Kanmantoo Copper Mine Native Vegetation Management Plan For Life of Mine Extension February 2014

Version No.	Prepared By	Reviewed By	Approved By	Date
1	Hillgrove Resources	C. Davis	C. Davis	

Contents

1. INTRODUCTION 5

1.1 Background 5

1.2 Regulatory Framework 7

1.2.1 *Mining Act 1971* 7

1.2.2 *Native Vegetation Act 1991* 7

1.2.3 *Environment Protection Biodiversity Conservation Act 1999* 7

1.3 Purpose of this Plan 8

1.4 NVMP Structure 8

2. SITE AND VEGETATION DESCRIPTION 9

2.1 Land Use History 9

2.2 Vegetation Communities 10

2.2.1 *Eucalyptus odorata* low woodland 13

2.2.2 *L. effusa* ± *Helichrysum leucopsideum* open tussock grassland 13

2.2.3 *Austrostipa* sp. open tussock grassland 13

2.2.4 *Acacia pycnantha* low woodland 13

2.3 Flora of Conservation Significance 16

2.3.1 Plant Species of Conservation Significance 16

2.3.2 Vegetation Communities of Conservation Significance 16

2.4 Fauna of Conservation Significance 17

2.5 Distribution of Weed Species 18

3. MANAGEMENT AND MITIGATION MEASURES 19

3.1 Vegetation Clearing 19

3.1.1 Avoiding Areas with Communities of Conservation Significance & Minimising Clearing where it is Deemed Necessary 19

3.1.2 Avoiding Disturbance in all Other Remnant Native Vegetation 20

3.1.3 Appropriately Managing the Approved Clearance of Native Vegetation 20

3.1.4 Monitoring of all Vegetation Clearance 21

3.1.5 Mitigation of Approved Vegetation Disturbance Through the Provision of Corresponding SEB-offset Areas 21

4. SEB- OFFSET CALCULATION 23

4.1 Extent of Vegetation Clearance 23

4.1.1 *Eucalyptus odorata* low woodland 23

4.1.2 *L. effusa* ± *Helichrysum leucopsideum* open tussock grassland 23

2.2.3 *Austrostipa* sp. open tussock grassland 23

2.2.4 *Acacia pycnantha* low woodland 23

4.1.1 Significance of Vegetation to be Disturbed 24

4.1.2 Conservation Value of Vegetation 24

4.2 Impacts of Vegetation Clearance 28

4.3 Estimated Significant Environmental Benefit 28

4.3.1 Initial SEB Assessment 28
4.3.2 SEB Credit for On-site Restoration Activities 28
4.3.3 SEB Credit for Mitigation of Impacts 29
4.3.4 Calculated SEB Offset Requirement 29

5. PROVISION OF SEB 30

5.1 Rationale 30
5.2 Implementation 31
5.2.1 Sharefarmer Negotiations – Removal of Grazing & Cropping Pressure from Designated SEB-offset Areas 33
5.2.2 Scheduling Offset Programs for Each Offset Patch 34
5.2.3 Surveying proposed revegetation plots within assigned SEB-offset land parcels 34
5.2.4 Install and maintain rabbit-proof fencing to protect land parcels or individual SEB-patches as appropriate 35
5.2.5 Purchase of specialist equipment and/or engagement of Contractors 36
5.2.6 Commence weed control and feral animal control programs within designated SEB-offset areas prior to planting and through the establishment phase 37
5.2.7 Investigative studies to quantify the parameters for successful revegetation on specific SEB-offset patches 38
5.2.8 & 9 Commencement of vegetation enhancement programs for remnant native vegetation located during detailed site studies and adjustment of offset patch boundaries where necessary 40
5.2.10 Build up seed reserves and order specific seed supplies or tube stock to meet planting schedules 41
5.2.11 Land Preparation 43
5.2.12 Planting Programs 45
5.2.13 Assess results and adjust methods 47
5.2.14 Replanting and Amendment Programs 48
5.2.15 Establishment of Heritage Agreements 48

6. REFERENCES & SELECTED RESOURCES 52

Figures

Figure 1. ML6345 and Adjacent EML6340 Areas – Pre 2011 Image 6
Figure 2. Original ML vegetation survey as described by Ecological Associates in 2007 11
Figure 3. Revised 2013 EBS Vegetation Survey, Listing Patch Numbers, and EPBC Survey Points 12
Figure 4. ML Vegetation Communities, Highlighting PEPR-Approved Disturbance Boundary and Proposed LOM Disturbance Boundary 14
Figure 5. Proposed Additional Native Vegetation Disturbance Associated with LOM Extension 15

Tables

Table 1.	Native Vegetation Communities within ML 6345	10
Table 2.	Summary of Native Vegetation Disturbance and SEB-Offset areas – LOM Extension.	24
Table 3.	Hillgrove-owned properties adjacent to the ML and Assignment of SEB Offsets	30
Table 4.	Proposed SEB-Offset Work Program	32

Plates

Plate 1.	Seed Production Area highlighting diversity grass seed plots	42
Plate 2.	Seed Multiplication Area established on former cropping land adjacent to the ML	43
Plate 3.	8:1 *E. odorata* protected from disturbance by amendments to the LOM extension plan, Northern–end Patch 10	49
Plate 4.	4:1 *E. odorata* – woodland enhancement, Patch 2, NW corner of ML	50
Plate 5.	Revegetating disturbed areas within the ML, Gate 1 near Patch 29	50
Plate 6.	Landcare Volunteers, COOE and EBS staff assisting with Plant Rescue in PEPR-approved Disturbance Area of Patch 10 (November 2011)	51
Plate 7.	Diuris behrii Daughter-tubers (foreground) under Propagation in the Native Orchid Society of SA's Shadehouse near Mt George SA	51

Attachments

A Initial SEB assessment guidelines

B 2013 EBS Vegetation Survey of Peppermint Box and Irongrass Communities at Kanmantoo Copper Mine

