# MORAWA PROPOSED ACCOMMODATION CAMP

# FLORA AND VEGETATION ASSESSMENT

*Prepared for*

KARARA MINING LIMITED

**Job 08.343**

**Report RP002**

Australia

# MORAWA PROPOSED ACCOMMODATION CAMP

# FLORA AND VEGETATION ASSESSMENT

*Prepared for*

KARARA MINING LIMITED

*Prepared by*

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# EXECUTIVE SUMMARY

ENV.Australia Pty Ltd was commissioned in October 2008 to undertake a flora and vegetation assessment of a site in Morawa, Western Australia, proposed for development as an accommodation camp. The site encompassed Lots 501, 502 and 504 on White Avenue, Morawa. The survey took place on 29 October 2008, with four person-days invested.

Thirteen quadrats were surveyed, and 71 flora taxa were recorded.

No Endangered or Vulnerable species under the *Environment Protection and Biodiversity Conservation Act 1999*, Declared Rare Flora species under the *Wildlife Conservation Act 1950*, or Priority species were recorded during the survey.

Five introduced species were recorded during the survey. One taxon, **Echium plantagineum* (Paterson's Curse), is Declared under the *Agriculture and Related Resources Protection Act 1976* as a weed species requiring management, and was well-established in the project area.

Four vegetation communities, two rehabilitated and two remnant, were mapped by ENV.Australia Pty Ltd within the project area. The largest community was a rehabilitated area: *Eucalyptus loxophleba* subsp. *supralaevis* low woodland over *Acacia ligulata / A. nigripilosa* subsp. *nigripilosa* open shrubland over *Maireana georgei* / *Enchylaena tomentosa* subsp. t*omentosa* / *Chenopodium gaudichaudianum* / *Rhagodia* sp. Watheroo open low heath. Across the two remnant vegetation types, vegetation condition ranged from Very Good to Very Poor. No communities listed as Threatened Ecological Communities or Priority Ecological Communities were recorded during the survey.

The regional vegetation association $E_6$Mi remains at only 15% of its pre-European settlement distribution, and Vegetation Type C described by ENV in the project area is considered representative of this vegetation association. The Environmental Protection Authority has set a target of 30% retention of the pre-European distribution of vegetation associations. Impact of the proposed Accommodation Camp on regional vegetation associations can be reduced if ENV Vegetation Type C is retained. Secondary impacts associated with the development include the risk of the introduction and spread of introduced species and an increase in dust.

No species or communities of conservation significance were recorded in the Accommodation Camp project area. However, Vegetation Type C is below the 30% retention threshold set by the Environmental Protection Authority and may be at variance with the related principle for the clearing of native vegetation.

# 1 INTRODUCTION

ENV.Australia Pty Ltd ('ENV') was commissioned in October 2008 to undertake a flora and vegetation assessment survey of Lots 501, 502 and 504 on White Avenue, Morawa, Western Australia ('the project area'). The survey was undertaken to provide information for environmental approval purposes.

The objectives of the flora and vegetation assessment were to:

- document all plant species in the project area;
- document and describe all plant species of conservation significance in the project area;
- document and describe the vegetation associations in the project area;
- describe the conservation significance of vegetation associations in the project area; and
- discuss the findings of the field survey in the context of the proposed development, and provide relevant recommendations.

## 1.1 LOCATION & PHYSICAL ENVIRONMENT

### Location

The project area is in the western section of Morawa Township, approximately 90 km south-east of Geraldton (Figure 1). The project area includes all of Lots 501, 502 and 504 on White Avenue, Morawa, and is approximately 38 ha in size. The project area comprises a rehabilitated area of approximately 22 ha and remnant native vegetation covering approximately 16 ha.

### Climate

The Morawa region has a dry warm mediterranean climate, with seven to eight dry months per year (Figure 2). The area experiences a wide range of temperatures throughout the year, with an average temperature of 27.4°C. During summer, maximum temperatures may reach 36.7°C, whilst in winter, minimum temperatures may reach 6.2°C (Bureau of Meteorology 2008).

### Geology and Landforms

The project area comprised a sand plain landform. Baxter & Lipple (1985) mapped the geology of the area as consisting of one unit:

Czc: Alluvial and colluvial deposits – transported clay, sand, lithic fragments; may be indurated.

## 1.2 BIOLOGICAL ENVIRONMENT

### IBRA

The Interim Biogeographic Regionalisation for Australia (IBRA) divides Australia into 85 bioregions based on major biological and geographical/geological attributes (Thackway & Cresswell 1995). These bioregions are subdivided into 404 subregions, as part of a refinement of the IBRA framework (Department of Environment, Water, Heritage & the Arts ('DEWHA') 2008).

The project area is in the Avon Wheatbelt bioregion and Ancient drainage subregion (Thackway & Cresswell 1995). Typically, the bioregion consists of proteaceous scrub-heaths, rich in endemics, on residual lateritic uplands and mixed eucalypt, *Allocasuarina huegeliana* and Jam-York Gum woodlands on Quaternary alluvials. The subregion is an ancient peneplain with low relief on a gently undulating landscape (Beecham 2001).

### Beard Mapping

The Accommodation Camp project area is in the Avon Botanical District, which forms part of the Wheatbelt Region in the Southwest Botanical Province of Western Australia, as per Beard (1990). The project area is in relatively close proximity to the boundary of the Eremaean and Southwest Botanical Districts. Beard (1975) mapped the survey area as comprising the following vegetation association:

$E_6$Mi: Sclerophyll Woodland; York gum (*Eucalyptus loxophleba)*.

Shepherd *et al*. (2002) give an estimate of the percentage of each of Beard's vegetation associations that remains compared to its pre-European settlement extent, so an estimate of the scarcity of each association can be determined. For the Beard vegetation association of the project area, $E_6$Mi, it is estimated that 15.2% of its pre-European settlement extent remains.

### Vegetation of Regional Significance

Current EPA guidance recommends a standard level of native vegetation retention of at least 30% of each ecological community, based on its pre-European settlement extent in the State. Below this threshold level, species loss is known to accelerate exponentially at an ecosystem level (EPA 2000). These levels have been documented in the *National Objectives and Targets for Biodiversity Conservation 2001-2005* (Commonwealth of Australia 2001), which recognises that the retention of 30% or more of the pre-European settlement extent of each ecological community is generally necessary if Australia's biological diversity is to be protected. The Beard association $E_6$Mi, which is mapped for the Morawa area, is estimated to be retained at 15.2% of its pre-

European settlement extent, i.e. at less than 30% of the retention rate recommended for Western Australia by the EPA's Position Statement No. 2 (EPA 2000). This is considered a constraint to clearing with regard to the regional significance of the vegetation complex present.

**Previous Flora & Vegetation Surveys**

In recent years several surveys have been commissioned in the vicinity (< 50 km) of the Morawa Township. These include;

- **Flora and Vegetation Assessment of the Proposed Linear Infrastructure Corridor – Proposed Karara Iron Ore Project (Woodman Environmental 2008a);**

Woodman Environmental was commissioned by Karara Mining Limited to conduct a Level Two survey of the proposed 100 km Linear Infrastructure Corridor from Karara Station to Lochada Road to intersect with the existing Oxiana Golden Grove transmission line. The transmission line crosses from the Eremaean Botanical Province in the east to the Southwest Botanical District in the west. The project area was traversed between October 2006 and July 2007, during which 15 vegetation communities were mapped and three priority flora species were located.

- **Tilley Siding Mining Proposal Rare and Priority Flora Survey (*ecologia* Environment 2007**);

*ecologia* Environment was commissioned by Midwest Corporation Limited to conduct a Declared rare and Priority flora search at Tilley Siding, located adjacent to the northern boundary of Morawa Township. The project area, approximately 105 ha in size, was traversed on foot on 28 September 2006, and no Declared Rare or Priority flora was located.

- **Vegetation and Flora Assessment, Koolanooka (ATA Environmental 2004)**;

ATA Environmental was commissioned by Midwest Corporation Limited to conduct a Level Two flora and vegetation assessment. The project area was 6400 ha in size and located 21 km east of Morawa, on the Koolanooka Hills. In October 2003 non-permanent transects, to 50 m in length, were traversed through each major vegetation type. Thirty-one vegetation types were mapped during the survey. No Declared Rare flora were recorded, but four Priority flora species were located during the survey.

- **Flora and Vegetation, Blue Hills (Bennett Environmental Consulting 2004).**

Bennett Environmental Consulting was commissioned by ATA Environmental to conduct a Level Two flora and vegetation assessment of the Blue Hills at Karara Station. The project area was located on the boundary of the Eremaean and Southwest Botanical Districts, and consisted of banded ironstone formation hills. Flora information from 29 quadrats and 13 relévés was collected from 20-24 October 2003. Fourteen vegetation types, no Declared Rare flora and two Priority flora species were located during the survey.

Other surveys in the regional area (>50 km) include;

- Karara-Mungada Flora and Vegetation Survey (Woodman Environmental 2008b); and
- Cumulative Impact Flora and Vegetation Assessment (Woodman Environmental 2008c).

These surveys, however, were conducted in the Eremaean Botanical Province, and therefore are unsuitable for direct comparison to the results of the current survey, which was in the Southwest Botanical Province.

# 2 METHODOLOGY

## 2.1 BACKGROUND TO SURVEY METHODOLOGY

All surveys undertaken by ENV are designed to meet the requirements of the following State and Federal legislation:

- *Environmental Protection Act 1986* (WA) (EP Act 1986);
- *Wildlife Conservation Act 1950* (WA) (WC Act 1950); and
- *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act 1999).

The survey was carried out in a manner designed to be compliant with the Environmental Protection Authority (EPA) requirements for the environmental surveying and reporting for flora and vegetation in Western Australia, as set out in the following documents:

- *Environmental Protection of Native Vegetation in Western Australia: Clearing of Native Vegetation with Particular Reference to Agricultural Areas. Position Statement No. 2* (EPA 2000);
- *Terrestrial Biological Surveys as an Element of Biodiversity Protection. Position Statement No. 3* (EPA 2002); and
- *EPA Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia No. 51* (EPA 2004).

The EPA Guidance Statement No. 51 (EPA 2004) outlines the expectations of the EPA and details the extent, design and intensity of field surveys for environmental assessments. Two formal levels of flora survey are defined by the EPA Guidance Statement No. 51:

- *Level One:* a 'desktop' study to collate historical knowledge conducted in conjunction with a reconnaissance survey (site inspection).
- *Level Two:* an intensive survey that incorporates a detailed and comprehensive survey to characterise the flora present, combined with a Level One survey.

The Guidance Statement states that where a project area in the Avon Wheatbelt bioregion is of more than 1 ha and disturbance is considered to be significant, a Level Two survey will be required. This is typically the case for most resource development projects. As a high level of disturbance to flora and vegetation (i.e.

clearing) is likely to be caused by the developments proposed by Karara Mining Limited, a Level Two survey was developed.

## 2.2 PROTECTION OF FLORA AND VEGETATION

Flora species are protected formally and informally by various legislative and non-legislative measures, which are as follows:

***Legislative Protection***

*EPBC Act 1999*:

- Threatened Flora Species; and
- Threatened Ecological Communities (TECs).

*WC Act 1950*:

- Declared Rare Flora (DRF) species.

*EP Act 1986*:

- offers protection to DRF species, TECs and other environmentally sensitive areas.

***Non-Legislative Protection***

Department of Environment and Conservation (DEC) Priority lists:

- Priority Flora species; and
- Priority Ecological Communities.

Informal recognition of locally significant populations:

- endemic species;
- range extensions; and
- previously undescribed taxa.

Conservation categories and definitions are presented in Appendix A for Declared Rare and Priority Flora species and Threatened and Priority Ecological Communities.

## 2.3 INTRODUCED SPECIES

The Environmental Weed Strategy for Western Australia (Department of Conservation and Land Management 1999) contains criteria for the assessment

and ranking of weeds in terms of their environmental impact on biodiversity. The Strategy defines environmental weeds as 'plants that establish themselves in natural ecosystems and proceed to modify natural processes, usually adversely, resulting in the decline of the communities they invade.'

Plants may also be 'Declared' by the Agriculture Protection Board under the *Agriculture and Related Resources Protection Act 1979* (WA) (ARRP Act). Declared Plants are gazetted under five categories (P1-P5), which define the action required. Details of the definitions of these categories are provided in Appendix B. A declaration may apply to the whole State, to districts, individual properties or even to single paddocks. If a plant is Declared, landholders are obliged to control that plant on their properties (Department of Agriculture and Food ('DAFWA') 2007).

## 2.4 SURVEY METHODOLOGY

### Desktop Review

The purpose of a desktop review is to gather background information on the project area and the flora species and vegetation it may support. This involves a search of literature, data, aerial photographs and maps for information pertaining to landforms likely to be found in the area.

A request for a database search was submitted to the DEC to ascertain whether any Declared Rare or Priority species have been recorded within the survey site and surrounding areas. A similar process was followed to establish whether there were any recorded Threatened or Priority Ecological Communities in the area. In addition, a review of literature was conducted along with a review of historical and current records of flora species for the project area. Collectively, these sources were used to compile a list of expected Declared Rare or Priority species, and Threatened or Priority Ecological Communities that could plausibly occur in the project area.

### Field Survey

The field survey took place on 29 October 2008, with four person-days invested. Thirteen quadrats, five in the native remnants and eight in the rehabilitated areas, were surveyed using 20 m x 20 m quadrats oriented cardinally (east-north-west-south). A GPS location and a photograph were taken for each quadrat from the north-west corner (Woodman Environmental methodology, D. Woodman, pers. comm.). Quadrats were positioned to be representative of the flora and vegetation of the project area. Relevés[1] and opportunistic collections were also

[1] For the purposes of this flora and vegetation assessment, a ***relevé*** is defined as an unconfined survey area in which a general statement about the floristic composition of the location can be made.

conducted where appropriate. For areas in which a 20 m x 20 m quadrat was inappropriate, (for example a drainage line 5 m wide), suitable quadrat dimensions were used whilst maintaining the same total search area.

The locations of the 13 quadrats from the survey are presented in Appendix C and Figure 3. Site photographs are presented in Appendix D.

