   | 1400                   | Dead       | Nil            | 389429  | 6418901  | 2 x CaBC  |
| 68  | Jarrah   | 1400                   | Alive      | Dead limbs     | 389429  | 6418901  |           |
| 69  | Jarrah   | 800                    | Dead       | Nil            | 389286  | 6418894  |           |

| No. | Tree sp. | Size<br>(DBH in<br>mm) | Alive/Dead | Hollows/Spouts        | Easting | Northing | Sightings |
|-----|----------|------------------------|------------|-----------------------|---------|----------|-----------|
| 70  | Tuart    | 800                    | Alive      | Nil                   | 389113  | 6419172  |           |
| 71  | Tuart    | 800                    | Alive      | Nil                   | 389113  | 6419175  |           |
| 72  | Tuart    | 1000                   | Alive      | Nil                   | 389128  | 6419173  |           |
| 73  | Tuart    | 550                    | Alive      | Nil                   | 389111  | 6419223  |           |
| 74  | Tuart    | 900                    | Alive      | Nil                   | 389113  | 6419217  |           |
| 75  | Tuart    | 550                    | Alive      | Nil                   | 389128  | 6419178  |           |
| 76  | Jarra    | 850                    | Dead       | Nil                   | 389129  | 6419177  |           |
| 77  | Tuart    | 500                    | Alive      | Nil                   | 389129  | 6419177  |           |
| 78  | Tuart    | 550                    | Alive      | Nil                   | 389118  | 6419280  |           |
| 79  | Tuart    | 650                    | Alive      | Nil                   | 389148  | 6419249  |           |
| 80  | Tuart    | 700                    | Alive      | Nil                   | 389130  | 6419277  |           |
| 81  | Tuart    | 1100                   | Alive      | Nil                   | 389134  | 6419295  |           |
| 82  | Tuart    | 650                    | Alive      | Nil                   | 389133  | 6419383  |           |
| 83  | Tuart    | 850                    | Alive      | Nil                   | 389123  | 6419379  |           |
| 84  | Tuart    | 1200                   | Alive      | Spout                 | 389114  | 6419460  |           |
| 85  | Tuart    | 750                    | Alive      | Nil                   | 389112  | 6419446  |           |
| 86  | Tuart    | 700                    | Alive      | Nil                   | 389122  | 6419417  |           |
| 87  | Jarra    | 750                    | Dead       | Spout                 | 389111  | 6419443  |           |
| 88  | Tuart    | 1000                   | Alive      | Spout                 | 389121  | 6419448  |           |
| 89  | Tuart    | 1050                   | Alive      | Nil                   | 389162  | 6419422  |           |
| 90  | Tuart    | 1100                   | Alive      | Spout                 | 389166  | 6419420  |           |
| 91  | Tuart    | 1100                   | Alive      | Spout                 | 389162  | 6419431  |           |
| 92  | Tuart    | 1400                   | Alive      | Nil                   | 389193  | 6419396  |           |
| 93  | Tuart    | 800                    | Alive      | Nil                   | 389152  | 6419367  |           |
| 94  | Tuart    | 1500                   | Alive      | Nil                   | 389172  | 6419368  |           |
| 95  | Tuart    | 700                    | Alive      | Nil                   | 389154  | 6419346  |           |
| 96  | Tuart    | 650                    | Alive      | Nil                   | 389169  | 6419302  |           |
| 97  | Tuart    | 700                    | Alive      | Nil                   | 389202  | 6419296  |           |
| 98  | Tuart    | 1400                   | Alive      | Spout                 | 389204  | 6419286  |           |
| 99  | Jarra    | 750                    | Alive      | Spout                 | 389197  | 6419268  |           |
| 100 | Tuart    | 800                    | Alive      | Nil                   | 389188  | 6419239  |           |
| 101 | Tuart    | 1900                   | Alive      | Hollows and<br>spouts | 389178  | 6419223  |           |
| 102 | Tuart    | 550                    | Alive      | Nil                   | 389141  | 6419214  |           |
| 103 | Tuart    | 1400                   | Alive      | Nil                   | 389177  | 6419215  |           |
| 104 | Tuart    | 900                    | Alive      | Nil                   | 389171  | 6419205  |           |
| 105 | Tuart    | 600                    | Alive      | Nil                   | 389169  | 6419202  |           |
| 106 | Tuart    | 950                    | Alive      | Nil                   | 389182  | 6419186  |           |