1. INTRODUCTION

1.1 Background

Hillgrove Resources Limited (Hillgrove or HGO) is an Australian copper-gold producer that has been listed on the Australian Stock Exchange since 2003. Hillgrove currently operates the Kanmantoo Copper Mines on Mining Lease (ML) 6345 in South Australia (SA) under the conditions approved in The Kanmantoo Copper Mines (KCM) Mining and Rehabilitation Program (MARP), February 2011 (see ftp://central.pir.sa.gov.au/Minerals/Kanmantoo_PEPR_main_v7.pdf). A MARP is now referred to as a Program for Environmental Protection and Rehabilitation (PEPR) by the SA Department for Manufacturing, Innovation, Trade, Resources and Energy (DMITRE). All currently approved documentation and associated resources for the Kanmantoo Copper Mines can be accessed via the following link:

http://www.minerals.dmitre.sa.gov.au/mines__and__developing_projects/approved_mines/kanmantoo

KCM is located approximately 45km SE of Adelaide. The two closest townships to the ML are Kanmantoo, approximately 1.5 km to the northeast, and Callington, approximately 4 km to the southeast. There has been a long history of mining and agricultural activity within the ML and both activities have significantly altered many of the landscapes and vegetation types from those of pre-European occupation. The pre-2011 state of the ML is illustrated by Figure 1 (below), while the initial details of vegetation cover and condition are illustrated by Figs. 2 & 3 and Table 1. A total of 112.9 ha of native vegetation remained within the ML prior to the commencement of PEPR-approved mining operations in 2011.

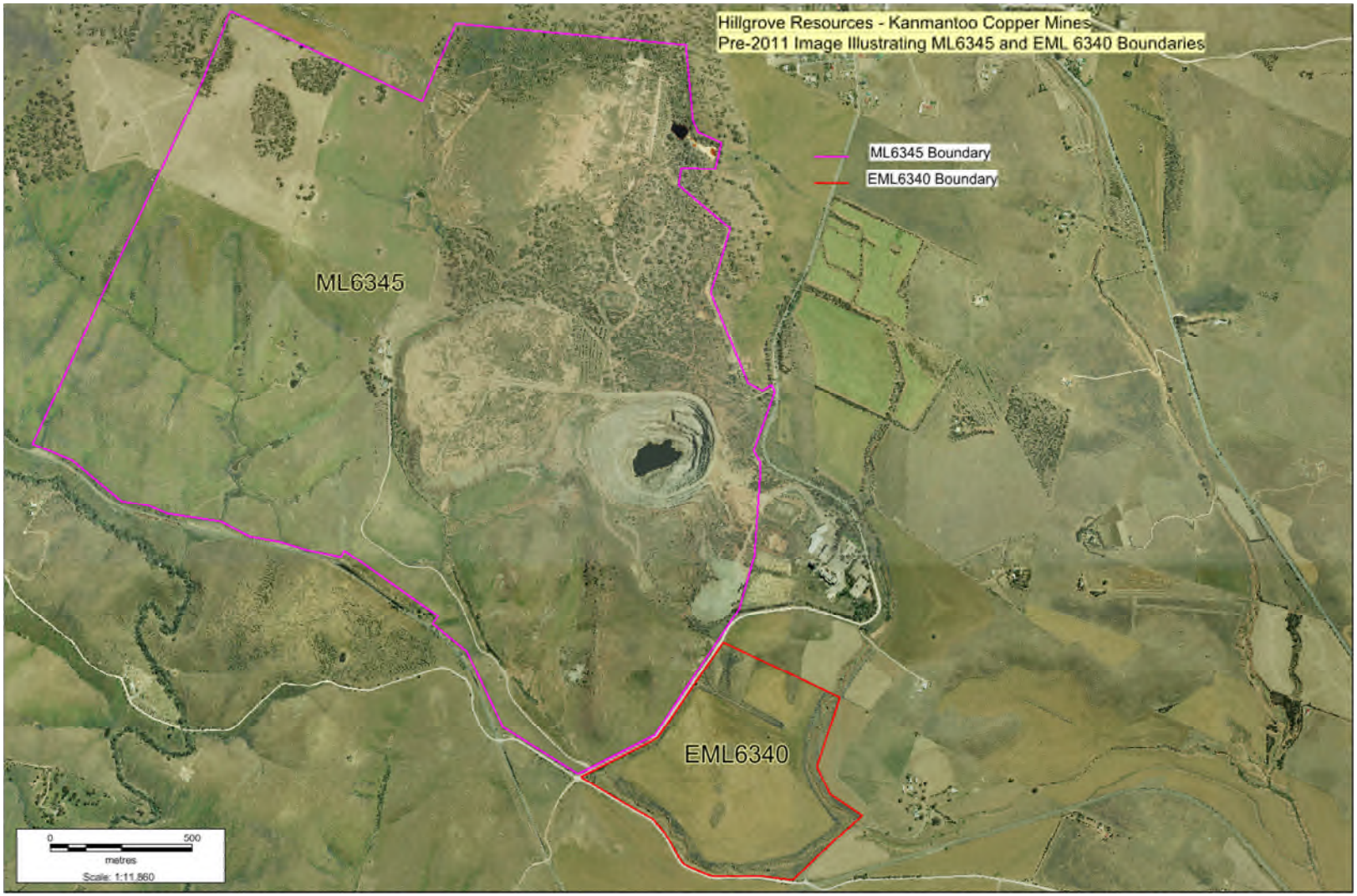
Hillgrove is currently expanding the historic Kanmantoo Copper Mines using open pit mining techniques. An initial mine life of seven years was proposed in the approved PEPR, however recent on-site exploration has defined additional mineral deposits which may allow operations to continue to at least 2019, based on current mining models. This document deals with aspects of a proposed extension to the life of mine (LOM), which extends mining operations and associated native vegetation disturbance into areas of vegetation not currently approved by the PEPR.