Data was recorded at all sites using standardised field sheets. The information noted at each site included landscape features, soils, bare ground and disturbance levels. Vegetation condition was described using Trudgen's 2002 scale (Woodman Environmental methodology, D. Woodman pers. comm.; Appendix E). Each species of plant at each site was recorded, including information on height and percentage cover (data sheets are presented in Appendix F). The opportunistic collections and relevés focussed mainly on the location of new flora taxa not recorded in the quadrats, and in particular on Declared Rare and Priority Flora, and flora not well known.

**Taxonomic Identification**

Where field identification of plant taxa was not possible, specimens were collected systematically for later identification by expert taxonomists utilising the resources of the Western Australian Herbarium ('WAH'). Species were identified through comparison with the reference collection and the use of identification keys.

The project species list was checked against FloraBase (WAH 2008) and Atkins (2008) Declared Rare and Priority Flora list to determine whether any of the species were listed as Rare or Priority species. Species were also checked against the EPBC Act 1999 listing of Threatened species to determine whether any were federally listed (DEWHA 2007).

**Vegetation Association Mapping**

Quadrat vegetation descriptions were used to delineate vegetation associations in the project area. These vegetation associations were then mapped using notes and maps created in the field. Once the vegetation associations were determined they were also checked against the listings of State and Commonwealth Threatened or Priority Ecological Communities. Vegetation unit descriptions were then tabulated, and these communities were mapped. Floristic communities were inferred from those available in Shepherd *et al.* (2002) on the basis of species composition.

## 2.5 PERMITS

Specimens collected during the survey were taken by permit of and subject to the conditions of the following licences issued under sections 23C and 23F of the WC Act 1950:

- SL008008 to Rebecca McIntyre;
- SL008250 to Brett Neasham;
- SL008014 to Elaine Chua; and
- SL008269 to Dale Broun.

# 3 FLORA SURVEY LIMITATIONS AND CONSTRAINTS

It is important to note the specific constraints imposed on individual surveys. Constraints are often difficult to predict, as is the extent to which they influence survey outcomes. Survey constraints of the flora and vegetation survey are detailed in Table 1.

**Table 1:** Limitations and Constraints Associated with the Flora and Vegetation Survey

| Variable | Impact on Survey Outcomes |
|---|---|
| Access Problems | All areas were accessible. |
| Experience levels | The biologists who executed these surveys and completed related taxonomy and reporting were practitioners suitably qualified in their respective fields:<br>• Ms Rebecca McIntyre – Senior Botanist / Environmental Scientist<br>• Mr Brett Neasham – Senior Botanist / Taxonomist<br>• Mr Dale Broun – Environmental Biologist<br>• Ms Elaine Chua – Environmental Biologist |
| Timing[2], weather, season. | The spring survey was undertaken on 29 October 2008. During the three months preceding the survey (July-September) the area received 126.4 mm of rainfall, which is slightly higher than the long-term average (115.7 mm) for these months (Bureau of Meteorology 2008).<br>Flora composition changes over time, with flora species having specific growing periods, especially annuals and ephemerals (some plants lasting for a markedly brief time, some only a day or two). Therefore the results of future botanical surveys in this location may differ from the results of this survey. |
| Completeness | The adequate level of rainfall meant that most species likely to be present would be in flower and available for sampling.<br>Species with insufficient material to be identified or those which were dead were either not collected or, where possible, were identified in the field to genus or family level only.<br>A comprehensive species list has not been prepared for areas that do not constitute a natural vegetation area, such as areas that have been totally |

[2] EPA Guidance Statement 51 (2004) stipulates that flora and vegetation surveys should be undertaken following the season that contributes the greatest rainfall in the region. In the Northern Wheat belt region this is spring.

| Variable | Impact on Survey Outcomes |
|---|---|
| | cleared. |
| Determination | The taxonomy and conservation status of the Western Australian flora are dynamic. This report was prepared in reliance on taxonomy and conservation status current at the time of preparation, but it should be noted this may change. |

# 4 RESULTS

## 4.1 DESKTOP REVIEW

A database search and desktop review of the area identified 66 flora species of conservation significance as potentially occurring in the project area. Six species were listed as Endangered and three species listed as Vulnerable under the EPBC Act. These species are also DRF under the WC Act. A further two DRF taxa also potentially occur, as well as 55 Priority Flora species. The List of conservation significant species potentially occurring in the project area is presented in Appendix A.

The desktop review determined that three TECs are known to occur in the vicinity of the project area. These communities are presented in Appendix A.

## 4.2 FIELD SURVEY

### 4.2.1 Flora

A total of 71 taxa (including species, subspecies and variants) were identified in the Accommodation Camp project area during the survey. These 71 taxa represented 27 families and 46 genera (refer to Appendix G for the flora species inventory).

The plant families most frequently recorded from the survey were:

- Chenopodiaceae (10 taxa);
- Mimosaceae (8 taxa); and
- Myrtaceae (8 taxa).

The most frequently recorded genera from the survey were:

- *Acacia* (8 taxa);
- *Ptilotus* (4 taxa) and
- *Rhagodia* (3 taxa).

The most common taxon recorded in the survey was *Waitzia acuminata*, which was recorded at 10 of the 13 sites, followed by *Solanum lasiophyllum*, which was recorded at nine sites. The flora species matrix is presented in Appendix H.

### 4.2.2 Protected Flora

No Endangered or Vulnerable species pursuant to the EPBC Act 1999 were located during the survey.

No plant taxa gazetted as Declared Rare pursuant to the WC Act 1950 were located in the survey area.

No plant taxa Listed as Priority Flora by the DEC were located in the survey area.

### 4.2.3 Locally Significant Flora

No plant taxa considered of local significance were located in the survey area.

### 4.2.4 Introduced Flora

Five introduced species were recorded within the Accommodation Camp project. The introduced species identified during the field surveys, with their ratings and criteria according to the Environmental Weed Strategy for Western Australia (CALM 1999) detailed in Table 2. Eleven sites contained introduced species, with the locations of these introduced species presented in Appendix I.

**Table 2:** Introduced Flora Species Recorded During the Survey

| Taxon | Common Name | Criteria | | | | Number of Sites |
|---|---|---|---|---|---|---|
| | | Rating | Invasiveness | Distribution | Impacts | |
| **Avena fatua* | Wild Oat | Moderate | Yes | Yes | - | 1 |
| **Sonchus oleraceus* | Common Sowthistle | Moderate | Yes | Yes | - | 3 |
| ** Mesembryanthemum nodiflorum* | Slender Iceplant | Mild | - | Yes | - | 8 |
| **Echium plantagineum* | Paterson's Curse | To be Announced | Yes | - | Yes | 6 |
| **Raphanus* sp. | - | Not Listed | - | - | - | 1 |

Pursuant to Section 37 of the *Agriculture and Related Resources Protection Act 1976* (WA), the Agriculture Protection Board lists the classes of plants that are subject to a declaration made under Section 35 of the Act. One plant taxon recorded, **Echium plantagineum*, is listed as a Declared Plant by DAFWA.

### 4.2.5 Vegetation

Four vegetation communities were mapped by ENV within the project area. The descriptions of these vegetation communities, example sites and vegetation condition are presented in Table 3 and are mapped in Figure 4. Two of the ENV vegetation communities represented native remnants and two represented rehabilitated communities.

One of the ENV native remnant vegetation communities broadly corresponds to a Shepherd *et al.* (2002) vegetation type;

- ENV Vegetation Type C corresponding with Shepherd *et al.* vegetation type # 949 (Eucalyptus woodland / Acacia mixed open shrubland).

The second ENV native remnant vegetation community, Vegetation Type B, did not correspond to any Shepherd *et al.* (2002) vegetation types. This vegetation community was of Very Poor condition and lacked upper storey species.

The ENV Vegetation Types D and E were not compared to Shepherd *et al.* (2002) vegetation types, as they represent rehabilitated areas.

**Table 3:** Vegetation Communities Recorded

| Vegetation community | Vegetation description | Sites | Average Condition |
|---|---|---|---|
| Vegetation Type B (Native Remnant) | *Solanum lasiophyllum* / *Ptilotus polystachyus* subsp. *polystachyus* open low heath, over *Austrostipa* sp. / *Aristida contorta* grassland | GA27 | Very Poor |
| Vegetation Type C (Native Remnant) | *Melaleuca stereophloia* low woodland over *Acacia acuminata / A. longiphyllodinea* open shrubland over *Waitzia acuminata / Schoenia cassiniana / Dianella divaricata* var. *revoluta* herbland | GA21, GA22, GA29 | Very Good |
| Vegetation Type D (Rehabilitated) | *Eucalyptus loxophleba* subsp. *supralaevis* / *Allocasuarina huegeliana* low open woodland over *Acacia acuminata* / *A. nigripilosa* subsp. *nigripilosa* tall open shrubland over *Schoenia cassiniana* / mixed herbland | GA24, GA25, GBB14, GBB15 | Good |
| Vegetation Type E (Rehabilitated with patches of remnant vegetation) | *Eucalyptus loxophleba* subsp. *supralaevis* low woodland over *Acacia ligulata / A. nigripilosa* subsp. *nigripilosa* open shrubland over *Maireana georgei* / *Enchylaena tomentosa* subsp. t*omentosa* / *Chenopodium gaudichaudianum* / *Rhagodia* sp. Watheroo open low heath | GA23, GA26, GA28 GA30, GA31 | Good-Poor |

### 4.2.6 Threatened Ecological and Priority Ecological Communities

No communities listed as TECs under the EPBC Act 1999 or included on the State list were recorded in the project area.

No communities listed as PECs as per the DEC Priority list were recorded in the project area.

### 4.2.7 Vegetation Condition

The vegetation condition across the native remnant vegetation ranged from Very Good to Very Poor. Some disturbance was evident within sites. Disturbances recorded included clearing associated with tracks, introduced species, invasion and rubbish. The caravan park in the south-eastern corner of the project area was Completely Degraded. Vegetation condition is mapped in Figure 5.

The vegetation of the rehabilitated areas were not graded on the condition scale, as these areas have been completely altered from their natural state.

# 5 DISCUSSION

### *Flora of Conservation Significance*

No species listed under the EPBC Act, Declared Rare Flora species or Priority Flora species were recorded during the survey.

The DEC database search showed records of two Declared Rare Flora taxa, *Eucalyptus synandra* and *Grevillea bracteosa* subsp. *howatharra* and one Priority 1 species, *Acacia pterocaulon,* within a 3 km radius of the centre of the Morawa Township. All three of these species are long-lived perennials, and thus would have been located if present in the project area. *ecologia* Environment (2007) surveyed a similar area, on the northern limit of the Morawa Township, and, consistent with the results of this survey, located no Declared Rare or Priority flora.

### *Flora Species Richness*

Seventy-one plant species, representing 27 families and 46 genera, were recorded in the survey area. Dominant families were Chenopodiaceae (10 taxa), Mimosaceae (eight taxa) and Myrtaceae (eight taxa). The genera with most species were *Acacia* (eight taxa), *Ptilotus* (four taxa) and *Rhagodia* (three taxa).

The average floral species richness per quadrat of the native area in the project area was 16, whereas that of the rehabilitated areas was 11.95. Compared to the species richness per quadrat of 19.2 species found by Bennett Environmental Consulting (2004), the native vegetation is of similar richness, but the rehabilitated vegetation is of relatively low species richness per quadrat. The difference in species richness per quadrat is most likely a factor of disturbance. The Blue Hills area surveyed by Bennett Environmental Consulting (2004) was relatively undisturbed and located on the slopes and hills of the region, whereas the current study was on the lower plains near a township, and as a result reflected a high level of historical disturbance, some of which has been the subject of rehabilitation efforts.

Other surveys from the Morawa area collected flora information using transects and not quadrats, and therefore cannot be directly compared to the results of this survey.

### *Introduced Flora Species*

The species list for the Accommodation Camp survey included five introduced plant species: **Echium plantagineum, *Avena fatua*, **Sonchus oleraceus, *Mesembryanthemum nodiflorum* and **Raphanus* sp.

One taxon located in the project area, **Echium plantagineum* (Paterson's Curse), is listed as a Declared Plant species by the Agriculture Protection Board (Department of Agriculture 2007). This species is a large (10-60 cm) bristly annual that can be easily identified by its numerous purple flowers (Hussey *et al*. 2007). **Echium plantagineum* was well established in the project area, and has been recorded by several other studies in the local area (*ecologia* Environmental 2007; ATA Environmental 2004; Bennett Environmental Consulting 2004). The *Agriculture and Related Resources Protection Act 1976* (WA) lists this species as P1 for the whole State, and stipulates the infested area must be managed in such a way as to prevent the spread of seed or plant parts within and from the property. Therefore ENV considers that a weed management plan will be required for the site.

**Avena fatua* is the main oat species found in crops, and is native to southern Europe (Hussey *et al*. 2007). This species is widespread throughout southern Western Australia, but was located at only one site in the north-eastern corner of the project area.

**Sonchus oleraceus* is a common weed of disturbed sites in Western Australia (WAH 2008). It is a yellow-flowered annual with flaccid leaves that are weakly prickly (Hussey *et al*. 2007). **Sonchus oleraceus* was located at three sites in the project area.

**Mesembryanthemum nodiflorum* is a prostrate succulent, introduced from South Africa (Hussey *et al*. 2007). The ability of this species to accumulate salt has enabled it to establish in disturbed and saline areas across southern Australia (CSIRO 2004). **Mesembryanthemum nodiflorum* was recorded at eight of the 13 sites in the project area, and was well established on the western side of the project area.

**Raphanus sp.* was located at one site in the project area. There was insufficient material to identify this specimen to species level, however, this genus as a whole is introduced to Western Australia.

Overall, introduced species were located at 11 of the 13 sites in the project area. Sites GBB15 and GA25 were the only sites free from introduced species.

***Vegetation Communities***

No TECs or PECs were recorded in the Accommodation Camp survey area. Four ENV vegetation communities were recorded and described during the survey; two native remnant and two rehabilitated communities. One of the remnant communities, Vegetation Type C, corresponds to a broad vegetation type described by Shepherd *et al.* (2002): #949. The rehabilitation areas could not be compared to Shepherd *et al.* (2002).

Shepherd *et al*. (2002) give an estimate of the percentage of each of Beard's vegetation associations that remain compared to the pre-European settlement extent, so an estimate of the scarcity of each association can be determined. For the Beard vegetation association of the project area, $E_6$Mi, it is estimated that 15.2% of its pre-European settlement extent remains, which is less than the 30% retention rate required by the EPA's Position Statement No. 2 (EPA 2000). However, only one vegetation type described by ENV, Vegetation Type C, is considered representative of this vegetation association. The rehabilitated areas and the native community, Vegetation Type B, are not considered representative of the regional significant vegetation type because of the level of disturbance they have experienced.