| No. | Tree sp. | Size<br>(DBH in<br>mm) | Alive/Dead | Hollows/Spouts | Easting | Northing | Sightings |
|-----|----------|------------------------|------------|----------------|---------|----------|-----------|
| 107 | Tuart    | 600                    | Alive      | Nil            | 389203  | 6419165  |           |
| 108 | Tuart    | 800                    | Alive      | Nil            | 389201  | 6419175  |           |
| 109 | Jarraah  | 600                    | Alive      | Nil            | 389165  | 6419164  |           |
| 110 | Tuart    | 800                    | Alive      | Spout          | 389156  | 6419145  |           |
| 111 | Jarraah  | 900                    | Alive      | Spout          | 389173  | 6418994  |           |
| 112 | Tuart    | 600                    | Alive      | Nil            | 389121  | 6418882  |           |
| 113 | Jarraah  | 750                    | Alive      | Nil            | 389150  | 6419094  |           |
| 114 | Tuart    | 1000                   | Alive      | Nil            | 389250  | 6419246  |           |
| 115 | Tuart    | 850                    | Alive      | Nil            | 389245  | 6419243  |           |
| 116 | Tuart    | 1100                   | Alive      | Nil            | 389265  | 6419252  |           |
| 117 | Tuart    | 550                    | Alive      | Nil            | 389269  | 6419262  |           |
| 118 | Tuart    | 650                    | Alive      | Nil            | 389271  | 6419281  |           |
| 119 | Tuart    | 550                    | Alive      | Nil            | 389269  | 6419290  |           |
| 120 | Tuart    | 650                    | Alive      | Nil            | 389253  | 6419307  |           |
| 121 | Jarraah  | 1500                   | Dead       | Spout          | 389236  | 6419331  |           |
| 122 | Jarraah  | 1200                   | Dead       | Spouts         | 389238  | 6419323  |           |
| 123 | Tuart    | 1000                   | Alive      | Nil            | 389241  | 6419315  |           |
| 124 | Tuart    | 650                    | Alive      | Nil            | 389314  | 6419298  |           |
| 125 | Tuart    | 1200                   | Alive      | Nil            | 389251  | 6419374  |           |
| 126 | Tuart    | 950                    | Dead       | Nil            | 389253  | 6419385  |           |
| 127 | Tuart    | 1000                   | Alive      | Nil            | 389244  | 6419438  |           |
| 128 | Jarraah  | 550                    | Alive      | Nil            | 389261  | 6419432  |           |
| 129 | Jarraah  | 550                    | Alive      | Nil            | 389336  | 6419444  |           |
| 130 | Jarraah  | 1800                   | Alive      | Spouts         | 389471  | 6419445  |           |
| 131 | Jarraah  | 1300                   | Alive      | Spouts         | 389485  | 6419426  |           |
| 132 | Jarraah  | 500                    | Alive      | Nil            | 389578  | 6419441  |           |
| 133 | Jarraah  | 700                    | Alive      | Nil            | 389612  | 6419453  |           |
| 134 | Jarraah  | 750                    | Alive      | Nil            | 389685  | 6419437  |           |
| 135 | Jarraah  | 950                    | Alive      | Spouts         | 389773  | 6419417  |           |
| 136 | Jarraah  | 500                    | Dead       | Spout          | 389842  | 6419438  |           |
| 137 | Marri    | 1100                   | Alive      | Spout          | 389857  | 6419438  |           |
| 138 | Marri    | 600                    | Alive      | Spout          | 389842  | 6419427  |           |
| 139 | Marri    | 600                    | Alive      | Nil            | 389835  | 6419410  |           |
| 140 | Jarraah  | 600                    | Alive      | Nil            | 389835  | 6419405  |           |
| 141 | Marri    | 900                    | Alive      | Spouts         | 389823  | 6419395  |           |
| 142 | Marri    | 550                    | Alive      | Nil            | 389857  | 6419408  |           |
| 143 | Marri    | 700                    | Alive      | Nil            | 389835  | 6419389  |           |
| 144 | Marri    | 700                    | Alive      | Nil            | 389844  | 6419364  |           |