Details of how, where and when a Significant Environmental Benefit Offset (SEB-offset) would be provided for corresponding areas of native vegetation disturbance associated with the initial phase of mining operations were detailed in the ML's Native Vegetation Management Plan (NVMP), which contained within Appendix 3 of the approved PEPR, which can be accessed via the link to DMITRE's web page where it is referred to as Appendix 9, (2010):

ftp://central.pir.sa.gov.au/Minerals/Kanmantoo_Appendix_Volume3_v7.pdf

This document constitutes an appendix to the original NVMP. It should be viewed as a stand-alone NVMP, addressing additional areas of native vegetation disturbance and the corresponding areas of SEB-offset associated with the life of mine (LOM) extension only (hereby referred to as 'the LOM extension'). For full site details, operating and rehabilitation plans associated with the initial phase of mining operations at Kanmantoo, please refer to the approved PEPR and associated resources via the link provided above.

Figure 1. ML6345 and Adjacent EML6340 Areas – Pre 2011 Image



1.2 Regulatory Framework

1.2.1 *Mining Act 1971*

The principal legislation for the regulation of mining in South Australia is the *Mining Act 1971*, which is administered by the Department for Manufacturing, Innovation, Trade, Resources and Energy SA (DMITRE). Hillgrove Resources Ltd was granted mining lease (ML) 6345 under the provisions of this Act in order to proceed with mining on-site at Kanmantoo.

1.2.2 *Native Vegetation Act 1991*

All native vegetation in South Australia is protected under the provisions of the *Native Vegetation Act 1991*, where the South Australian Native Vegetation Council (NVC) must approve any clearance of vegetation not exempted under regulations.

DMITRE has been delegated the authority from the NVC to administer the SEB requirements (as they apply to mining operations) under the *Mining Act 1971*, on the basis that DMITRE will apply the policies of the NVC to clearance and revegetation as part of the requirements of a PEPR under Regulation 42 of that act (DWLBC, 2005).

1.2.3 *Environment Protection Biodiversity Conservation Act 1999*

The controlling provisions of the Environment Protection and Biodiversity Conservation Act (1999) or 'EPBC Act' are administered by the Australian Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC). The currently proposed areas of vegetation disturbance within ML6345 associated with Hillgrove's LOM extension will disturb additional areas of Peppermint Box Woodland and Iron-grass Grassland not originally covered by the PEPR. Both communities are considered to be 'critically endangered' under the EPBC Act. Subsequently, independent surveys of proposed new disturbance areas were conducted by EBS-Ecology on 25 June 2013 (please see Attachment B).

Survey results, together with supporting information were referred to DSEWPaC, who determined that disturbance of critically endangered Peppermint Box Woodland and Iron-grass Grassland by the proposed LOM extension were assessed as '*Controlled Actions'* under the EPBC Act. This requires Hillgrove to clearly demonstrate how remnant vegetation will be preserved and how an SEB-offset will be delivered for corresponding areas of disturbance before this action can be approved by DSEWPaC. This NVMP addresses this condition and incorporates changes to earlier versions of this NVMP following public and State Government input.

It should be noted that Hillgrove have taken all practicable steps to minimise the potential impacts to EPBC Act-listed vegetation communities during mining operations to date. Ongoing refinements to LOM pit designs and day to day restriction of vehicle and pedestrian movement within the ML will work collectively to reduce the area of vegetation disturbance throughout the LOM extension.

1.3 Purpose of this Plan

This NVMP has been developed in accordance with the Draft Guidelines for a Native Vegetation Significant Environmental Benefit Policy for the Clearance of Native Vegetation Associated with the Minerals and Petroleum Industry (DWLBC, 2005). It provides a framework for managing and mitigating the potential impacts of vegetation clearance as a result of mining operations. This NVMP details the following in relation to new areas of native vegetation clearance associated with the LOM extension:

- Where native vegetation clearance will occur and how much clearance will be required
- The type and condition of native vegetation to be disturbed
- The type, condition and area of corresponding SEB-offset to be provided
- Where the SEB-offset will be delivered
- How the SEB-offset will be achieved

This NVMP encompasses and responds to comments provided by the South Australian Government (DEWNR) and our local community in relation to the original (August 2013) NVMP draft as a component of the EPBC Referral conducted by DSEWPAC.

Areas of new native vegetation disturbance have been substantially reduced from those proposed in the August 2013 version of the NVMP in response to community concerns raised during consultative meetings associated with revision of the PEPR to encompass the LOM extension.

1.4 NVMP Structure

This NVMP comprises a title page, a table of contents and six chapters:

- **Chapter 1** - (this chapter) – Background information.
- **Chapter 2** – Site and vegetation and fauna description.
- **Chapter 3** – Management and mitigation measures.
- **Chapter 4** – SEB Offset calculation.
- **Chapter 5** – SEB Offset implementation
- **Chapter 6** – References.

2. SITE AND VEGETATION DESCRIPTION

ML 6345 contained approximately 113 ha of remnant vegetation; consisting of 7 differing vegetation communities distributed over approximately 440 ha prior to 2011 (see Table 1). Vegetation condition ranged from degraded and highly modified patches, given an SEB Condition Ratio of '2:1', to patches with high levels of diversity in very good to excellent condition, given an SEB Ratio of 8:1. A total of 20.5ha of native vegetation disturbance was approved in our initial PEPR, requiring the establishment of 125.5 ha of SEB-offset vegetation within the ML, in conjunction with measures to protect and enhancement all remnant vegetation within the ML.

Surveys of potential new disturbance areas associated with the LOM-extension proposal were conducted by EBS-Ecology in June 2013. Significant rainfall through the winters of 2011, 2012 and 2013 and associated vegetation recovery following previous drought affected seasons, enabled the survey team to accurately represent the endemic flora of each area for referral to DSEWPaC. ML vegetation condition was significantly improved at the time of the 2013 survey, when compared to that viewed by Ecological Associates during the dry spring of 2007.

Though the June 2013 EBS survey was not conducted at the seasonal peak, we consider that the surveyors were sufficiently experienced to accurately identify emergent flora within the survey areas and we are comfortable that their findings provide an accurate representation of patch composition and quality. Regardless of this, have applied an 8:1 offset-ratio to disturbance in vegetation patches listed as 6:1, and a 10:1 offset-ratio to disturbance in patches listed as 8:1 vegetation in the EBS 2013 survey. The distribution of vegetation communities described by EBS is illustrated by Figure 3 (below).