The Accommodation Camp survey area is in the western section of the Morawa Township, and therefore anthropogenic activities have influenced the vegetation condition. Disturbance factors including past clearing, earth-moving, tracks, rubbish and introduced species have left the native vegetation of the area in a Very Good to Very Poor Condition.

### *Principles for Clearing Native Vegetation*

The results of the flora and vegetation survey are discussed in Table 4 in relation to the relevant vegetation clearing principles detailed in Schedule 5.0 of the EP Act 1986*,* namely, clearing principles a, c, d, e, f and h.

**Table 4:** Clearing Principles Relevant to the Flora and Vegetation Assessment of the Survey Area

| Clearing Principle | Survey Findings |
|---|---|
| A: *Native vegetation should not be cleared if it comprises a high level of biological diversity* | The average number of flora taxa recorded per quadrat in the native vegetation in the project area was 16. This is similar to the species richness of the study of Bennett Environmental Consulting (2004), which showed 19.2 species per quadrat. The average number of flora taxa recorded per quadrat in the rehabilitated areas was 11.95, and compared to other studies, this displays a low level of biological diversity. Clearing of native vegetation in the project area may be at variance with this principle. |
| C: *Native vegetation should not be cleared if it includes, or is necessary for, the continued existence of, rare flora* | No Declared Rare Flora listed under the EPBC Act or WC Act were recorded in the project area. No plant taxa listed as Priority Flora by the DEC were located in the survey area. The project is not at variance with this principle. |

| Clearing Principle | Survey Findings |
|---|---|
| D: *Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of, a threatened ecological community* | No TECs are present in the Accommodation Camp project area. The project is not at variance with this principle. |
| E: *Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared* | The broad vegetation community ($E_6$Mi) mapped by Beard (1975) for the Accommodation Camp project area is considered to exist at 15.2 % of its pre-European settlement extent (Shepherd *et al.* 2002). This vegetation community has been extensively cleared for agriculture in the region. Only one vegetation community, Vegetation Type C, described by ENV is considered to represent the regional vegetation. This vegetation community covers a small area on the western boundary of the project area. The remainder of the site consists of native vegetation of Very Poor condition and rehabilitation, and thus does not represent the vegetation community, $E_6$Mi. As a result, the project area is considered significant as a remnant of native vegetation which has been otherwise extensively cleared. The project may be at variance with this principle. |
| F: *Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland* | No watercourses or wetlands are present in the survey area. The project is not at variance with this principle. |
| H: *Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation areas* | The closest DEC-managed conservation estate, Watheroo National Park, is ~65 km away, and the closest Shire-managed reserve, Koolanooka Dam Nature Reserve, is ~10 km from the Accommodation Camp project area. The project area is therefore not adjacent to any designated conservation areas. The project is not at variance with this principle. |

# 6 IMPACT ASSESSMENT AND RECOMMENDATIONS

## 6.1 GENERAL IMPACTS

The main impact associated with the proposed Accommodation Camp will be the loss of vegetation through the construction of the camp and access roads. One vegetation community in the Accommodation Camp project area is representative of the regional vegetation, assessed as being only 15.2% intact across its pre-European settlement extent in Western Australia (Shepherd *et al.* 2002). The vegetation community representing this community in the project area is on the western boundary of the project area and is relatively small. Clearing within this vegetation type should be avoided.

Another general impact associated with the Accommodation Camp is an increase in dust. Dust caused by clearing and construction may impact on surrounding flora and vegetation. This impact should be minor if appropriate management plans and dust suppression measures are implemented.

## 6.2 INTRODUCED SPECIES

The clearing of vegetation and construction of infrastructure related to the Accommodation Camp will see an increase in traffic and activity in the area. This could lead to introduced species being dispersed during clearing by soil movement or from seeds on heavy machinery, or from the increase in traffic.

The Declared Plant **Echium plantagineum* (Paterson's Curse) was recorded in high numbers by ENV (2008) and in the surrounding region by previous surveys (*ecologia* Environmental 2007; ATA Environmental 2004; Bennett Environmental Consulting 2004). The presence of this introduced species in the area means that care should be taken to ensure it is not spread further and the current covers of the species is not increased. Effective management of the species in the project area should help to decrease its cover and minimise its spread.

## 6.3 MANAGEMENT RECOMMENDATIONS

The following actions are recommended to respond to identified impacts from the proposed works and to aid in conserving flora and vegetation of conservation significance:

**Clearing**

- as much as possible of ENV Vegetation Type C should be retained to contribute to preservation of the regional vegetation complex;
- all clearing operations should be kept to a minimum to reduce impacts on surrounding native vegetation;

- the boundaries of areas that are to be disturbed should be clearly demarcated to prevent any erroneous damage to vegetation;
- where possible, current tracks should be used for site access to minimise impact on the area's flora and vegetation;
- temporarily disturbed areas are to be rehabilitated post-construction using stockpiled topsoil, vegetation and leaf litter from the site; and
- no vegetation should be disturbed for temporary laydown. Already disturbed areas should be used for this if possible.

**Introduced Species Management**

- Prepare a weed management strategy for the project area that includes the following:

  - clearing should be undertaken in accordance with an approved weed management strategy to help reduce the spread of introduced species;

  - personnel should be made aware of the Declared Plant, **Echium plantagineum* (Paterson's Curse), in the area to avoid its accidental spread;

  - all heavy machinery and vehicles should be cleaned when moving onto site, should remain onsite for the duration of construction, and should be cleaned before moving offsite; and

  - regular monitoring of disturbed areas should be undertaken to prevent further spread of introduced species, and further spot-spraying of any emergent weed plants should be executed where necessary.

# 7 CONCLUSIONS

A total of 71 taxa were recorded within the entire Accommodation Camp project area, including 66 native and five introduced taxa. No flora species of conservation significance were located.

Because of the presence of the declared weed **Echium plantagineum* (Paterson's Curse), a weed management plan should be developed for the project area.

Four vegetation communities were identified within the Accommodation Camp project area, with no communities listed as TECs or PECs. One of the ENV vegetation communities in the Accommodation Camp project area has only 15.2% of its pre-European extent intact in Western Australia (Shepherd *et al.* 2002) and should be retained.

ENV concludes that the flora and vegetation of the project area in general should pose minimal constraints to the development proposal. The exception to this relates to clearing of the Beard $E_6$Mi vegetation association and restrictions may apply if impact on this vegetation is deemed to be at variance with Clearing Principle E.

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# STATEMENT OF LIMITATIONS

### Scope of Services

This environmental site assessment report ('the report') has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and ENV.Australia Pty Ltd (ENV) ('scope of services'). In some circumstances the scope of services may have been limited by factors such as time, budget, access and/or site disturbance constraints.

### Reliance on Data

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

### Environmental Conclusions

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

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

### Report for Benefit of Client

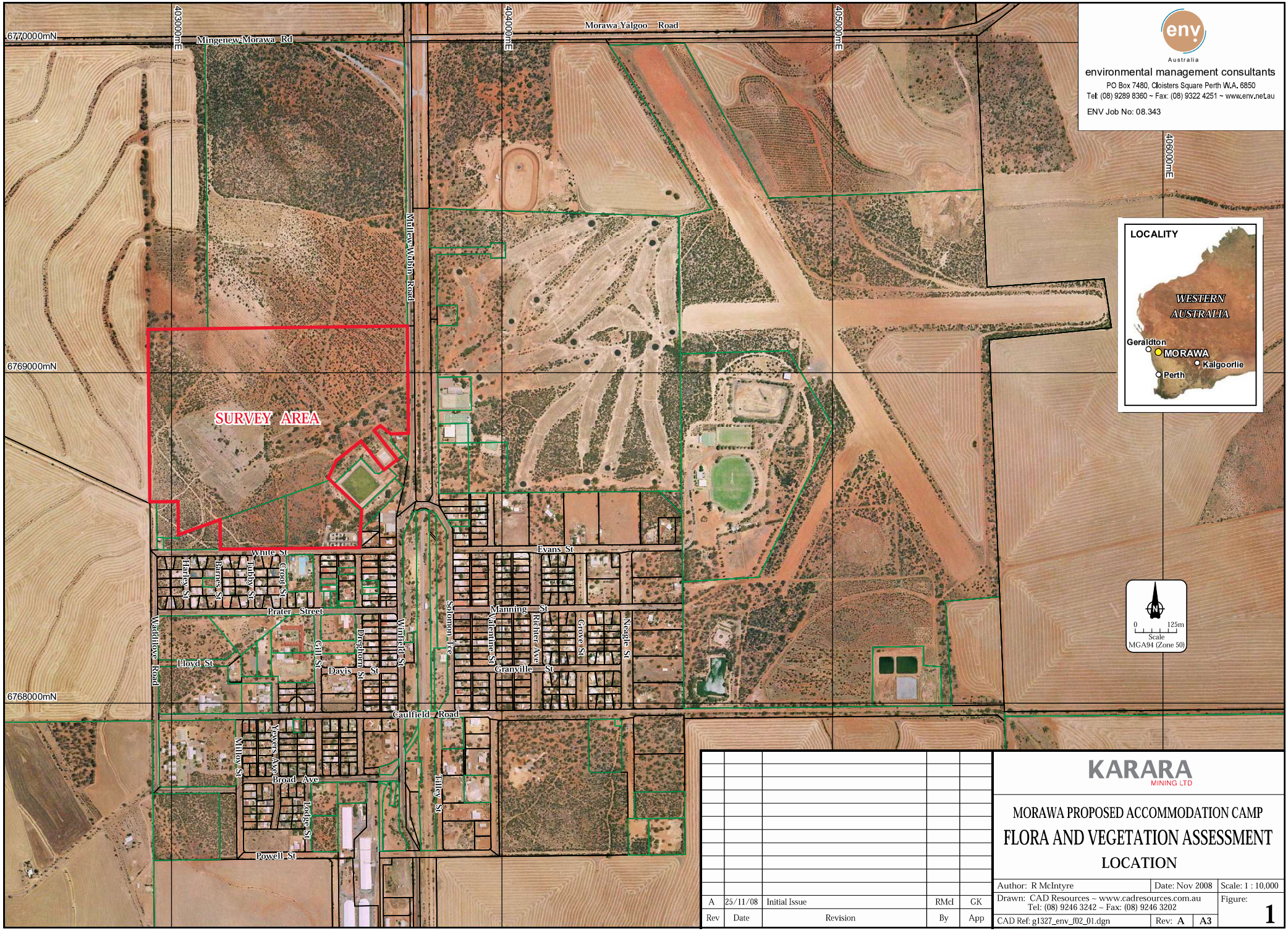
The report has been prepared for the benefit of the Client and for no other party. ENV assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other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

**Other Limitations**

ENV will not be liable to update or revise the report to take into account any events or circumstances occurring or facts becoming apparent after the date of the report.

The scope of services did not include any assessment of the title to or ownership of the properties, buildings and structures referred to in the report, nor the application or interpretation of laws in the jurisdiction in which those properties, buildings and structures are located.

# FIGURES

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| Rev | Date | Revision | By | App |
|---|---|---|---|---|
| A | 25/11/08 | Initial Issue | RMcI | GK |

KARARA MINING LTD

MORAWA PROPOSED ACCOMMODATION CAMP

# FLORA AND VEGETATION ASSESSMENT

## LOCATION

| | | |
|---|---|---|
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| Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202 | | Figure: 1 |
| CAD Ref: g1327_env_f02_01.dgn | Rev: A | A3 |

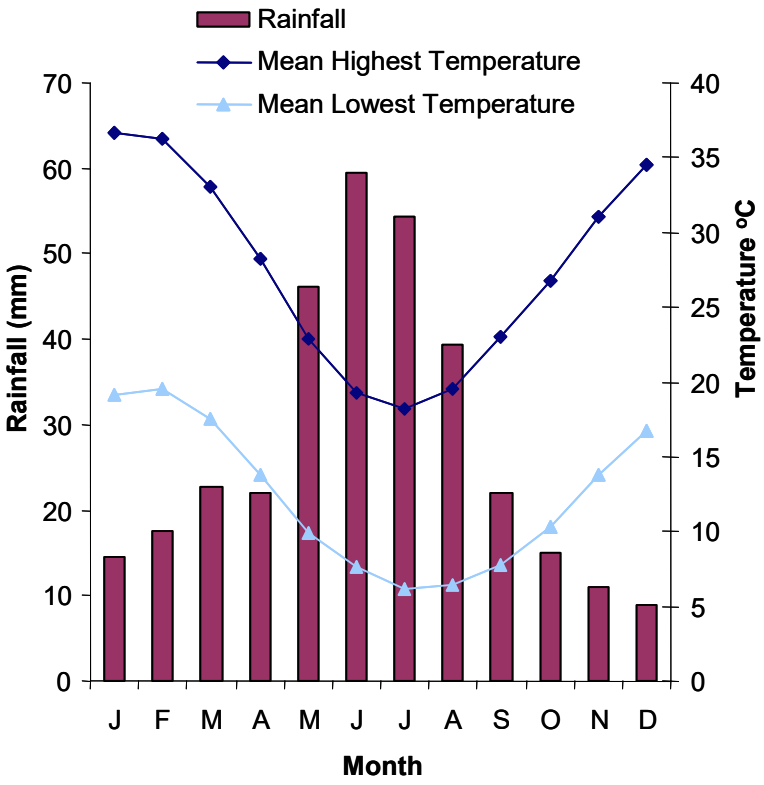


**Figure 2:** Average monthly rainfall and maximum and minimum temperatures for Morawa Airport (Bureau of Meteorology 2008).