| No. | Tree sp. | Size<br>(DBH in<br>mm) | Alive/Dead | Hollows/Spouts        | Easting | Northing | Sightings |
|-----|----------|------------------------|------------|-----------------------|---------|----------|-----------|
| 145 | Jarrah   | 1500                   | Dead       | Hollows and<br>spouts | 389841  | 6419344  |           |
| 146 | Marri    | 500                    | Alive      | Nil                   | 389860  | 6419331  |           |
| 147 | Tuart    | 800                    | Alive      | Nil                   | 389874  | 6419289  |           |
| 148 | Marri    | 600                    | Alive      | Nil                   | 389883  | 6419250  |           |
| 149 | Tuart    | 600                    | Alive      | Nil                   | 389891  | 6419222  |           |
| 150 | Jarrah   | 1400                   | Dead       | Hollows and<br>spouts | 389856  | 6419110  |           |
| 151 | Marri    | 1000                   | Alive      | Nil                   | 389848  | 6419124  |           |
| 152 | Marri    | 950                    | Alive      | Nil                   | 389869  | 6419125  |           |
| 153 | Marri    | 650                    | Alive      | Nil                   | 389871  | 6419117  |           |
| 154 | Marri    | 800                    | Alive      | Nil                   | 389849  | 6419080  |           |
| 155 | Tuart    | 1300                   | Alive      | Nil                   | 389842  | 6419074  |           |
| 156 | Marri    | 700                    | Alive      | Nil                   | 389833  | 6419073  |           |
| 157 | Marri    | 1200                   | Alive      | Nil                   | 389806  | 6419081  |           |
| 158 | Marri    | 700                    | Alive      | Nil                   | 389850  | 6419061  |           |
| 159 | Marri    | 550                    | Alive      | Nil                   | 389838  | 6419051  |           |
| 160 | Marri    | 550                    | Alive      | Nil                   | 389840  | 6419060  |           |
| 161 | Marri    | 800                    | Alive      | Nil                   | 389847  | 6418913  |           |
| 162 | Marri    | 750                    | Alive      | Nil                   | 389774  | 6418927  |           |
| 163 | Marri    | 550                    | Alive      | Nil                   | 389770  | 6418928  |           |
| 164 | Marri    | 800                    | Alive      | Spout                 | 389774  | 6418922  |           |
| 165 | Marri    | 800                    | Alive      | Nil                   | 389781  | 6418924  |           |
| 166 | Marri    | 800                    | Alive      | Nil                   | 389780  | 6418919  |           |
| 167 | Marri    | 1100                   | Alive      | Nil                   | 389767  | 6418921  |           |
| 168 | Jarrah   | 1200                   | Dead       | Spout                 | 389753  | 6418927  |           |
| 169 | Jarrah   | 1100                   | Dead       | Spout                 | 389762  | 6418976  |           |
| 170 | Marri    | 700                    | Alive      | Nil                   | 389786  | 6418988  |           |
| 171 | Marri    | 1200                   | Alive      | Spouts                | 389778  | 6418979  |           |
| 172 | Marri    | 900                    | Alive      | Spouts                | 389778  | 6418971  |           |
| 173 | Marri    | 1000                   | Alive      | Nil                   | 389700  | 6418962  |           |
| 174 | Jarrah   | 750                    | Alive      | Nil                   | 389709  | 6418969  |           |
| 175 | Jarrah   | 1200                   | Alive      | Nil                   | 389796  | 6418963  | 1xR-tBC   |

# **Appendix E**

**Habitat Tree Survey  
(Bamford, 2012)**



**M.J. & A.R. Bamford**  
**CONSULTING ECOLOGISTS**  
23 Plover Way,  
Kingsley, WA, 6026  
ph: 08 9309 3671 fx: 08 9409 2710  
email: bamford.consulting@iinet.net.au  
ABN 84 926 103 081

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**Summary report for Black-Cockatoo breeding and roosting observations  
at Sixty Eight Road Baldvis**

**5<sup>th</sup> and 7<sup>th</sup> January 2012**

Prepared by N. Huang 13/01/2012

**Introduction**

In June 2011, Bamford Consulting Ecologists (BCE) was commissioned to conduct a survey for potential nest trees of Black-Cockatoos on proposed development land in Baldvis. The ~38 ha area of land is located at Lots 21, 569 and 1263 Sixty Eight Road, Baldvis. The three species of black-cockatoos (Carnaby's, Baudin's and Forest Red-tailed Black-Cockatoo [*Calyptrorhynchus latirostris*, *C. baudinii* and *C. banksii naso* respectively]) are expected to occur within the region and are threatened under state and federal legislation. The study found a total of 175 potential nesting trees (Tuart, Jarrah and Marri) at the site, with 41 of these containing obvious hollows and/or spouts. The potential nesting trees were mostly located on Lot 21 and along the eastern part of the site. Several of these trees had large hollows, although no evidence of nesting was recorded.