2.1 Land Use History

The Kanmantoo Copper Mines have a long history of mineral exploration and mining which began in 1846 and continued to 1874, with intermittent prospecting continuing in the area until the 1960s. In the early 1970s, Kanmantoo Mines Limited commenced open-cut mining over the northernmost workings of the earlier underground Kanmantoo mines. The first open-cut mine operated for six years. Mining infrastructure remaining on the site from these operations included an open pit (approximately 120 m deep), processing plant (now used as a site for fertiliser manufacture), a partially revegetated waste rock dump and a tailings dam. The site also has been disturbed by past works to establish hardstands, roadways and other historic infrastructure.

In late 2003, Hillgrove began an exploration program in the Kanmantoo area and in April 2004, the company acquired the historic Kanmantoo Copper Mines mining lease (ML 5776).

Grazing and cereal cropping has been occurring in the Kanmantoo/Callington region for over 100 years. The flora in and around the Kanmantoo Copper Mines has been substantially altered through a long history of clearing to support intensive grazing and dry-land cropping. Woody weeds now occur in many remnant stands of native vegetation and introduced grasses occupy large parts of the ML area, particularly over former cropping land and around fenced grazing paddocks. Hillgrove discontinued grazing and cropping within ML6345 prior to the commencement of on-ground works in 2011.

2.2 Vegetation Communities

The Kanmantoo Copper Mines are located in the region covered by the Biodiversity Plan for the South Australian Murray–Darling Basin and within the Eastern Mount Lofty Ranges Regional Ecological Area (REA). The ML is in a 425mm rainfall zone. It is on the cusp between two adjacent floristic regions of SA, driven by high and low rainfall respectively. Subsequently, the ML's flora is diverse, containing a broad range of species which are routinely seen in either rainfall zone.

There has been extensive clearance of native vegetation within the Eastern Mount Lofty Ranges REA, with only 6% of the pre-European settlement vegetation cover remaining (Ecological Associates, 2007). As with most settled areas in Australia, the majority of regional clearance has been associated with agricultural enterprises, housing and establishment of related infrastructure.

Eight native vegetation communities were listed within the ML area by Ecological Associates in 2007. This was revised to 7 communities by EBS-ecology in 2013, due to the absence of significant stands of *Eucalyptus gracilis* within the woodland 'Patch 18' to the north of the historic open-pit (Fig 2). Vegetation communities impacted by the LOM extension are summarised in Table 1 and described in detail below. The total area of native vegetation represented by the EA 2007 and EBS 2013 surveys remains the same. The 2013 EBS survey is appended as Attachment B, below.

Table 1. Native Vegetation Communities within ML 6345

		PEPR/EA Survey			Revised EBS 2013 Survey	
Vegetation Community	**Conservation Significance**	**Condition (SEB Ratio)**	**Patch Numbers**	**Area (ha) Within ML**	**Patch Numbers**	**Area (ha) Within ML**
Eucalyptus odorata low woodland	National level, critically endangered. State level - Priority 3	8:1	10, 14	14.93	10, 14	20.28
		6:1	12, 17, 23	9.66	12, (17 inc in 10), 23	8.29
		4:1	1, 2, 3, 4, 5, 6, 11, 13	28.50	1, 2, 3, 4, 5, 6, 11, 13	28.50
		2:1	15, 30	1.05	15, 30	1.05
Lomandra effusa +/- Helichrysum leucopsideum open tussock grassland	National level, critically endangered. State level - Priority 1	8:1	22, 28, 37	17.77	22, 28, 37	15.86
		6:1	29, 36	2.06	29, 36	6.94
		4:1	24, 25, 31, 32, 33	3.46	24, 25, 31, 32, 33	3.46
Austrostipa sp. open tussock grassland	Regional level - threatened	8:1	27	11.61	27	8.66
		6:1	26	4.66	26	4.66
		4:1	34, 35	0.73	34, 35	0.73
Callitris gracilis low woodland	Regional level - threatened	8:1	16	0.19	16	0.19
Eucalyptus leucoxylon +/- Lomandra effusa woodland	Regional level - threatened	6:1	8	1.27	8	1.27
Eucalyptus gracilis +/- Eucalyptus oleosa open mallee	Not listed	8:1	18	4.00	(Inc in 10)	0.00
Acacia pycnantha low woodland	Not listed	6:1	19	7.74	19	7.74
		4:1	7, 20, 21	3.49	7, 20, 21	3.49
Allocasuarina verticillata +/- Callitris gracilis woodland	Not listed	8:1	9	1.84	9	1.84
Scattered Trees	Not listed	n/a	n/a	56 trees	n/a	56 trees
			Total	**112.96**	Total	**112.96**

Figure 2. Original ML vegetation survey as described by Ecological Associates in 2007