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| Rev | Date | Revision | By | App |
|---|---|---|---|---|
| A | 25/11/08 | Initial Issue | QS | GK |

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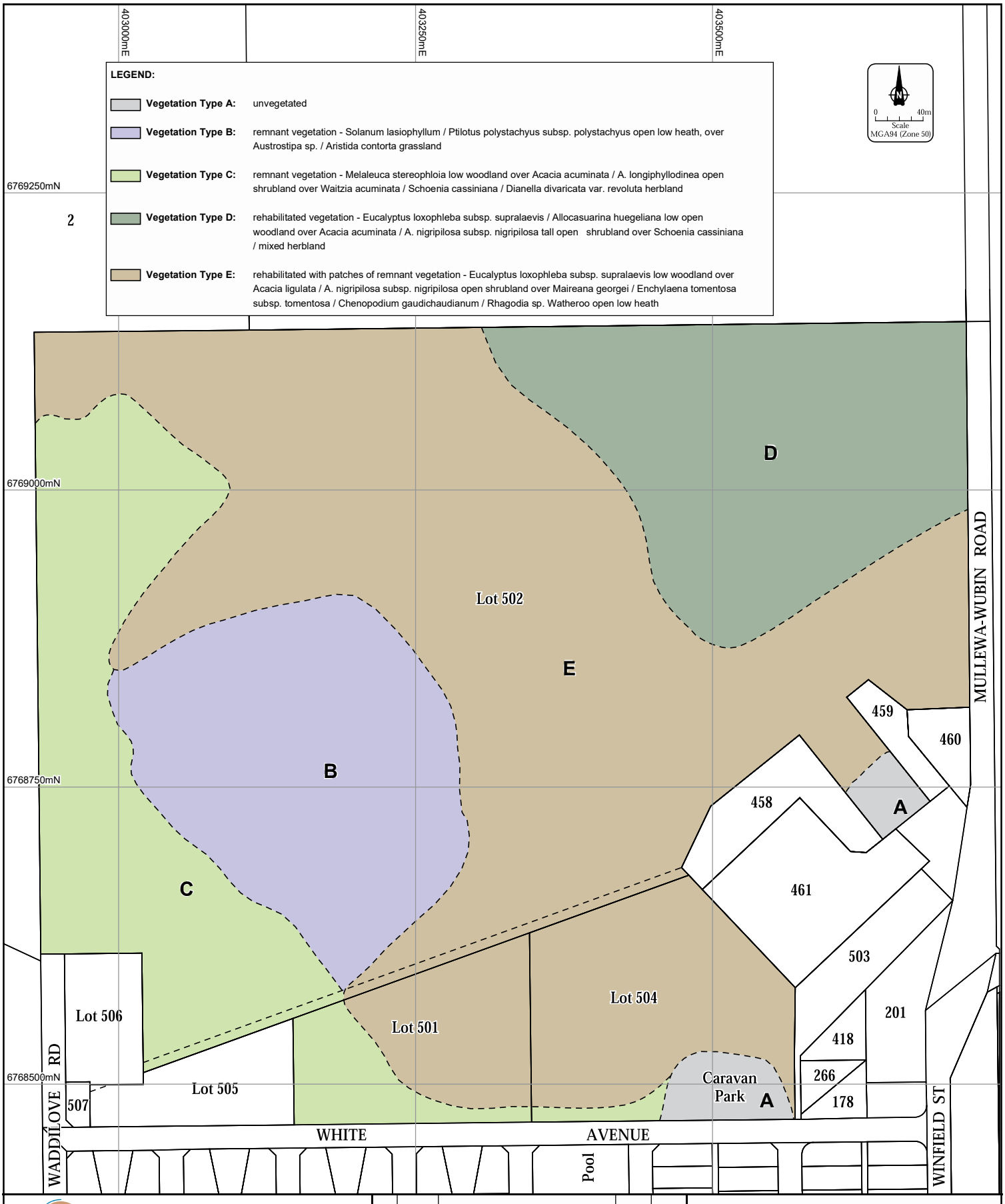
MORAWA PROPOSED ACCOMMODATION CAMP

# FLORA AND VEGETATION ASSESSMENT

## SURVEY LOCATIONS

| | | |
|---|---|---|
| Author: R McIntyre | Date: Nov 2008 | Scale: 1 : 3,000 |
| Drawn: CAD Resources ~ www.cadresources.com.au<br>Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202 | | Figure: 3 |
| CAD Ref: g1327_env_f02_02.dgn | Rev: A | A3 |





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ENV Job No: 08.343

| Rev | Date | Revision | By | App |
|---|---|---|---|---|
| B | 10/12/08 | Legend amended | CS | GK |
| A | 28/11/08 | Initial Issue | QS | GK |

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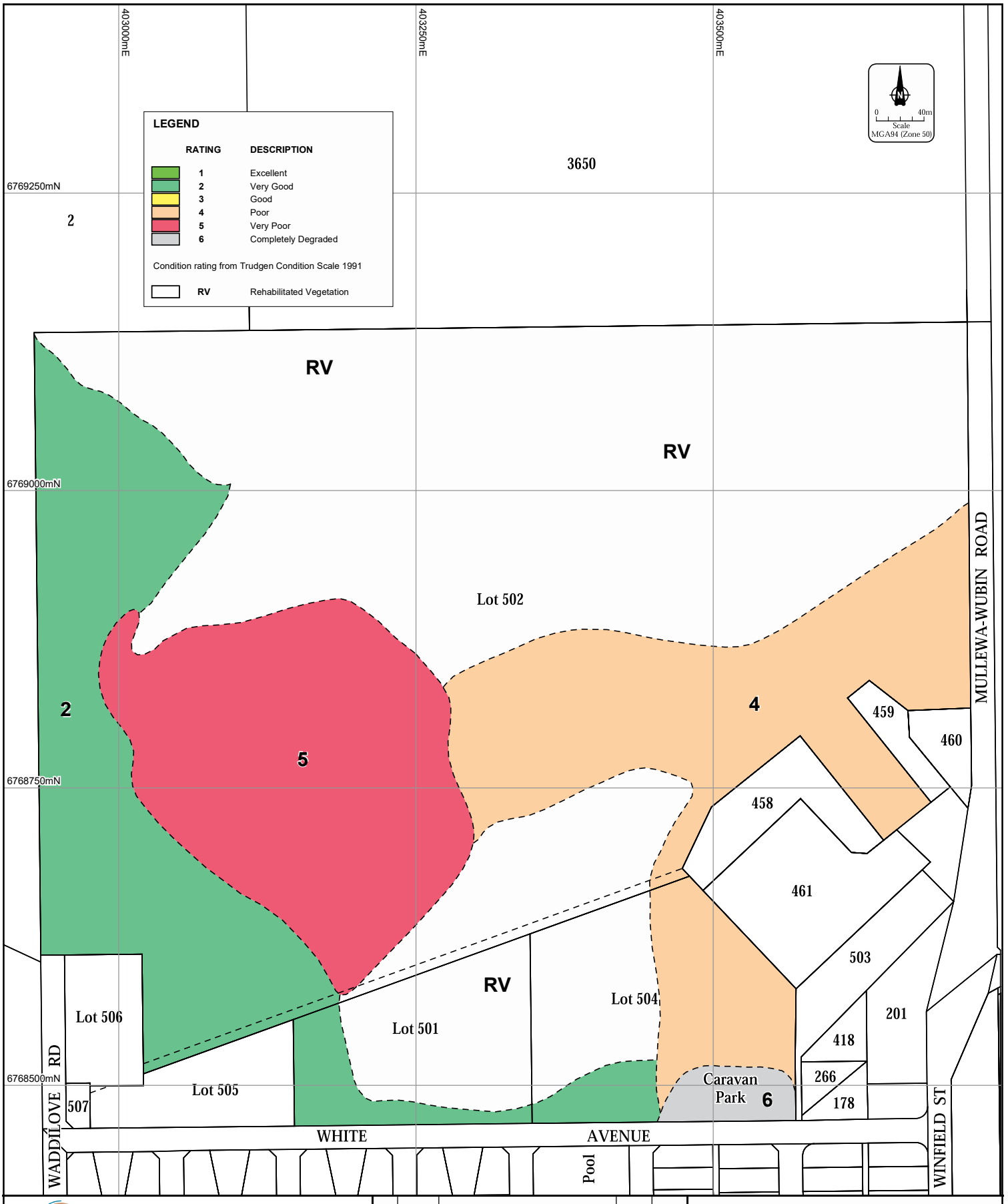
MORAWA PROPOSED ACCOMMODATION CAMP

# FLORA AND VEGETATION ASSESSMENT

## VEGETATION COMMUNITIES

| | | |
|---|---|---|
| Author: R McIntyre | Date: Dec 2008 | Scale: 1 : 3,000 |
| Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202 | | Figure: 4 |
| CAD Ref: g1327_env_f02_03.dgn | Rev: B A3 | |





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ENV Job No: 08.343

| Rev | Date | Revision | By | App |
|---|---|---|---|---|
| B | 10/12/08 | Rehabilitated vegetation added | CS | GK |
| A | 28/11/08 | Initial Issue | QS | GK |

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# MORAWA PROPOSED ACCOMMODATION CAMP
# FLORA AND VEGETATION ASSESSMENT
## VEGETATION CONDITION

Author: R McIntyre | Date: Dec 2008 | Scale: 1 : 3,000

Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202

CAD Ref: g1327_env_f02_04.dgn | Rev: B | A3

Figure: 5

# APPENDIX A

# DEFINITIONS OF DECLARED RARE AND PRIORITY FLORA AND THREATENED/ PRIORITY ECOLOGICAL COMMUNITIES

# MORAWA PROPOSED ACCOMMODATION CAMP – FLORA & VEGETATION ASSESSMENT

## APPENDIX A

Appendix A1 - Definition of Declared Rare and Priority Flora Species (Department of Environment and Conservation 2006)

| Conservation Code | Category |
|---|---|
| **R** | **Declared Rare Flora - Extant Taxa**<br>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. |
| **X** | **Declared Rare Flora - Presumed Extinct Taxa**<br>Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such. |
| **P1** | **Priority One - Poorly Known Taxa**<br>Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals, etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey. |
| **P2** | **Priority Two - Poorly Known Taxa**<br>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 urgently need further survey. |
| **P3** | **Priority Three - Poorly Known Taxa**<br>Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but are in need of further survey. |
| **P4** | **Priority Four - Rare Taxa**<br>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. |

# Appendix A2 - Categories of Threatened Flora Species (Environmental Protection and Biodiversity Conservation Act 1999)

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

# Appendix A3 - Definition of Threatened Ecological Communities (Environmental Protection and Biodiversity Conservation Act 1999)

**Presumed Totally Destroyed (PD)**

An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B):

A) records within the last 50 years have not been confirmed despite thorough searches or known or likely habitats;

B) all occurrences recorded within the last 50 years have since been destroyed.

**Critically Endangered (CR)**

An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):

A) the estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii):

   i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 5 years);
   ii) modification throughout its range is continuing such that in the immediate future (within approximately 5 years) the community is unlikely to be capable of being substantially rehabilitated.

B) current distribution is limited, and one or more of the following apply (i, ii or iii):

   i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 5 years);
   ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes;
   iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.

C) the ecological community exists only as highly modified occurrences which may be capable of being rehabilitated if such work begins in the immediate future (within approximately 5 years).

**Endangered (EN)**

An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):

A) the estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 70% and either or both of the following apply (i or ii):

i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term (within approximately 10 years);
ii) modification throughout its range is continuing such that in the short term future (within approximately 10 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

B) current distribution is limited, and one or more of the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 10 years);
ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes;
iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.

C) the ecological community exists only as highly modified occurrences which may be capable of being rehabilitated if such work begins in the short term future (within approximately 10 years).

**Vulnerable (VU)**

An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction in the medium to long term future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):

A) the ecological community exists largely as modified occurrences which are likely to be capable of being substantially restored or rehabilitated;

B) the ecological community can be modified or destroyed and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations;

C) the ecological community may still be widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

# Appendix A5 – Potentially Occurring Flora of Conservation Significance (Department of Environment and Conservation 2008)

| Species | Conservation Code† |
|---|---|
| *Daviesia speciosa* | Endangered, R |
| *Glyceria drummondii* | Endangered, R |
| *Grevillea murex* | Endangered, R |
| *Paracaleana dixonii* | Endangered, R |
| *Verticordia spicata* subsp. *squamosa* | Endangered, R |
| *Wurmbea tubulosa* | Endangered, R |
| *Eucalyptus blaxellii* | Vulnerable, R |
| *Eucalyptus synandra* | Vulnerable, R |
| *Tecticornia bulbosa* | Vulnerable, R |
| *Grevillea phanerophlebia* | R |
| *Pityrodia axillaris* | R |
| *Acacia congesta* subsp. *cliftoniana* | 1 |
| *Acacia lineolata* subsp. *multilineata* | 1 |
| *Acacia pterocaulon* | 1 |
| *Atriplex muelleri* | 1 |
| *Baeckea decipiens* | 1 |
| *Baeckea* sp. Morawa (MA Langley MA4177*)* | 1 |
| *Baeckea* sp. Billeranga Hills (M.E.Trudgen 2206) | 1 |
| *Chamelaucium repens* | 1 |
| *Commersonia adenothalia* ms | 1 |
| *Enekbatus planifolius* ms | 1 |
| *Gastrolobium rotundifolium* | 1 |

| | |
|---|---|
| *Gnephosis setifera* | 1 |
| *Lepidium fasciculatum* | 1 |
| *Lepidium sagittulatum* | 1 |
| *Malleostemon* sp. Yalgoo Road (Morawa Tree Committee 329) | 1 |
| *Melaleuca barlowii* | 1 |
| *Mesomelaena stygia* subsp. *deflexa* | 1 |
| *Micromyrtus rogeri* | 1 |
| *Rhodanthe collina* | 1 |
| *Scholtzia* sp. Yandanooka (R. Soullier 646) | 1 |
| *Stylidium pendulum* | 1 |
| *Stylidium xanthopis* | 1 |
| *Verticordia comosa* | 1 |
| *Acacia lanceolata* | 2 |
| *Epitriche demissus* | 2 |
| *Eucalyptus abdita* | 2 |
| *Fitzwillia axilliflora* | 2 |
| *Hemigenia pimelifolia* | 2 |
| *Tricoryne* sp. Wongan Hills (BH Smith 794) | 2 |
| *Acacia isoneura* subsp. *isoneura* | 3 |
| *Angianthus micropodioides* | 3 |
| *Calytrix drummondii* | 3 |
| *Calytrix ecalycata* subsp. *ecalycata* | 3 |
| *Cryptandra stellulata* | 3 |
| *Darwinia* sp. Morawa (CA Gardner 2662) | 3 |

| | |
|---|---|
| *Enekbatus longistylus* ms | 3 |
| *Eucalyptus arachnaea* subsp. *arrecta* | 3 |
| *Grevillea asparagoides* | 3 |
| *Grevillea candicans* | 3 |
| *Grevillea granulosa* | 3 |
| *Grevillea leptopoda* | 3 |
| *Grevillea makinsonii* | 3 |
| *Grevillea tenuiloba* | 3 |
| *Hibbertia glomerosa* var. *bistrata* | 3 |
| *Lepidobolus densus* ms | 3 |
| *Melaleuca sclerophylla* | 3 |
| *Microcorys tenuifolia* | 3 |
| *Persoonia pentasticha* | 3 |
| *Pityrodia viscida* | 3 |
| *Podotheca uniseta* | 3 |
| *Psammomoya implexa* | 3 |
| *Thryptomene* sp. Mingenew (Diels & Pritzel 332) | 3 |
| *Thysanotus vernalis* | 3 |
| *Eucalyptus diminuta* | 4 |
| *Verticordia capillaris* | 4 |