Further to the previous study, BCE was requested to revisit the site to determine if breeding was occurring on site this season and whether the site was being used for roosting.

**Methods**

The area was visited on 5<sup>th</sup> and 7<sup>th</sup> January 2012 by Ms. Natalia Huang (B.Sc. Hons.) and Mr. Andrew Moore (B.Sc. M.Sc.). The site was visited from several hours before sunset til after

dusk. All trees were revisited and any hollows or spouts obvious from the ground were examined with binoculars to look for recent chew marks. Looking for recent chew marks around a hollow or spout is a commonly used method to determine whether the hollow or spout has been recently used as a nest. However, this technique has limitations, with some hollows, spouts or chew marks not visible from the ground. It is also possible to find nesting hollows through examining the behaviour by cockatoos (for example, an individual or couple perched outside a hollow). Roosting was determined by observing movements of Black-Cockatoos at dusk. All sightings and movements of Black-Cockatoos were recorded.

## **Results and Discussion**

No hollows or spouts were found that displayed signs of recent breeding on the site, although there were some hollows with what appeared to be old chew marks. No behavioural evidence of breeding by cockatoos was observed. There were, however, several very large trees with numerous suitable hollows and spouts that may have been used as nests previously and possibly with hollows and spouts not visible from the ground. The details of these are provided in Table 1. Breeding has possibly occurred on site previously, however it does not appear breeding has occurred on site this season. It may be beneficial for the very large trees to be retained on site to provide essential breeding habitat for the three species of Black-Cockatoo in the future, in an area where ongoing clearing of such habitat is taking place.

The site did not appear to be a current roosting site for Black-Cockatoos, with no cockatoos observed flying into and remaining on site at dusk. On 5<sup>th</sup> January, a flock of about 25 Carnaby's Black-Cockatoo was observed around 6:45 pm moving through the trees from the southeast corner of the site and through the Marri trees around the house (on the east of the site) before flying off in a north-easterly direction. Extensive signs of foraging throughout the Marri trees, particularly those around the house, suggest these trees may be important foraging habitat for the cockatoos. A report from the tenant says she hears cockatoos daily and sees them feeding regularly in trees around the house (Sue, pers. comm.).



On the same evening, a flock of Forest Red-tailed Black-Cockatoo was heard foraging in eucalypt trees in the block to the north of the site (<500 m from the boundary). Between 6 pm to 7:30 pm, a total of approximately six parties of two to three individuals flew intermittently from this location over the site (across Lot 21) in a south-westerly direction. On the second survey evening, there were two parties of three individuals of the Forest Red-tailed Black-Cockatoo flying over the site in the same trajectory towards the southwest. It is likely there is a roosting site for this species to the southwest of the site. A Carnaby's Black-Cockatoo was heard calling to the south of the site on the second evening but no individuals of this species were observed that evening.

Other species observed were common and included the Western Gerygone, Red-capped Parrots, Galah, Weebill, Australian Ringneck, Black-faced Cuckoo-shrike, Rainbow Bee-eater, Whistling Kite, Splendid Fairy-wren, Australian Raven and Crested Pigeon. Nests of what are believed to be of the Whistling Kite were recorded in several Tuart trees on Lot 21. The Whistling Kite was heard on both evenings and is likely to be utilising the nests at present. Diggings of the goanna *Varanus gouldii* were observed. Two species of frog (adults and tadpoles) were recorded in the swimming pool at the abandoned house on Lot 21: Motorbike Frog *Litoria moorei* and Pobblebonk Frog *Limnodynastes dorsalis*.