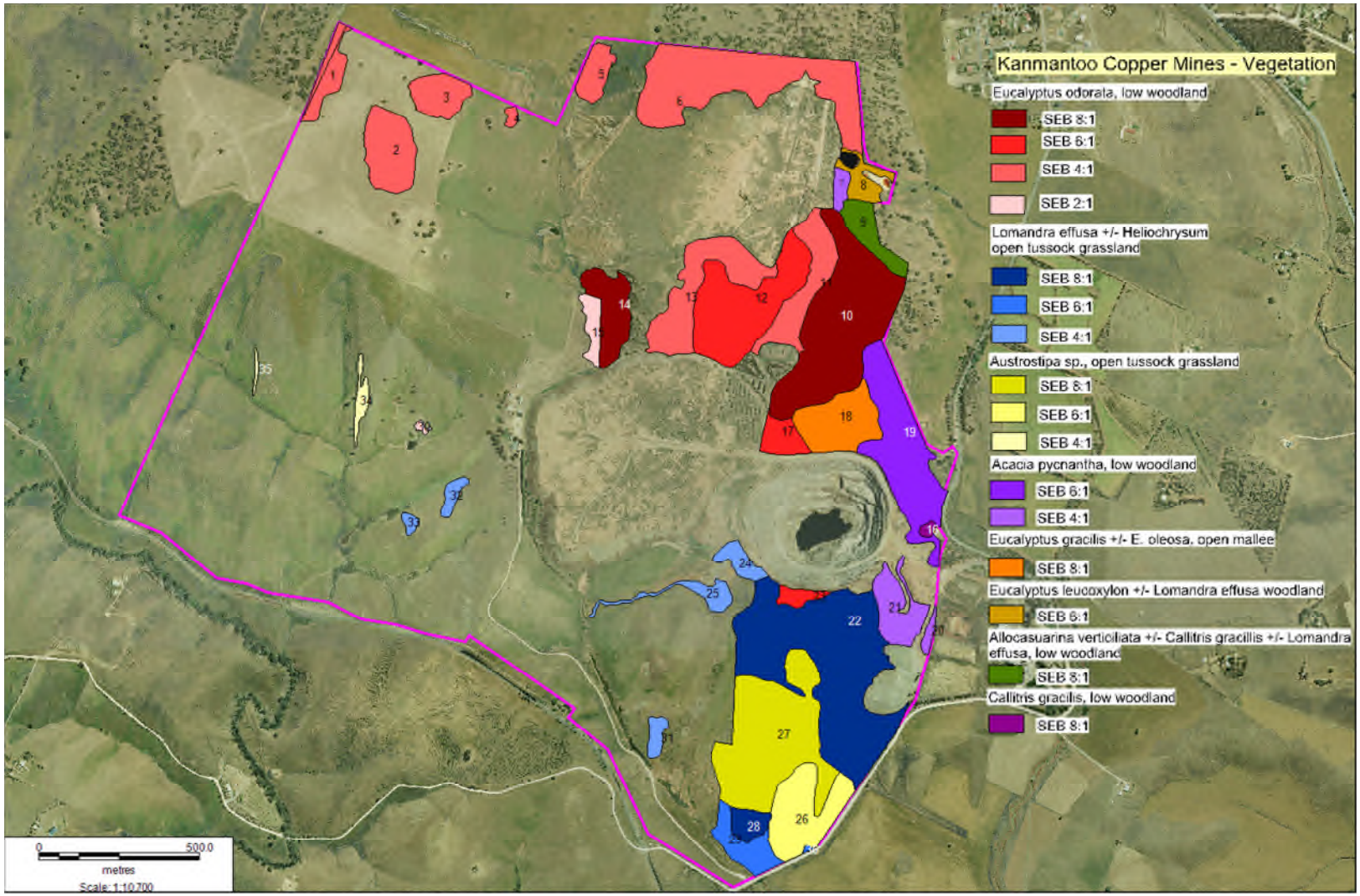
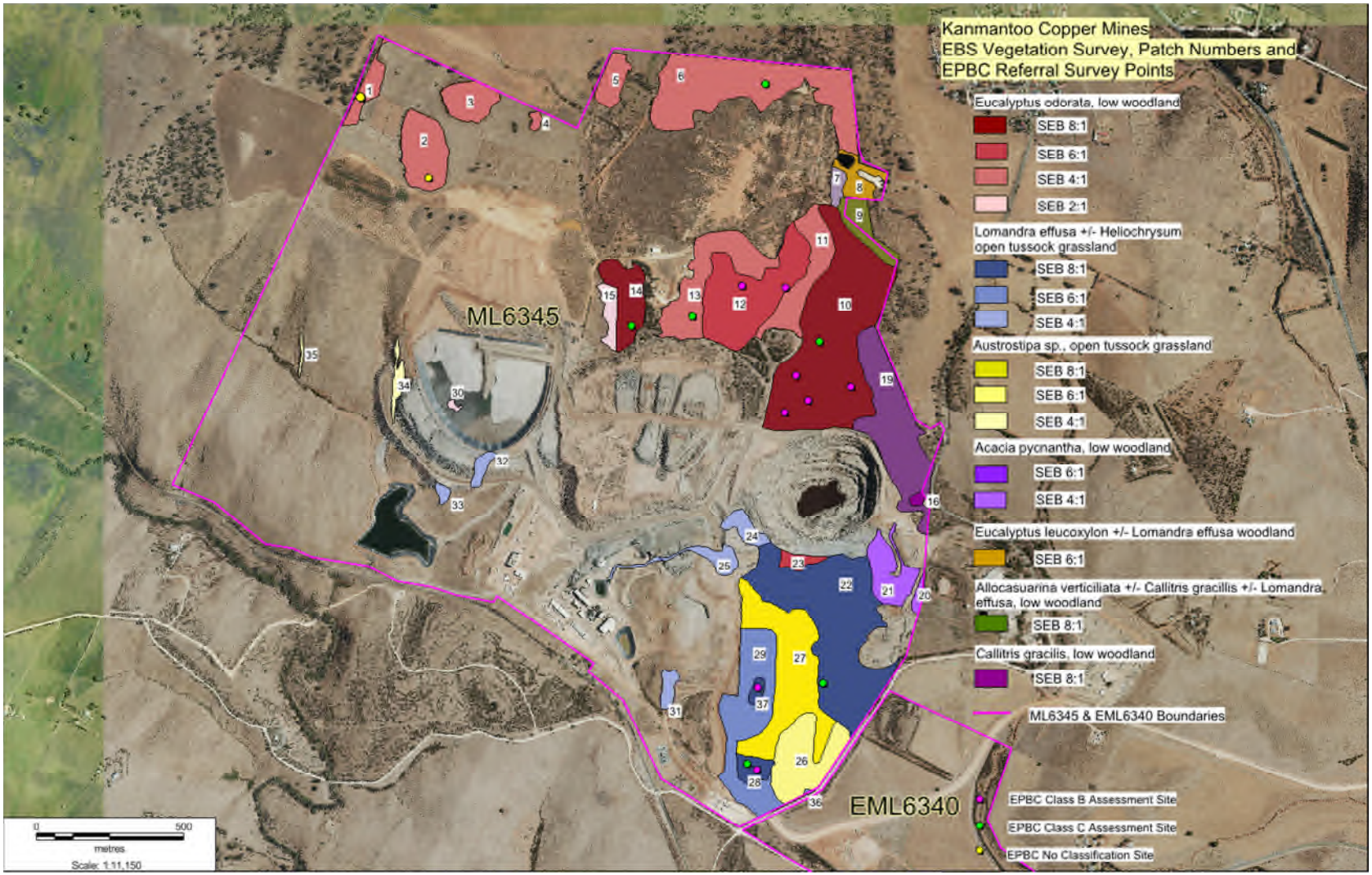