†R: Declared Rare, 1, 2, 3, 4 = Priority 1, 2, 3, 4

# Appendix A5 – Potentially Occurring Vegetation Communities of Conservation Significance

| Community ID | Community Name | Status |
|---|---|---|
| Mound Spring (Three Springs Area) | Assemblages of the organic mound springs of the Three Springs area | TEC - Endangered |
| Billeranga System | Plant assemblages of the Billeranga System | TEC - Vulnerable |
| Moonagin System | Plant assemblages of the Moonagin System | TEC - Vulnerable |

# APPENDIX B

# DEFINITIONS OF INTRODUCED SPECIES CATEGORIES AND RATINGS

# MORAWA PROPOSED ACCOMMODATION CAMP – FLORA & VEGETATION ASSESSMENT

## APPENDIX B

## Appendix B1 - Definition of Introduced Flora Species (CALM 1999)

The DEC's Environmental Weed Strategy for Western Australia ranks weeds in terms of their environmental impact on biodiversity using the criteria: invasiveness, distribution, and environmental impacts:

- ***Invasiveness*** - ability to invade bushland in good to excellent condition or ability to invade waterways.
- ***Distribution*** - wide current or potential distribution including consideration of known history of wide spread distribution elsewhere in the world.
- ***Environmental Impacts*** - ability to change the structure, composition and function of ecosystems. In particular an ability to form a monoculture in a vegetation community.

The rating of each weed is determined by the following scoring system:

- ***High*** - a weed species would have to score yes for all three criteria. Rating a weed species as high would indicate prioritising this weed for control and/or research i.e. prioritising funding to it.
- ***Moderate*** - a weed species would have to score yes for two of the above criteria. Rating a weed species as moderate would indicate that control or research effort should be directed to it if funds are available, however it should be monitored (possibly a reasonably high level of monitoring).
- ***Mild*** - a weed species scoring one of the criteria. A mild rating would indicate monitoring of the weed and control where appropriate.
- ***Low*** - a weed species would score none of the criteria. A low ranking would mean that this species would require a low level of monitoring.

# Appendix B2 – Declared Plant Categories (Richardson 2007)

**P1 - Prohibits movement.**

The movement of plants or their seeds is prohibited within the State.

This prohibits the movement of contaminated machinery and produce including livestock and fodder.

**P2 Aim is to eradicate infestation.**

Treat all plants to destroy and prevent propagation each year until no plants remain. The infested area must be managed in such a way that prevents the spread of seed or plant parts on or in livestock, fodder, grain, vehicles and/or machinery.

**P3 Aims to control infestation by reducing area and/or density of infestation.**

The infested area must be managed in such a way that prevents the spread of seed or plant parts within and from the property on or in livestock, fodder, grain, vehicles and/or machinery.

Treat to destroy and prevent seed set all plants:

- within 50 m inside of the boundaries of the infestation;
- within 50 m of roads and high water mark on waterways;
- within 50 m of sheds, stock yards and houses.

Treatment must be done prior to seed set each year.

Properties with less than 20 ha of infestation must treat the entire infestation.

Additional areas may be ordered to be treated.

**P4 Aims to prevent infestation spreading beyond existing boundaries of infestation**

The infested area must be managed in such a way that prevents the spread of seed or plant parts within and from the property on or in livestock, fodder, grain, vehicles and/or machinery.

Treat to destroy and prevent seed set all plants:

- within 50 m inside of the boundaries of the infested property for one-leaf and 20m for two-leaf;
- within 50 m of roads and high water mark on waterways;

- within 50 m of sheds, stock yards and houses.

Treatment must be done prior to seed set each year. Properties with less than 20 ha of infestation must treat the entire infestation.

Additional areas may be ordered to be treated.

Special considerations: In the case of P4 infestations where they continue across property boundaries there is no requirement to treat the relevant part of the property boundaries as long as the boundaries of the infestation as a whole are treated. There must be agreement between neighbours in relation to the treatment of these areas.

**P5 Aims to control infestations on public lands.**

## Appendix B3 – Introduced Flora Species Potentially Occurring within the Project Area

(Ratings CALM 1999; Descriptions WAH 2008)

| Species | Rating | Description (WAM 2003) |
|---|---|---|
| **Echium plantagineum* | Declared Plant | Paterson's Curse<br>Erect annual or biennial, herb, to 0.6 m high. Weed of roadsides, vacant lands and disturbed grounds |
| **Galium aparine* | Declared Plant | Goosegrass<br>Lax, weak annual or herb, to 0.4 m high. Favours Rocky sites |
| ** Brassica tournefortii* | High | Mediterranean Turnip<br>Annual, herb, to 0.6 m high. Aggressive weed of disturbed ground. |
| **Anagallis arvensis* | Moderate | Pimpernel<br>Erect or spreading annual, herb, to 0.4 m high. Gravelly soil, sand, loam, clay or wet soil. Favors disturbed areas. |
| **Arctotheca calendula* | Moderate | Cape weed<br>Decumbent or ascending annual, herb, to 0.03–0.3 m high. Weed of roadsides, waste places and cultivated land. |
| ** Cuscuta epithymum* | Moderate | Lesser Dodder<br>Parasitic, twining annual, herb or climber. Often found on sandy soils over limestone or granite. |
| **Ehrharta longiflora* | Moderate | Annual Veldt Grass<br>Caespitose annual or herb, to 0.6 m high. Found on white or grey sand, loam. |
| ** Erodium cicutarium* | Moderate | Common Storksbill<br>Decumbent, ascending or erect annual, herb, to 0.2 m high. A weed of wasteland, crops and pastures |

| Species | Rating | Description (WAM 2003) |
|---|---|---|
| * *Hypochaeris glabra* | Moderate | Smooth Catsear<br>Rosetted annual or perennial, herb, to 0.5 m high. Common weed of lawns, horticultural areas, roadsides and bushland |
| * *Lamarckia aurea* | Moderate | Goldentop<br>Tufted annual or herb, to 0.2 m high. Found on sandy clay, clay. Favors roadsides and disturbed areas |
| **Pentaschistis airoides* | Moderate | False Hairgrass<br>Delicate tufted annual herb, 0.05–0.16 m high. Found on yellow to grey sand, loam, clay, sandy clay, granite and laterite. |
| * *Rostraria pumila* | Moderate | Tufted annual, grass-like or herb, to 0.2 m high. Found on grey, black or red sand, sandy clay and clay. Favors roadsides, sand dunes, cliff slopes |
| * *Sonchus oleraceus* | Moderate | Common Sowthistle<br>Erect annual, herb, to 1.5 m high. Weed of disturbed ground. |
| * *Urospermum picroides* | Moderate | False Hawkbit<br>Erect annual herb, to 1.2 m high. Found on sandy soils. Weed of moist situations, along watercourses, coastal inlets and roadsides |
| * *Ursinia anthemoides* | Moderate | Ursinia<br>Erect annual, herb, to 0.5 m high. Weed of roadsides and waste places. |
| **Vulpia myuros* var. *myuros* | Moderate | Slender annual, grass-like or herb, to 0.4 m high. |
| * *Medicago minima* | Mild | Small Burr Medic<br>Prostrate annual, herb, to 0.1 m high. Found on grey loamy sand, red-brown clay loam, granite and ironstone. |

| Species | Rating | Description (WAM 2003) |
|---|---|---|
| **Mesembryanthemum nodiflorum* | Mild | Slender Iceplant<br>Prostrate or erect, succulent annual, herb, to 0.2 m high. Found on sandy clay, loam, clay loam. Prefers claypans and saline areas. |
| ** Silene nocturna* | Mild | Mediterranean Catchfly<br>Erect or spreading annual, herb, to 0.5 m high. Found on roadsides |
| ** Chenopodium murale* | Low | Nettle-leaf Goosefoot<br>Erect, annual, herb, to 1 m high. Agricultural weed, cultivated and disturbed areas. |
| ** Malva parviflora* | Low | Marshmallow<br>Erect or decumbent herb, to 1.2 m high. Found on sandy and clayey soils. Favors disturbed areas |
| ** Vulpia muralis* | Low | Slender annual, grass-like or herb, to 0.6 m high. |
| ** Spergula pentandra* | TBA | Five Anther Spurry<br>Spreading annual, herb, to 0.3 m high. |
| ** Cleretum papulosum* subsp. *papulosum* | Not Listed | Succulent annual, herb, to 0.1 m high. Found on sandy loam, brown to red-brown clay, grey sandy gravel, granite, laterite. |

# APPENDIX C

# FLORA SURVEY QUADRAT LOCATIONS

# MORAWA PROPOSED ACCOMMODATION CAMP – FLORA & VEGETATION ASSESSMENT

## APPENDIX C

## FLORA SURVEY LOCATIONS

| Site Number | # Easting | # Northing |
|---|---|---|
| GA21 | 50402990 | 6768488 |
| GA22 | 50402975 | 6768915 |
| GA23 | 50403145 | 6769065 |
| GA24 | 50403314 | 6769333 |
| GA25 | 50403362 | 6769184 |
| GA26 | 50403360 | 6768983 |
| GA27 | 50403247 | 6768817 |
| GA28 | 50403390 | 6768502 |
| GA29 | 50403216 | 6768513 |
| GA30 | 50403362 | 6768706 |
| GA31 | 50403440 | 6768803 |
| GBB14 | 50403402 | 6769093 |
| GBB15 | 50403650 | 6769035 |

# Australian Geocentric 1994 (GDA94), Zone 50K.

# APPENDIX D

# FLORA QUADRAT PHOTOGRAPHS

# MORAWA PROPOSED ACCOMMODATION CAMP – FLORA & VEGETATION ASSESSMENT

## APPENDIX D

## PHOTOGRAPHS OF SURVEY SITES

GA21

GA22

GA23

GA24

GA25

GA26

GA27

GA28

GA29

GA30

GA31

GBB14

GBB15

# APPENDIX E

# VEGETATION CONDITION SCALES

# MORAWA PROPOSED ACCOMMODATION CAMP – FLORA & VEGETATION ASSESSMENT

## APPENDIX E

Definition of Condition Scales (Trudgen 2002)

| Condition Code | Definition |
|---|---|
| **E** | **Excellent**<br>Pristine or nearly so, no obvious signs of damage caused by the activities of European man. |
| **VG** | **Very Good**<br>Some relatively slight signs of damage caused by the activities of European man, e.g. some signs of damage to tree trunks caused by repeated fire and the presence of some relatively non-aggressive introduced species such as **Euphorbia hirta*, **Ursinia anthemoides* or *Briza* species, or occasional vehicle tracks. |
| **G** | **Good**<br>More obvious signs of damage caused by the activities of European man, including some obvious impact on the vegetation structure such as caused by low levels of grazing or by selective logging. Introduced species as above, possibly plus some more aggressive ones. |
| **P** | **Poor**<br>Still retains basic vegetation structure or ability to regenerate to it after very obvious impacts of activities of European man such as grazing or partial clearing (chaining) or very frequent fires. Introduced species as above, probably plus some more aggressive ones such as *Ehrharta* and *Cenchrus* species. |
| **VP** | **Very Poor**<br>Severely impacted by grazing, fire, clearing or a combination of these activities. Scope for some regeneration but, not to a state approaching good condition without intensive management. Usually with a number of introduced species including aggressive species. |
| **D** | **Completely Degraded**<br>Areas that are completely or almost completely without native species in the structure of their vegetation, e.g. areas that are cleared or “parkland cleared” with their flora comprising weed or crop species with isolated native trees or shrubs. |

# APPENDIX F

# FLORA QUADRAT DATA SHEETS

# MORAWA PROPOSED ACCOMMODATION CAMP – FLORA & VEGETATION ASSESSMENT

## APPENDIX F

## DATA SHEETS

**Mingenew to** **Site** GA21

**Described** EL **Date** 10/29/2008 **Type** Q 20 x 20 m
**Season** **Uniformity**

**Location** Morawa Accommodation Camp (corner of White Ave and Waddlelove St - near water tank).

**MGA** 50 402990 **mE** 6768488 **mN**
**Habitat** Plain.
**Soil** Light orange, yellow cream sandy loam.
**Rock** Gravelly, limestone.
**Vegetation** Melaleuca sp. and Grevillea sp. open health over Calytrix flavescens, Jacksonia sp., Hibbertia sp. and Dampiera lavandulacea low shrubland over Ecdeiocolea monostachya open grassland over Waitzia acuminata open herbland.
**Veg Condition** Very Good - Good
**Fire**
**Notes** Bare ground: 70%.
Litter cover: + Logs, 5% Twigs, + Lvs.
Disturbance type: Earth moving, near residential area and litter.