## **Summary**

Breeding by the Black-Cockatoos did not appear to take place on the site this season, although it may have occurred in previous years. Retention of some very large trees with suitable hollows and spouts may provide important breeding opportunities for Black-Cockatoos in the future, particularly in an area where such habitat is declining rapidly. The site did not appear to be a current roosting site for the Black-Cockatoos, although it may have been used previously. The site is currently being used for foraging by at least the Carnaby's Black-Cockatoo and probably the Forest Red-tailed Black-Cockatoo.

**Table 1. Details of trees considered suitable for breeding.**

Extract from previous report (BCE 2011). These trees may also be suitable foraging habitat. Those indicated in bold are considered particularly suitable as they are very large and contain numerous hollows and spouts.

| No.        | Tree sp.       | Size (DBH in mm) | Alive/Dead   | Hollows/Spouts             | Easting       | Northing       |
|------------|----------------|------------------|--------------|----------------------------|---------------|----------------|
| <b>9</b>   | <b>Tuart</b>   | <b>1200</b>      | <b>Alive</b> | <b>hollows, dead limbs</b> | <b>389080</b> | <b>6419367</b> |
| 12         | Tuart          | 1115             | Alive        | hollows, dead limbs        | 389182        | 6419414        |
| 13         | Tuart          | 1270             | Alive        | hollows                    | 389212        | 6419419        |
| <b>18</b>  | <b>Tuart</b>   | <b>1400</b>      | <b>Alive</b> | <b>Hollow</b>              | <b>389228</b> | <b>6419291</b> |
| <b>22</b>  | <b>Tuart</b>   | <b>1400</b>      | <b>Alive</b> | <b>Several hollows</b>     | <b>389223</b> | <b>6419211</b> |
| 33         | Jarraah        | 1300             | Alive        | Hollow                     | 389222        | 6419050        |
| 34         | Jarraah        | 1500             | Alive        | Hollow                     | 389228        | 6419014        |
| 35         | Jarraah        | 1600             | Alive        | Hollow                     | 389236        | 6418954        |
| 36         | Jarraah        | 1200             | Alive        | Hollows                    | 389226        | 6418919        |
| <b>41</b>  | <b>Jarraah</b> | <b>1000</b>      | <b>Alive</b> | <b>Hollows</b>             | <b>389114</b> | <b>6419134</b> |
| 49         | Tuart          | 1600             | Alive        | Hollow                     | 389280        | 6419314        |
| 50         | Jarraah        | 1500             | Alive        | Hollows                    | 389259        | 6419411        |
| 63         | Marri          | 1400             | Dead         | Hollows                    | 389806        | 6419043        |
| 84         | Tuart          | 1200             | Alive        | Spout                      | 389114        | 6419460        |
| 88         | Tuart          | 1000             | Alive        | Spout                      | 389121        | 6419448        |
| 90         | Tuart          | 1100             | Alive        | Spout                      | 389166        | 6419420        |
| 91         | Tuart          | 1100             | Alive        | Spout                      | 389162        | 6419431        |
| <b>101</b> | <b>Tuart</b>   | <b>1900</b>      | <b>Alive</b> | <b>Hollows and spouts</b>  | <b>389178</b> | <b>6419223</b> |
| 121        | Jarraah        | 1500             | Dead         | Spout                      | 389236        | 6419331        |
| 122        | Jarraah        | 1200             | Dead         | Spouts                     | 389238        | 6419323        |
| 130        | Jarraah        | 1800             | Alive        | Spouts                     | 389471        | 6419445        |
| 131        | Jarraah        | 1300             | Alive        | Spouts                     | 389485        | 6419426        |
| 137        | Marri          | 1100             | Alive        | Spout                      | 389857        | 6419438        |
| 145        | Jarraah        | 1500             | Dead         | Hollows and spouts         | 389841        | 6419344        |
| 150        | Jarraah        | 1400             | Dead         | Hollows and spouts         | 389856        | 6419110        |
| 168        | Jarraah        | 1200             | Dead         | Spout                      | 389753        | 6418927        |
| 169        | Jarraah        | 1100             | Dead         | Spout                      | 389762        | 6418976        |
| 171        | Marri          | 1200             | Alive        | Spouts                     | 389778        | 6418979        |

**Reference**

Bamford Consulting Ecologists (BCE) (2011). Black-Cockatoo Nest Tree Survey, Sixty Eight Road, Baldivis, June 2011. Unpublished report to Bayley Environmental Services by BCE, Kingsley.