Figure 3. Revised 2013 EBS Vegetation Survey, Listing Patch Numbers, and EPBC Survey Points



Key changes to patch areas between the EA (2007) survey and EBS (2013) survey include the reassignment of Patch 18, '*E. gracilis*+/- *E. oleosa* open mallee to become part of an expanded Patch 10 (8:1 *E. odorata* low woodland). The inclusion of Patch 17 (6:1 *E. odorata*) into Patch 10 upgrades this area to 8:1. Minor realignment of boundaries between Patch 22 (*L. effusa* grassland) and Patch 27 *(Austrostipa sp*. Grassland) and the creation of a new Patch 37, 8:1 *L. effusa* +/- *H. leucopsideum* open tussock grassland within Patch 29 were possible due to improved vegetation expression. These changes are illustrated by the differences between vegetation patch boundaries observed in Figures 2 & 3.

The native vegetation communities which were approved for disturbance by the initial phase of mining operations are fully described by the current NVMP (PEPR, (2010) and are illustrated by the yellow disturbance footprint in Fig 4. Vegetation communities which will be disturbed by activities associated with the LOM extension are within the red LOM disturbance footprint, illustrated by Figs. 4 & 5 (below), and within the hatched areas illustrated by Fig. 6 (below).

2.2.1 *Eucalyptus odorata* low woodland

This is the most extensive vegetation community in the ML area, originally occupying approximately 58 ha with patch conditions ranging from 2:1 (EPBC unclassified) to 8:1 (EPBC Class B). The greatest areas are rated as 4:1 (EPBC Class C).

The LOM extension will disturb a total of 1.8ha of 8:1 *E. odorata* woodland in patch 10, rated as EPBC Category B by EBS (2013). This area is in very good condition and was classified as Class B due to the presence of more than 15 native species, more than 3 additional herbaceous species and more than 2 grass species over an area of more than 1ha (see Fig 5, below).

2.2.2 *L. effusa ± Helichrysum leucopsideum* open tussock grassland

This vegetation community originally occupied approximately 26 ha of the ML area and occurs predominantly to the south of the existing open pit on the crest and slopes of MacFarlane Hill.

The LOM extension will disturb a total of 3.4 ha of 8:1 *L. effusa* grassland in patch 22, rated as EPBC Category C by EBS (2013). This area is in very good condition and was classified as Category C due to the presence of more than 5 native species and more than 1 grass species.

Other areas of *L. effusa* grassland disturbance attributable to the LOM extension include 0.01ha of 6:1 grassland in patch 29 and 1.0ha of 4:1 grassland in patches 25, 31 and 33. These areas are highlighted by Fig. 5 (below).

2.2.3 *Austrostipa* sp. open tussock grassland

Remnant patches of *Austrostipa* sp. open tussock grassland originally occupied approximately 14 ha within the ML. The community is floristically similar to *L. effusa* open tussock grassland; however, *L. effusa* is absent and the native grass *Austrostipa* sp. is the dominant species. *Austrostipa* sp. open tussock grassland occurs predominantly on the southern crest and slopes of MacFarlane Hill.

The LOM extension will disturb a total of 0.2ha of 8:1 Austrostipa sp. Grassland within patch 27. This area is highlighted by Fig. 5, below.

2.2.4 *Acacia pycnantha* low woodland

Remnant patches of *Acacia pycnantha* low woodland occur to the immediate east and northeast of the existing pit and originally occupied 11.2 ha within the ML. Vegetation disturbance attributable to the LOM extension will include 1.5 ha of 6:1 *A. pycnantha* woodland in patch 19 and 1.1ha of *A. pycnantha* woodland in patches 20 and 21 as illustrated by Fig.5.

Figure 4. ML Vegetation Communities, Highlighting PEPR-Approved Disturbance Boundary and Proposed LOM Disturbance Boundary