**SPECIES**

| Quad | Name | Cover C | Height | Specimen | Notes |
|---|---|---|---|---|---|
| | Acacia longiphyllodinea | + | 1.55m | GA21.10 | |
| | Allocasuarina lehmanniana | + | 1.8m | GAOPCOL16 | |
| | Baeckea megaflora | + | 1m | GA21.07 | |
| | Borya sphaerocephala | 1% | 0.1m | GA21.13 | |
| | Calytrix flavescens | 10% | 0.5m | GA21.06 | |
| | Dampiera lavandulacea | 1% | 0.3m | GA21.02 | |
| | Dianella revoluta var. divaricata | 10% | 1.2m | GAOPCOL21 | |
| | Ecdeiocolea monostachya | 25% | 1.4m | GA21.01 | |
| | Echium plantagineum | 1% | <1.2m | GA01.04 | |
| | Grevillea sp. | 5% | 1.4m | GA21.09 | Require fruit |
| | Grevillea sp. | 2% | 2m | GA01.01 | |
| | Hibbertia sp. | 1% | 0.5m | GA21.05 | |
| | Jacksonia sp. | 5% | 0.6m | GA21.04 | |
| | Malleostemon tuberculatus | + | 1.2m | GA21.08 | |
| | Melaleuca sp. | 25% | 1.6m | GA21.03 | |
| | Mesembryanthemum nodiflorum | + | 0.2m | GA01.15 | Weed |
| | Monachather sp. | + | 0.45m | GA04.04 | |
| | POACEAE sp. | + | 0.6m | GA21.11 | |
| | Ptilotus polystachyus var. polystachyus | + | 0.8m | GAOPCOL10 | |
| | Raphanus sp. | + | 0.5m | GA21.14 | Weed |
| | Schoenia cassiniana | + | 0.15m | GA02.02 | |
| | Solanum lasiophyllum | + | 0.6m | GAOPCOL27 | |
| | Sonchus oleraceus | + | 0.35m | GAR07.07 | Weed |
| | Velleia cycnopotamica | + | 0.05m | GA21.12 | |
| | Waitzia acuminata | 20% | 0.15m | GA01.02 | |

**Mingenew to** **Site** GA22

**Described** EL **Date** 10/29/2008 **Type** Q 20 x 20 m
**Season** **Uniformity**

**Location** Morawa Accommodation Camp (along bike trail).

**MGA** 50 402975 **mE** 6768915 **mN**
**Habitat** Plain.
**Soil** Light red-brown sand.
**Rock**
**Vegetation** Melaleuca stereophloia and Acacia acuminata shrubland over Enchylaena tomentosa var. tomentosa and Acacia nigripilosa subsp. nigripilosa low scattered shrubs over Waitzia acuminata, Mesembryanthemum nodiflorum and Schoenia cassiniana herbland.

**Veg Condition** Very Good.
**Fire**
**Notes** Bare ground: 75%.
Litter cover: 10% Logs, 20% Twigs, 20% Lvs.
Disturbance type: Nearby tracks and litter.

**SPECIES**

| Quad | Name | Cover C | Height | Specimen | Notes |
|---|---|---|---|---|---|
| | Acacia acuminata | 2% | 2.1m | GA22.02 | Variable species |
| | Acacia nigripilosa subsp. nigripilosa | 1% | 0.7m | GAR07.05 | |
| | Comesperma integerrimum | + | CR | GA22.04 | On Melaleuca |
| | Dianella revoluta var. divaricata | 1% | <1m | GAOPCOL21 | |
| | Enchylaena tomentosa var. tomentosa | 2% | 0.2m | GAR07.02 | |
| | Melaleuca stereophloia | 15% | 1.8m | GA22.01 | |
| | Mesembryanthemum nodiflorum | 15% | 0.15m | GA01.15 | Weed |
| | Monachather sp. | + | 0.3m | GA04.04 | |
| | Ptilotus polystachyus var. polystachyus | + | 0.25m | GAOPCOL10 | |
| | Schoenia cassiniana | 4% | 0.1m | GA02.02 | |
| | Sida sp. dark green fruit (S. van Leeuwen 2260) | + | 0.15m | GA22.03 | |
| | Solanum lasiophyllum | 2% | 0.3m | GAOPCOL27 | |
| | Waitzia acuminata | 30% | 0.15m | GA01.02 | |

**Mingenew to** **Site** GA23

**Described** EL **Date** 10/29/2008 **Type** Q 20 x 20 m
**Season** **Uniformity**

**Location** Morawa Accommodation Camp.

**MGA** 50 403145 **mE** 6769065 **mN**
**Habitat** Plain - very open.
**Soil** Brown, orange clay sand.
**Rock**
**Vegetation** Atriplex cinerea, Maireana carnosa and Mesembryanthemum nodiflorum low open heath over Ecdeiocolea monostachya very open grassland.
**Veg Condition** Poor.
**Fire**
**Notes** Bare ground: 80%.
Litter cover: 5% Twigs, 2% Lvs.
Disturbance type: Clearing, tracks, looks like area has been rehabilitated.

**SPECIES**

| Quad | Name | Cover C | Height | Specimen | Notes |
|---|---|---|---|---|---|
| | Atriplex cinerea | 40% | <1m | GA23.01 | |
| | Ecdeiocolea monostachya | 2% | 0.8m | GAR05.13 | |
| | Maireana carnosa | 20% | 0.25m | GAOPCOL42 | |
| | Maireana georgei | 2% | 0.4m | GA23.02 | |
| | Mesembryanthemum nodiflorum | 5% | 0.1m | GA01.15 | Weed |
| | Solanum lasiophyllum | + | 1m | GAOPCOL27 | |

## Mingenew to **Site** GA24

**Described** EL **Date** 10/29/2008 **Type** Q 20 x 20 m
**Season** **Uniformity**

**Location** Morawa Accommodation Camp.

**MGA** 50 403314 **mE** 6769333 **mN**
**Habitat** Plain - very open.
**Soil** Light cream sand.
**Rock**
**Vegetation** Eucalyptus loxophleba subsp. supralaevis and Eucalyptus ewartiana low woodland over Acacia acuminata high open shrubland over Acacia stereophylla var. stereophylla and Solanum lasiophyllum open shrubland over Monachather sp. very open grassland over Waitzia acuminata and Angianthus tomentosus open herbland.
**Veg Condition** Good.
**Fire**
**Notes** Bare ground: 90%.
Litter cover: + Logs, 15% Twigs, 15% Lvs.
Disturbance type: Clearing and earth moving.

**SPECIES**

| Quad | Name | Cover C | Height | Specimen | Notes |
|---|---|---|---|---|---|
| | Acacia acuminata | 5% | <2.5m | GA22.02 | Variable species |
| | Acacia stereophylla var. stereophylla | 2% | 1.75m | GA24.06 | |
| | Angianthus tomentosus | 5% | 0.01m | GA24.03 | |
| | CHENOPODIACEAE sp. | + | 0.25m | GA24.08 | Unidentified beyond family due to lack of identifying material |
| | Dianella revoluta var. divaricata | 1% | <1.2m | GAOPCOL21 | |
| | Echium plantagineum | + | <1m | GA01.04 | |
| | Eucalyptus ewartiana | 2% | 2.4m | GA24.01 | Photo: 2477 |
| | Eucalyptus loxophleba subsp. supralaevis | 10% | 4m | GA24.02 | Photo: 2478-2479 |
| | Halgania anagalloides | + | 0.15m | GA24.05 | |
| | Jacksonia sp. | 1% | <1m | GA21.04 | |
| | Monachather sp. | 1% | <0.7m | GA04.04 | |
| | Schoenia cassiniana | + | 0.1m | GA02.02 | |
| | Senna glutinosa subsp. charlesiana | + | 1.6m | GA24.07 | |
| | Solanum lasiophyllum | 2% | 0.7m | GAOPCOL27 | |
| | Waitzia acuminata | 5% | 0.15m | GA01.02 | |

**Mingenew to** **Site** GA25

**Described** EL **Date** 10/29/2008 **Type** Q 20 x 20 m
**Season** **Uniformity**

**Location** Morawa Accommodation Camp.

**MGA** 50 403362 **mE** 6769184 **mN**
**Habitat** Open Plain.
**Soil** Light orange cream sand.
**Rock**
**Vegetation** Eucalyptus loxophleba subsp. supralaevis scattered low trees over Acacia acuminata and Grevillea sp. high open shrubland over Acacia nigripilosa subsp. nigripilosa open heath over Rhagodia sp. Watheroo (R.J. Cranfield & P.J. Spencer 8183) low scattered shrubs over Waitzia acuminata very open herbland.
**Veg Condition** Very Good – Good.
**Fire**
**Notes** Bare ground: 80%.
Litter cover: + Logs, 5% Twigs, 5% Lvs.
Disturbance type: Tracks, clearing and signs of rabbits.

**SPECIES**

| Quad | Name | Cover C | Height | Specimen | Notes |
|---|---|---|---|---|---|
| | Acacia acuminata | 5% | <2m | GA22.02 | Variable species |
| | Acacia nigripilosa subsp. nigripilosa | 20% | <1.4m | GAR07.05 | |
| | Acacia nigripilosa subsp. nigripilosa | 40% | <2.2m | GA25.06 | Highly variable species. |
| | Angianthus tomentosus | + | 0.02m | GA24.03 | |
| | Dianella revoluta var. divaricata | + | 0.6m | GAOPCOL21 | |
| | Eucalyptus loxophleba subsp. supralaevis | 2% | 3.5m | GA25.02 | |
| | Grevillea sp. | 5% | <2m | GA25.03 | |
| | Maireana georgei | + | 1m | GA25.04 | |
| | Monachather sp. | + | 0.3m | GA04.04 | |
| | Rhagodia sp. | + | 0.6m | GA25.01 | Need fruit/flowers. |
| | Rhagodia sp. Watheroo (R.J. Cranfield & P.J. Spencer 8183) | 1% | 0.7m | GA25.05 | |
| | Waitzia acuminata | 5% | <0.2m | GA01.02 | |

## Mingenew to **Site** GA26

**Described** EL **Date** 10/29/2008 **Type** Q 20 x 20 m
**Season** **Uniformity**

**Location** Morawa Accommodation Camp.

**MGA** 50 403360 **mE** 6768953 **mN**
**Habitat** Low open woodland.
**Soil** Red sand.
**Rock**
**Vegetation** Eucalyptus loxophleba subsp. supralaevis low woodland over Senna charlesiana high open shrubland over Acacia nigripilosa subsp. nigripilosa scattered shrubs over Chenopodium gaudichaudianum, Enchylaena tomentosa var. tomentosa and Maireana georgei low open heath over Austrostipa elegantissima scattered grasses.

**Veg Condition** Very Good – Good.
**Fire**
**Notes** Bare ground: 50%.
Litter cover: + Logs, 30% Twigs, 30% Lvs.
Disturbance type: Tracks and earth moving.

**SPECIES**

| Quad | Name | Cover C | Height | Specimen | Notes |
|---|---|---|---|---|---|
| | Acacia nigripilosa subsp. nigripilosa | 1% | 1.55m | GAR07.05 | |
| | Austrostipa elegantissima | 1% | 1.2m | GAR13.02 | |
| | Austrostipa sp. | + | 0.5m | GAR09.01 | |
| | Chenopodium gaudichaudianum | 25% | 0.6m | GAR06.07 | |
| | Enchylaena tomentosa var. tomentosa | 20% | 0.2m | GAR07.02 | |
| | Eucalyptus loxophleba subsp. supralaevis | 20% | 6-8m | GA25.02 | |
| | Maireana carnosa | 1% | 0.15m | GAOPCOL42 | |
| | Maireana georgei | 20% | 0.25m | GA25.04 | |
| | Mesembryanthemum nodiflorum | + | 0.3m | GA01.15 | Weed |
| | Ptilotus exaltatus var. exaltatus | + | 0.4m | GA26.01 | |
| | Senna charlesiana | 2% | 2.3m | GA26.02 | |

**Mingenew to** **Site** GA27

**Described** EL **Date** 10/29/2008 **Type** Q 20 x 20 m
**Season** **Uniformity**

**Location** Morawa Accommodation Camp.

**MGA** 50 403247 **mE** 6768817 **mN**
**Habitat** Grassy sand plain.
**Soil** Ash felt - light brown loam.
**Rock**
**Vegetation** Solanum lasiophyllum open heath over Austrostipa sp., Aristida contorta and Monachather sp. open grassland over Ptilotus polystachyus var. polystachyus and Echium plantagineum very open herbland.
**Veg Condition** Poor.
**Fire**
**Note** Bare ground: 70%.
Litter cover: + Twigs, + Lvs.
Disturbance type: Nearby road.

**SPECIES**

| Quad | Name | Cover C | Height | Specimen | Notes |
|---|---|---|---|---|---|
| | Angianthus tomentosus | + | 0.02m | GA24.03 | |
| | Aristida contorta | 10% | 0.4m | GA03.01 | |
| | Austrostipa sp. | 35% | 0.3-0.5m | GAR09.01 | |
| | Echium plantagineum | 1% | 0.8m | GA01.04 | |
| | Echium plantagineum | + | 0.25m | GA01.14 | |
| | Enchylaena tomentosa var. tomentosa | + | 0.15m | GAR07.02 | |
| | Maireana carnosa | + | 0.2m | GAOPCOL42 | |
| | Monachather sp. | 10% | 0.6m | GA04.04 | |
| | Ptilotus ? obovatus | + | 0.45m | GA27.03 | No flowers |
| | Ptilotus obovatus var. obovatus | + | 0.5 | GA27.02 | |
| | Ptilotus polystachyus var. polystachyus | 10% | 0.6m | GAOPCOL10 | |
| | Solanum lasiophyllum | 30% | <1m | GAOPCOL27 | |
| | Sonchus oleraceus | + | 0.1m | GAR07.07 | Weed |
| | Waitzia acuminata | + | 0.15m | GA01.02 | |
| | Waitzia acuminata | + | 0.2m | GA27.01 | |

## Mingenew to **Site** GA28

**Described** EL **Date** 10/29/2008 **Type** Q 20 x 20 m
**Season** **Uniformity**

**Location** Morawa Accommodation Camp (near caravan park).

**MGA** 50 403390 **mE** 6768502 **mN**
**Habitat** Plain.
**Soil** Orangey Red Sandy Loam.
**Rock**
**Vegetation** Acacia ligulata and Alyogyne hakeifolia high open shrubland over Acacia nigripilosa subsp. nigripilosa, Senna charlesiana and Rhagodia sp. Watheroo (R.J. Cranfield & P.J. Spencer 8183) shrubland over Ptilotus obovatus var. obovatus, Enchylaena tomentosa var. tomentosa and Solanum lasiophyllum low open heath over Aristida contorta and Austrostipa sp. very open grassland over Ptilotus gaudichaudii var. parviflorus, Waitzia acuminata and Echium plantagineum herbland.
**Veg Condition** Very Good.
**Fire**
**Note** Bare ground: 60%.
Litter cover: + Logs, 10% Twigs, 10% Lvs.
Disturbance type: Nearby road.