# **Appendix F**

## **DSEWPC Advice**



Mr Andrew Auret  
ABN Consolidated Holdings Pty Ltd  
General Manager (Developments)  
PO Box 389  
OSBORNE PARK WA 6916

Dear Mr Auret

**Decision on referral**

**Sand Mining and Residential Development Lots 569, 1263 Baldivis Road and Lot 21, Sixty Eight Road, Baldivis, WA (EPBC no 2012/6526).**

Thank you for submitting a referral under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This is to advise you of my decision about the proposed action to expand sand mining activities and construct a residential development on Lots 569, 1263 Baldivis Road and Lot 21, Sixty Eight Road, Baldivis, Western Australia.

**As a delegate of the Minister for Sustainability, Environment, Water, Population and Communities, I have decided that the proposed action is not a controlled action. This means that the proposed action does not require further assessment and approval under the EPBC Act before it can proceed.**

A copy of the document recording this decision is enclosed. This document will be published on the department's website.

Please note that this decision relates only to the specific matters protected under Chapter 2 of the EPBC Act.

This decision does not affect any requirement for separate state or local government environment assessment and approvals of the proposed action.

The department has an active audit program for proposals that have been referred under the EPBC Act. The audit program aims to ensure that proposals are implemented as planned. Please note that your project may be selected for audit by the department at any time and all related records and documents may be subject to scrutiny. Information about the department's compliance monitoring and auditing program is enclosed.

I have written separately to Mr Anthony Sutton, Director Assessment Compliance Services, Office of the Environmental Protection Authority, advising him of this decision.

If you have any questions about the referral process or this decision, please contact the project manager, Matt Barwick, by email to [matt.barwick@environment.gov.au](mailto:matt.barwick@environment.gov.au), or telephone 02 6274 2332 and quote the EPBC reference number shown at the beginning of this letter.

Yours sincerely

A handwritten signature in black ink, appearing to be 'BA' followed by a stylized flourish.

Barbara Jones  
Assistant Secretary  
North, West & Offshore Assessment Branch

26 September 2012

cc. Mr Paul van der Moezel  
Managing Director  
PGV Environmental



# **Appendix G**

## **Serpentine-Jarrahdale Landcare Correspondence Regarding Cockatubes**

## Phil Bayley

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**From:** Francis Smit [francis@landcaresj.com.au]  
**Sent:** Wednesday, 12 March 2014 5:18 PM  
**To:** 'Mitch Whalan'; 'Phil Bayley'  
**Subject:** Cockatube Installation  
**Attachments:** Rockingham Lakes Regional Park - Cockatubes.xlsx

Hi Phil and Mitch,

Cockatube installation completed yesterday.  
Data attached.  
Invoice to follow.  
Special thanks Phil for your map and support.  
Always happy to oblige.

Kind regards,  
Francis Smit

Executive Officer  
Landcare SJ Inc.  
P.O. Box 41, Mundijong WA 6123  
tel: 08 9526 0012  
fax: 08 9526 0653  
e: [francis@landcaresj.com.au](mailto:francis@landcaresj.com.au)

**Landcare SJ Inc.**  
**Cockatube Installation - Rockingham**  
**ABN Group/Bayley Environmental Services**

| Tube # | Length (cm) | Internal<br>Diameter (cm) | Estimated<br>Height (m) | GPS co-ordinates       |
|--------|-------------|---------------------------|-------------------------|------------------------|
| 1      | 140         | 40                        | 10                      | 50H0385262<br>6424614  |
| 2      | 132         | 33                        | 7                       | 50H0385272<br>6424645  |
| 3      | 114         | 37                        | 7                       | 50H0385292<br>6424638  |
| 4      | 96          | 40                        | 11                      | 50H0385321<br>6424517  |
| 5      | 101         | 40                        | 8                       | 50H0385315<br>6424532  |
| 6      | 127         | 32                        | 8                       | 50H0385217<br>6424624  |
| 7      | 124         | 40                        | 7                       | 50H03852365<br>6424634 |
| 8      | 131         | 40                        | 9                       | 50H0385163<br>6424438  |
| 9      | 142         | 40                        | 10                      | 50H0385172<br>642444   |
| 10     | 108         | 37                        | 8                       | 50H0385176<br>6424436  |