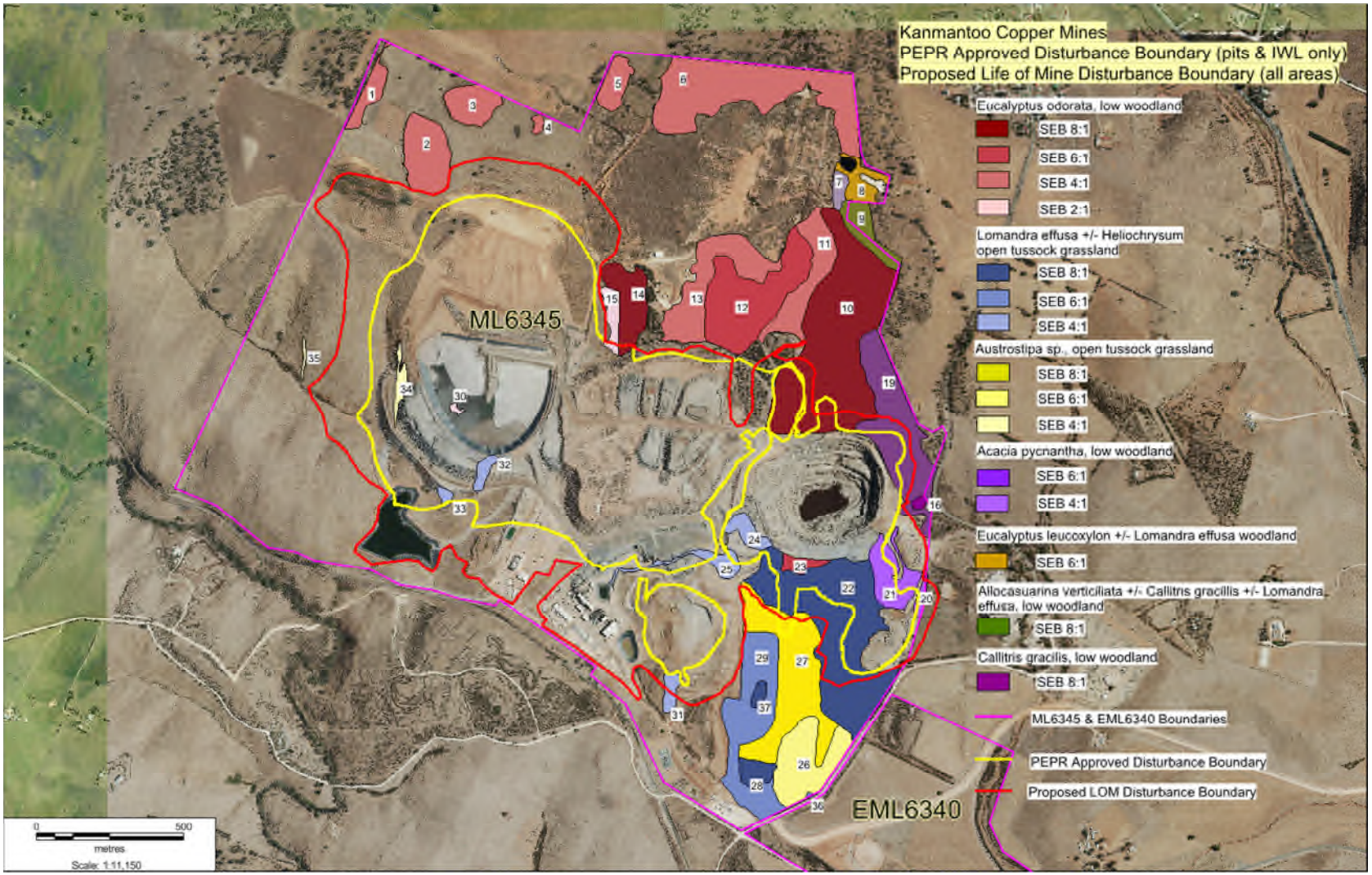
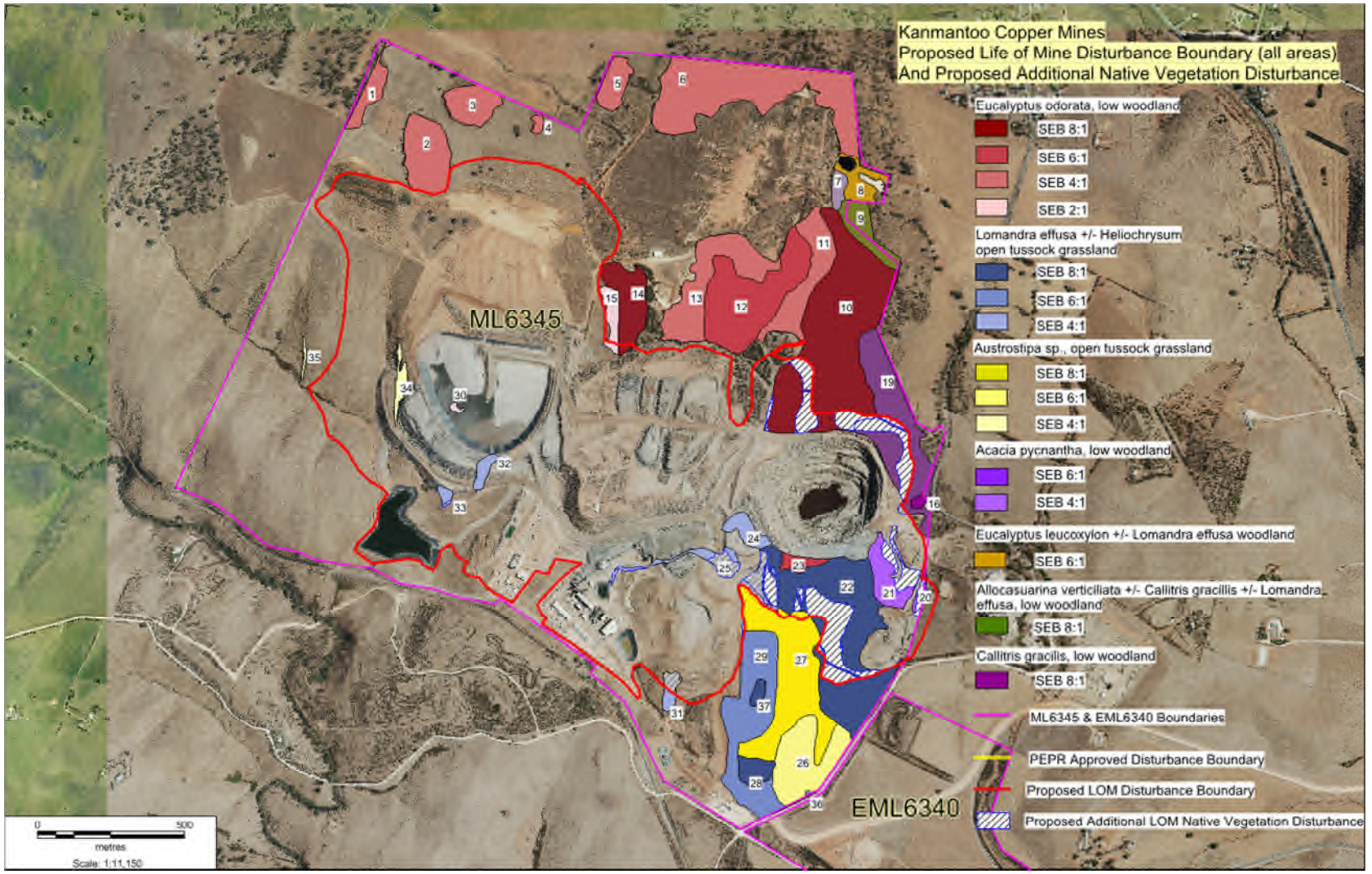


Figure 5. Proposed Additional Native Vegetation Disturbance Associated with LOM Extension



2.3 Flora of Conservation Significance

2.3.1 Plant Species of Conservation Significance

No individual plant species of national (EPBC Act-listed) conservation significance (Section 179) have been recorded in the ML and none are considered likely to be present.