**SPECIES**

| Quad | Name | Cover C | Height | Specimen | Notes |
|---|---|---|---|---|---|
| | Acacia ligulata | 5% | 2.6m | GA28.02 | |
| | Acacia nigripilosa subsp. nigripilosa | 5% | 1.8m | GAR07.05 | |
| | Acacia sp. | 1% | 1.2m | GA28.03 | |
| | Alyogyne hakeifolia | 1% | 3.5m | GAOPCOL48 | |
| | Aristida contorta | 2% | 0.4m | GA03.01 | |
| | Austrostipa sp. | 2% | <0.8m | GAR09.01 | |
| | Comesperma integerrimum | + | CR | GA22.04 | |
| | Dianella revoluta var. divaricata | + | 0.6m | GAOPCOL21 | |
| | Echium plantagineum | 2% | <1.3m | GA01.04 | |
| | Echium plantagineum | + | 0.4m | GA01.14 | |
| | Enchylaena tomentosa var. tomentosa | 10% | 0.3m | GAR07.02 | |
| | Maireana carnosa | 2% | 0.1m | GAOPCOL42 | |
| | Mesembryanthemum nodiflorum | + | 0.2m | GA01.15 | Weed |
| | Ptilotus gaudichaudii var. parviflorus | 35% | <0.5m | GA28.01 | |
| | Ptilotus obovatus var. obovatus | 40% | <0.8m | GA27.02 | |
| | Rhagodia sp. Watheroo (R.J. Cranfield & P.J. Spencer 8183) | 2% | 1.2m | GA25.05 | |
| | Senna charlesiana | 2% | 1.8m | GA26.02 | |
| | Solanum lasiophyllum | 5% | <0.5m | GAOPCOL27 | |
| | Sonchus oleraceus | + | 0.2m | GAR07.07 | Weed |
| | Waitzia acuminata | + | 0.15m | GA27.01 | |
| | Waitzia acuminata | 2% | 0.25m | GA01.02 | |

## Mingenew to **Site** GA29

**Described** EL **Date** 10/29/2008 **Type** Q 20 x 20 m
**Season** **Uniformity**

**Location** Morawa Accommodation Camp.

**MGA** 50 403216 **mE** 6768513 **mN**
**Habitat** Very open plain.
**Soil** Light orange cream sand.
**Rock**
**Vegetation** Melaleuca stereophloia and Acacia acuminata high shrubland over Acacia sp. and Acacia nigripilosa subsp. nigripilosa shrubland over Enchylaena tomentosa var. tomentosa and Rhagodia sp. Watheroo (R.J. Cranfield & P.J. Spencer 8183) low open shrubland over Aristida contorta and Austrostipa sp. grassland over Pogonolepis stricta and Waitzia acuminata open herbland.
**Veg Condition** Good.
**Fire**
**Note** Bare ground: 75%.
Litter cover: 30% Twigs, 50% Lvs.
Disturbance type: Near road side, litter.

**SPECIES**

| Quad | Name | Cover C | Height | Specimen | Notes |
|---|---|---|---|---|---|
| | Acacia acuminata | 10% | 2.6m | GA29.01 | Variable species |
| | Acacia nigripilosa subsp. nigripilosa | 2% | 1.6m | GAR07.05 | |
| | Acacia sp. | 20% | 1.2m | GA28.03 | |
| | Aristida contorta | 35% | 0.25m | GA03.01 | |
| | Austrostipa sp. | 2% | 0.8m | GAR09.01 | |
| | Enchylaena tomentosa var. tomentosa | 2% | 0.2m | GAR07.02 | |
| | Goodenia sp. | + | 0.7m | GA29.03 | |
| | Maireana carnosa | + | 0.15m | GAOPCOL42 | |
| | Melaleuca stereophloia | 15% | 2.4m | GA22.01 | |
| | Mesembryanthemum nodiflorum | + | 0.15m | GA01.15 | Weed |
| | Pogonolepis stricta | 5% | 0.01m | GA29.02 | |
| | Ptilotus polystachyus var. polystachyus | + | 1.2m | GAOPCOL10 | |
| | Rhagodia sp. Watheroo (R.J. Cranfield & P.J. Spencer 8183) | 2% | 0.5m | GA25.05 | |
| | Waitzia acuminata | 5% | 0.15m | GA01.02 | |

**Mingenew to** **Site** GA30

**Described** EL **Date** 10/29/2008 **Type** Q 20 x 20 m
**Season** **Uniformity**

**Location** Morawa Accommodation Camp (near caravan park).

**MGA** 50 403362 **mE** 6768706 **mN**
**Habitat** Plain.
**Soil** Red brown sandy loam.
**Rock**
**Vegetation** Acacia ligulata and Acacia sp. open shrubland over Ptilotus obovatus var. obovatus, Rhagodia sp. Watheroo (R.J. Cranfield & P.J. Spencer 8183) and Maireana carnosa low open heath over Aristida contorta and Austrostipa sp. scattered grasses over Ptilotus gaudichaudii var. parviflorus herbland.

**Veg Condition** Very Good – Good.
**Fire**
**Note** Bare ground: 70%.
Litter cover: 20% Twigs, 20% Lvs.
Disturbance type: Nearby road and litter.

**SPECIES**

| Quad | Name | Cover C | Height | Specimen | Notes |
|---|---|---|---|---|---|
| | Acacia ligulata | 2% | 1.9m | GA30.01 | |
| | Acacia sp. | 1% | 1m | GA28.03 | |
| | Aristida contorta | 2% | 0.2m | GA03.01 | |
| | Austrostipa sp. | 2% | 0.5m | GAR09.01 | |
| | Chenopodium gaudichaudianum | + | 1.2m | GAR06.07 | |
| | Echium plantagineum | + | 0.8m | GA01.04 | |
| | Echium plantagineum | + | 0.3m | GA01.14 | |
| | Enchylaena tomentosa var. tomentosa | 1% | 0.4m | GAR07.02 | |
| | Maireana carnosa | 5% | 0.15m | GAOPCOL42 | |
| | Maireana georgei | + | 0.8m | GA25.04 | |
| | Mesembryanthemum nodiflorum | + | 0.15m | GA01.15 | Weed |
| | Ptilotus gaudichaudii var. parviflorus | 40% | 0.25m | GA28.01 | |
| | Ptilotus obovatus var. obovatus | 40% | <0.3m | GA27.02 | |
| | Ptilotus polystachyus var. polystachyus | + | 0.4m | GAOPCOL10 | |
| | Rhagodia sp. Watheroo (R.J. Cranfield & P.J. Spencer 8183) | 5% | 0.6m | GA25.05 | |
| | Solanum lasiophyllum | 2% | 0.5m | GAOPCOL27 | |
| | Waitzia acuminata | + | 0.2m | GA27.01 | |

## Mingenew to Morawa **Site** GA31

**Described** EL **Date** 10/29/2008 **Type** Q 20 x 20 m
**Season** **Uniformity**

**Location** Morawa Accommodation Camp.

**MGA** 50 403440 **mE** 6768803 **mN**
**Habitat** Low open Woodland.
**Soil** Red brown loamy sand.
**Rock**
**Vegetation** Eucalyptus loxophleba subsp. supralaevis woodland over Chenopodium gaudichaudianum, Rhagodia sp. Watheroo (R.J. Cranfield & P.J. Spencer 8183), Enchylaena tomentosa var. tomentosa and Maireana georgei low shrubland over Mesembryanthemum nodiflorum very open
**Veg Condition** Poor.
**Fire**
**Note** Bare ground: 70%.
Litter cover: 5% Logs, 60% Twigs, 60% Lvs.
Disturbance type: Nearby road and litter (mainly glass).

**SPECIES**

| Quad | Name | Cover C | Height | Specimen | Notes |
|---|---|---|---|---|---|
| | Acacia nigripilosa subsp. nigripilosa | + | 1m | GAR07.05 | |
| | Austrostipa sp. | + | 0.8m | GAR09.01 | |
| | Chenopodium gaudichaudianum | 5% | 0.8m | GAR06.07 | |
| | Dianella revoluta var. divaricata | + | 0.7m | GAOPCOL21 | |
| | Enchylaena tomentosa var. tomentosa | 2% | 0.2m | GAR07.02 | |
| | Eremophila clarkei | + | 1.6 | GA31.02 | |
| | Eucalyptus loxophleba subsp. supralaevis | 25% | 10m | GA31.01 | Photo: 2500 - 2502 |
| | Maireana carnosa | + | 0.1m | GAOPCOL42 | |
| | Maireana georgei | 2% | 0.2m | GA25.04 | |
| | Mesembryanthemum nodiflorum | 2% | 0.15m | GA01.15 | Weed |
| | Ptilotus exaltatus var. exaltatus | + | 0.2m | GA26.01 | |
| | Rhagodia sp. Watheroo (R.J. Cranfield & P.J. Spencer 8183) | 2% | 0.2m | GA25.05 | |
| | Waitzia acuminata | + | 0.15m | GA01.02 | |

## Mingenew to Morawa Site GAOPCO

**SPECIES**

| Quad | Name | Cover C | Height | Specimen | Notes |
|---|---|---|---|---|---|
| ? | Goodenia sp. | | 0.15m | GAOPCOL44 | 403327 mE, 6769454 mN - 1 individual - Photo: 2480 - 2481, Morawa Accommodation Camp |
| | Acacia jibberdingensis | | >3m | GAOPCOL47 | 403229 mE, 6768763 mN - 10 individuals - Photo: 2490 - 2491, Morawa Accommodation Camp |
| | Alyogyne hakeifolia | | 1.9m | GAOPCOL48 | 403411 mE, 6768465 mN - 2 individuals, Morawa Accommodation Camp |
| | Dicrastylis fulva | | 0.7m | GAOPCOL45 | 403327 mE, 6769454 mN - 1 individual - Photo: 2482 - 2483, Morawa Accommodation Camp |
| | Schoenia cassiniana | | 0.15m | GAOPCOL46 | 403351 mE, 6769328 mN - 100+ individuals, Morawa Accommodation Camp |
| | Thysanotus manglesianus | | CR | GAOPCOL50 | 403106 mE, 6768582 mN - 5 individuals - Photo: 2497, Morawa Accommodation Camp |

## Mingenew to Morawa **Site** GBB14

**Described** DA **Date** 10/29/2008 **Type** R
**Season** **Uniformity**

**Location** Morawa Accommodation Camp.

**MGA** 50 403402 **mE** 6769093 **mN**
**Habitat** Revegetated area bordered by road.
**Soil** Pale orange clay sand.
**Rock**
**Vegetation** Eucalyptus loxophleba subsp. supralaevis, Eucalyptus sp. and Allocasuarina huegeliana low open woodland over Acacia acuminata, Acacia nigripilosa subsp. nigripilosa and Grevillea sp. open shrubland over scattered mixed herbs.
**Veg Condition** N/A.
**Fire** Very Old.
**Note** Bare ground: 75%.
Litter cover: - logs, - Twigs, - Lvs.
Disturbance type: Revegetated.

**SPECIES**

| Quad | Name | Cover C | Height | Specimen | Notes |
|---|---|---|---|---|---|
| | Acacia acuminata | + | 3m | GBB01.07 | |
| | Acacia acuminata | 2% | 2m | GBB08.05 | |
| | Acacia nigripilosa subsp. nigripilosa | 2% | 2m | GBB05.29 | |
| | Acacia nigripilosa subsp. nigripilosa | + | 0.3m | GBB05.29 | |
| | Acacia sp. | + | 1.5m | GBB14.07 | |
| | Allocasuarina huegeliana | 1% | 8m | GBB14.05 | |
| | Aristida contorta | + | 0.1m | GBB05.12 | |
| | Austrostipa elegantissima | + | 0.8m | GBB08.08 | |
| | Avena fatua | + | 0.4m | NC | |
| | Echium plantagineum | + | 0.4m | GBB03.03 | Weed |
| | Eucalyptus loxophleba subsp. supralaevis | 5% | 4m | GBB14.01 | |
| | Eucalyptus sp. | 2% | 4m | GBB14.03 | |
| | Eucalyptus sp. | 2% | 2m | GBB14.02 | |
| | Grevillea sp. | 2% | 2m | GBB14.04 | |
| | Lomandra sp. | + | 0.3m | GBB14.09 | |
| | Maireana georgei | + | 0.3m | GBB14.06 | |
| | Maireana tomentosa subsp. tomentosa | + | 0.4m | GBB06.02 | |
| | Ptilotus gaudichaudii var. parviflorus | + | 0.3m | GBB02.08 | |
| | Ptilotus polystachyus var. polystachyus | + | 0.4m | GBB01.16 | |
| | Senna glutinosa subsp. charlesiana | + | 1.2m | GBB14.08 | |
| | Solanum lasiophyllum | + | 0.3m | GBB02.12 | |

**Mingenew to** **Site** GBB15

**Described** DA **Date** 10/29/2008 **Type** R
**Season** **Uniformity**

**Location** Morawa Accommodation Camp.

**MGA** 50 403650 **mE** 6769035 **mN**
**Habitat** Revegetated area bordered by road.
**Soil** Orange clayey sand.
**Rock**
**Vegetation** Eucalyptus loxophleba subsp. Supralaevis, Eucalyptus sp., and Allocasuarina huegeliana low open woodland over Acacia acuminata, Acacia ligulata and Acacia acuminata high open shrubland over scattered mixed herbs.

**Veg Condition** N/A.
**Fire** Very Old.
**Note** Bare ground: 70%.
Litter cover: - logs, 5% Twigs, 5% Lvs.
Disturbance type: Revegetated.
Notes: Older rehabilitated area to the west (same species) at 403479 mE, 6768897 mN.

**SPECIES**

| Quad | Name | Cover C | Height | Specimen | Notes |
|---|---|---|---|---|---|
| | Acacia acuminata | 2% | 4m | GBB01.07 | |
| | Acacia acuminata | 2% | 2.4m | GBB08.05 | |
| | Acacia coolgardiensis | 1% | 2.5m | GBB05.07 | |
| | Acacia ligulata | 2% | 2.5m | GBB15.01 | |
| | Acacia sp. | + | 0.6m | GBB14.07 | |
| | Allocasuarina huegeliana | 2% | 3m | GBB14.05 | |
| | Angianthus tomentosus | + | 0.2m | GBB09.02 | Variable species |
| | Aristida contorta | + | 0.2m | GBB05.12 | |
| | Austrostipa elegantissima | + | 0.4m | GBB08.08 | |
| | Austrostipa elegantissima | + | 0.4m | GBB08.08 | |
| | Enchylaena tomentosa | + | 0.7m | GBB01.09 | |
| | Eucalyptus loxophleba subsp. supralaevis | 2% | 4m | GBB14.01 | |
| | Eucalyptus sp. | 2% | 4m | GBB14.03 | |
| | Eucalyptus sp. | 2% | 3m | GBB14.02 | |
| | Grevillea sp. | + | 3m | GBB14.04 | |
| | Maireana tomentosa subsp. tomentosa | + | 0.4m | GBB06.02 | |
| | Monachather paradoxus | + | 0.4m | GBB05.06 | |
| | Podolepis canescens | + | 0.2m | GBB05.23 | |
| | Ptilotus obovatus var. obovatus | + | 0.2m | GBB08.01 | |
| | Ptilotus polystachyus var. polystachyus | + | 0.4m | GBB01.16 | |
| | Rhagodia drummondii | + | 0.3m | GBB04.10 | |
| | Solanum lasiophyllum | + | 0.3m | GBB05.05 | |
| | Solanum lasiophyllum | + | 1.4m | GBB02.12 | |
| | Waitzia acuminata | + | 0.2m | GBB01.12 | |

# APPENDIX G
# FLORA SPECIES INVENTORY

# MORAWA PROPOSED ACCOMMODATION CAMP – FLORA & VEGETATION ASSESSMENT

## APPENDIX G

Flora Species Inventory

| Family | Species Name |
|---|---|
| Adiantaceae | *Cheilanthes sieberi* subsp. *sieberi* |
| Aizoaceae | **Mesembryanthemum nodiflorum* |
| Amaranthaceae | *Ptilotus* ? *obovatus* |
| Amaranthaceae | *Ptilotus exaltatus* var. *exaltatus* |
| Amaranthaceae | *Ptilotus gaudichaudii* var. *parviflorus* |
| Amaranthaceae | *Ptilotus obovatus* var. *obovatus* |
| Amaranthaceae | *Ptilotus polystachyus* var. *polystachyus* |
| Anthericaceae | *Thysanotus manglesianus* |
| Asteraceae | *Angianthus tomentosus* |
| Asteraceae | *Podolepis canescens* |
| Asteraceae | *Pogonolepis stricta* |
| Asteraceae | *Schoenia cassiniana* |
| Asteraceae | **Sonchus oleraceus* |
| Asteraceae | *Waitzia acuminata* |
| Boraginaceae | **Echium plantagineum* |
| Boraginaceae | *Halgania anagalloides* |
| Boryaceae | *Borya sphaerocephala* |
| Brassicaceae | **Raphanus* sp. |
| Caesalpiniaceae | *Senna charlesiana* |
| Caesalpiniaceae | *Senna glutinosa subsp. charlesiana* |
| Casuarinaceae | *Allocasuarina huegeliana* |
| Casuarinaceae | *Allocasuarina lehmanniana* |
| Chenopodiaceae | *Atriplex cinerea* |
| Chenopodiaceae | CHENOPODIACEAE sp. |
| Chenopodiaceae | *Chenopodium gaudichaudianum* |
| Chenopodiaceae | *Enchylaena tomentosa* |

| Family | Species Name |
|---|---|
| Chenopodiaceae | *Enchylaena tomentosa* var. *tomentosa* |
| Chenopodiaceae | *Maireana georgei* |
| Chenopodiaceae | *Maireana tomentosa* subsp. *tomentosa* |
| Chenopodiaceae | *Rhagodia drummondii* |
| Chenopodiaceae | *Rhagodia* sp. |
| Chenopodiaceae | *Rhagodia* sp. Watheroo (R.J. Cranfield & P.J. Spencer 8183) |
| Dasypogonaceae | *Lomandra* sp. |
| Dilleniaceae | *Hibbertia* sp. |
| Ecdeiocoleaceae | *Ecdeiocolea monostachya* |
| Geraniaceae | *Erodium cygnorum* |
| Goodeniaceae | *Dampiera lavandulacea* |
| Goodeniaceae | *Goodenia* sp. |
| Goodeniaceae | *Velleia cycnopotamica* |
| Lamiaceae | *Dicrastylis fulva* |
| Malvaceae | *Alyogyne hakeifolia* |
| Malvaceae | *Sida* sp. dark green fruit (S. van Leeuwen 2260) |
| Mimosaceae | *Acacia acuminata* |
| Mimosaceae | *Acacia coolgardiensis* |
| Mimosaceae | *Acacia jibberdingensis* |
| Mimosaceae | *Acacia ligulata* |
| Mimosaceae | *Acacia longiphyllodinea* |
| Mimosaceae | *Acacia nigripilosa* subsp. *nigripilosa* |
| Mimosaceae | *Acacia sp.* |
| Mimosaceae | *Acacia stereophylla* var. *stereophylla* |
| Myoporaceae | *Eremophila clarkei* |
| Myrtaceae | *Baeckea megaflora* |
| Myrtaceae | *Calytrix flavescens* |
| Myrtaceae | *Eucalyptus ewartiana* |
| Myrtaceae | *Eucalyptus loxophleba* subsp. *supralaevis* |

| Family | Species Name |
|---|---|
| Myrtaceae | *Eucalyptus* sp. |
| Myrtaceae | *Malleostemon tuberculatus* |
| Myrtaceae | *Melaleuca* sp. |
| Myrtaceae | *Melaleuca stereophloia* |
| Papilionaceae | *Jacksonia* sp. |
| Phormiaceae | *Dianella revoluta* var. *divaricata* |
| Poaceae | **Avena fatua* |
| Poaceae | *Aristida contorta* |
| Poaceae | *Austrostipa elegantissima* |
| Poaceae | *Austrostipa* sp. |
| Poaceae | *Monachather paradoxus* |
| Poaceae | *Monachather* sp. |
| Poaceae | POACEAE sp. |
| Polygalaceae | *Comesperma integerrimum* |
| Proteaceae | *Grevillea* sp. |
| Solanaceae | *Solanum lasiophyllum* |

# APPENDIX H

# FLORA SPECIES-BY-SITE MATRIX

**MORAWA PROPOSED ACCOMMODATION CAMP – FLORA VEGETATION ASSESSMENT**

**APPENDIX H**

Matrix of Species Found Within Each Site

| Species Name | GA21 | GA22 | GA23 | GA24 | GA25 | GA26 | GA27 | GA28 | GA29 | GA30 | GA31 | GBB14 | GBB15 | GAOPCO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Avena fatua* | | | | | | | | | | | | + | | |
| **Echium plantagineum* | 1% | | | + | | | 1% | 2% | | + | | + | | |
| **Mesembryanthemum nodiflorum* | + | 15% | 5% | | | + | | + | + | + | 2% | | | |
| **Raphanus* sp. | + | | | | | | | | | | | | | |
| **Sonchus oleraceus* | + | | | | | | + | + | | | | | | |
| *Acacia acuminata* | | 2% | | 5% | 5% | | | | 10% | | | 2% | 2% | |
| *Acacia coolgardiensis* | | | | | | | | | | | | | 1% | |
| *Acacia jibberdingensis* | | | | | | | | | | | | | | + |
| *Acacia ligulata* | | | | | | | | 5% | | 2% | | | 2% | |
| *Acacia longiphyllodinea* | + | | | | | | | | | | | | | |
| *Acacia nigripilosa* subsp. *nigripilosa* | | 1% | | | 40% | 1% | | 5% | 2% | | + | 2% | | |
| *Acacia* sp. | | | | | | | | 1% | 20% | 1% | | + | + | |
| *Acacia stereophylla* var. *stereophylla* | | | | 2% | | | | | | | | | | |
| *Allocasuarina huegeliana* | | | | | | | | | | | | 1% | 2% | |
| *Allocasuarina lehmanniana* | + | | | | | | | | | | | | | |
| *Alyogyne hakeifolia* | | | | | | | | 1% | | | | | | + |
| *Angianthus tomentosus* | | | | 5% | + | | + | | | | | | + | |
| *Aristida contorta* | | | | | | | 10% | 2% | 35% | 2% | | + | + | |
| *Atriplex cinerea* | | | 40% | | | | | | | | | | | |
| *Austrostipa elegantissima* | | | | | | 1% | | | | | | + | + | |
| *Austrostipa* sp. | | | | | | + | 35% | 2% | 2% | 2% | + | | | |
| *Baeckea megaflora* | + | | | | | | | | | | | | | |
| *Borya sphaerocephala* | 1% | | | | | | | | | | | | | |
| *Calytrix flavescens* | 10% | | | | | | | | | | | | | |
| *Cheilanthes sieberi* subsp. *sieberi* | | | | | | | | | | | | | | |
| CHENOPODIACEAE sp. | | | | + | | | | | | | | | | |
| *Chenopodium gaudichaudianum* | | | | | | 25% | | | | + | 5% | | | |
| *Comesperma integerrimum* | | + | | | | | | + | | | | | | |
| *Dampiera lavandulacea* | 1% | | | | | | | | | | | | | |
| *Dianella revoluta* var. *divaricata* | 10% | 1% | | 1% | + | | | + | | | + | | | |
| *Dicrastylis fulva* | | | | | | | | | | | | | | + |
| *Ecdeiocolea monostachya* | 25% | | 2% | | | | | | | | | | | |
| *Enchylaena tomentosa* | | | | | | | | | | | | | + | |
| *Enchylaena tomentosa* var. *tomentosa* | | 2% | | | | 20% | + | 10% | 2% | 1% | 2% | | | |
| *Eremophila clarkei* | | | | | | | | | | | + | | | |
| *Erodium cygnorum* | | | | | | | | | | | | | | + |
| *Eucalyptus ewartiana* | | | | 2% | | | | | | | | | | |
| *Eucalyptus loxophleba* subsp. *supralaevis* | | | | 10% | 2% | 20% | | | | | 25% | 5% | 2% | |
| *Eucalyptus* sp. | | | | | | | | | | | | 2% | 2% | |
| *Goodenia* sp. | | | | | | | | | + | | | | | |
| *Grevillea* sp. | 2% | | | | 5% | | | | | | | 2% | | |
| *Halgania anagalloides* | | | | + | | | | | | | | | | |
| *Hibbertia* sp. | 1% | | | | | | | | | | | | | |
| *Jacksonia* sp. | 5% | | | 1% | | | | | | | | | | |
| *Lomandra* sp. | | | | | | | | | | | | + | | |
| *Maireana georgei* | | | 2% | | + | 20% | | | | + | 2% | + | | |
| *Maireana tomentosa* subsp. *tomentosa* | | | | | | | | | | | | + | + | |
| *Malleostemon tuberculatus* | + | | | | | | | | | | | | | |
| *Melaleuca* sp. | 25% | | | | | | | | | | | | | |
| *Melaleuca stereophloia* | | 15% | | | | | | | 15% | | | | | |
| *Monachather paradoxus* | | | | | | | | | | | | | + | |
| *Monachather* sp. | + | + | | 1% | + | | 10% | | | | | | | |
| POACEAE sp. | + | | | | | | | | | | | | | |
| *Podolepis canescens* | | | | | | | | | | | | | + | |
| *Pogonolepis stricta* | | | | | | | | | 5% | | | | | |
| *Ptilotus ? obovatus* | | | | | | | + | | | | | | | |
| *Ptilotus exaltatus* var. *exaltatus* | | | | | | + | | | | | + | | | |
| *Ptilotus gaudichaudii* var. *parviflorus* | | | | | | | | 35% | | 40% | | + | | |
| *Ptilotus obovatus* var. *obovatus* | | | | | | | + | 40% | | 40% | | | + | |
| *Ptilotus polystachyus* var. *polystachyus* | + | + | | | | | 10% | | + | + | | + | + | |
| *Rhagodia drummondii* | | | | | | | | | | | | | + | |
| *Rhagodia* sp. | | | | | + | | | | | | | | | |
| *Rhagodia* sp. Watheroo (R.J. Cranfield & P.J. Spencer 8183) | | | | | 1% | | | 2% | 2% | 5% | 2% | | | |
| *Schoenia cassiniana* | + | 4% | | + | | | | | | | | | | + |
| *Senna charlesiana* | | | | | | 2% | | 2% | | | | | | |
| *Senna glutinosa* subsp. *charlesiana* | | | | + | | | | | | | | + | | |
| *Sida* sp. dark green fruit (S. van Leeuwen 2260) | | + | | | | | | | | | | | | |
| *Solanum lasiophyllum* | + | 2% | + | 2% | | | 30% | 5% | | 2% | | + | + | |
| *Thysanotus manglesianus* | | | | | | | | | | | | | | + |
| *Velleia cycnopotamica* | + | | | | | | | | | | | | | |
| *Waitzia acuminata* | 20% | 30% | | 5% | 5% | | + | + | 5% | + | + | | + | |

+ denotes a percentage cover of less than 1%
# denotes species associated with the quadrat

# APPENDIX I

# LOCATIONS OF INTRODUCED FLORA SPECIES

# MORAWA PROPOSED ACCOMMODATION CAMP – FLORA & VEGETATION ASSESSMENT

## APPENDIX I

## LOCATION OF INTRODUCED SPECIES

| Taxa | Site Number | # Easting | # Northing |
|---|---|---|---|
| **Avena fatua* | GBB15 | 50403650 | 6769035 |
| **Echium plantagineum* | GA21 | 50402990 | 6768488 |
| | GA24 | 50403314 | 6769333 |
| | GA27 | 50403247 | 6768817 |
| | GA28 | 50403390 | 6768502 |
| | GA30 | 50403362 | 6768706 |
| | GBB14 | 50403402 | 6769093 |
| **Mesembryanthemum nodiflorum* | GA21 | 50402990 | 6768488 |
| | GA22 | 50402975 | 6768915 |
| | GA23 | 50403145 | 6769065 |
| | GA26 | 50403360 | 6768983 |
| | GA28 | 50403390 | 6768502 |
| | GA29 | 50403216 | 6768513 |
| | GA30 | 50403362 | 6768706 |
| | GA31 | 50403440 | 6768803 |
| **Raphanus* sp. | GA21 | 50402990 | 6768488 |
| **Sonchus oleraceus* | GA21 | 50402990 | 6768488 |
| | GA27 | 50403247 | 6768817 |
| | GA28 | 50403390 | 6768502 |

# Australian Geocentric 1994 (GDA94), Zone 50K.