Two flora species of state-listed conservation significance (i.e., listed under the NPW Act) have been recorded in the ML, and may be within LOM extension areas, however only one species has been located during recent surveys:

- ***Diuris behrii* (Behr's cowslip orchid)** - Listed as vulnerable. This species was recorded to the north of the main pit during the spring 2007 survey. It has not been observed within the proposed LOM extension areas within patch 10; however we will continue to look for it and will rescue any specimens if they are found. Rescued plants will be cared for by the Native Orchid Society of SA (NOSSA), under arrangements described by the current NVMP for preservation and propagation of *D. behrii* rescued from initial mine clearance areas. As with current *D. behrii* plants being cared for by NOSSA, future plants will be returned to the ML in prepared and protected areas within woodlands and suitable SEB-offset patches (see Plate 7, below).
- ***Ptilotus erubescens* (hairy-tails) -** Listed as rare. There is one historical record of *Ptilotus erubescens* within the ML Region. This record is from the Biological Database of South Australia (managed by the Department of Environment and Natural Resources) and dates from 1994. *P. erubescens* has not been observed within LOM extension areas and is not expected to be present.

The shrub *Acacia iteaphylla*, listed under the NPW Act as rare in South Australia, occurs within the ML and is within the LOM extension area; however, this species is growing outside of its natural range and can be considered introduced in the context of the ML's native vegetation. The species is commonly planted elsewhere in revegetation projects, but has the potential to become an invasive woody-weed at Kanmantoo.

2.3.2 Vegetation Communities of Conservation Significance

Three communities occur within the ML; all of which are likely to be disturbed by the LOM extension:

- ***E. odorata* low woodland.** This vegetation community is significant at the national level, listed as a critically endangered ecological community (as Peppermint Box (*E. odorata*) Grassy Woodland) under the EPBC Act (DEWR, 2007), at a state level, listed as Priority 3 for conservation under the NPW Act, and at the regional level, listed as threatened within the South Australian Murray–Darling Basin (Ecological Associates, 2007). Proposed LOM extension disturbance within EPBC Class B woodland is currently the subject of an EPBC referral.
- ***L. effusa* ± *Helichrysum leucopsideum* open tussock grassland.** This vegetation is significant at the national level, listed as a critically endangered ecological community (as Iron-grass Natural Temperate Grassland) under the EPBC Act (DEWR, 2007), at the state level, listed as Priority 1 for conservation in South Australia under the NPW Act, and at the regional level, listed as threatened within the South Australian Murray–Darling Basin (Ecological Associates, 2007).

Proposed LOM extension disturbance within the ML's 'Class C' *L. effusa* open tussock grassland communities are currently the subject of an EPBC Referral.

- ***Austrostipa* sp. open tussock grassland**, ***E. leucoxylon* ssp. *leucoxylon* ± *L. effusa* open woodland** and ***Callitris gracilis* low woodland** are significant at the regional level, listed as threatened within the South Australian Murray–Darling Basin.

2.4 Fauna of Conservation Significance

The following fauna species of national and state-listed conservation significance are present in the ML area. All species have been observed during each of the spring fauna surveys since the commencement of mining operations.

Birds

The **rainbow bee-eater** (*Merops ornatus*), a marine-listed species under the EPBC Act, was recorded across the ML area. Rainbow bee-eaters recorded in the ML area may be significant at the local level as they are likely to breed in sandy banks along water courses and use woodland habitat within the ML area, however, the presence of this species is unlikely to be significant at the regional, state or national level due to its wide distribution and transient nature. It is not expected that LOM extension disturbance will significantly impact rainbow bee-eater populations within the ML.

The **diamond firetail** (*Stagonopleura guttata*), listed as vulnerable under the NPW Act, has declined over most of its historical range across south-eastern and eastern Australia in both extent and density (Ecological Associates, 2007). The *E. odorata* low woodland in the ML area is likely to provide habitat for this species and the population in the ML area is likely to be significant at the local and regional level. It is not expected that disturbance of an additional 1.8 ha of *E. odorata* woodland by the LOM extension will significantly impact local or regional diamond firetail populations.

The **peregrine falcon** (*Falco peregrinus*) is listed as rare under the NPW Act. The species has a worldwide distribution; however, it has declined significantly in most countries other than Australia. In Australia the population is substantial, widespread and viable, while in South Australia the resident population is small, with the total population estimated at less than 3000 mature individuals (Ecological Associates, 2007). A study in Victoria (Ecological Associates, 2007) suggests that nesting pairs of this species are tolerant to disturbance associated with mines and quarries. It is not expected that disturbance associated with the LOM extension will adversely impact peregrine falcon populations in the ML.

The **white-winged chough** (*Corcorax melanorhamphos*) is listed as rare under the NPW Act, The species has a distribution across south eastern and eastern Australia and the population across this range has declined. Although still common in good habitat patches of drier woodland and open forest, choughs are weak flyers and do not cope well with habitat fragmentation, so many isolated populations are vulnerable (BIRD, 2007). A Chough family group have been observed in the woodland habitat within the ML area, ranging to the north of the main pit and the northern-boundary of the ML. It is not expected that disturbance associated with the LOM extension will adversely impact chough populations in the ML.

Mammals

The **brushtail possum** (*Trichosurus vulpecula*) was the only mammal species of listed conservation significance under the NPW Act that was recorded in the ML area. No mammal species of listed conservation significance were recorded under the EPBC Act, or considered

likely to be present, within the ML area. The brushtail possum has the widest distribution of any Australian mammal, being found across southern, eastern, and northern Australia.

The relatively large *E. odorata* low woodland habitat in the ML area is considered important to this species at the local and regional level. A total of eighty-eight Brushtail possum sightings were recorded during the 2012 Spring Fauna Survey (EBS, 2013). Most of these were in the isolated *E. odorata* patches near the Mine's Seed Production Area (SPA) in the North West quadrant of the ML and are well outside of the LOM extension area in Patch 10.

It is not expected that disturbance associated with the LOM extension will adversely impact the region's brushtail possum population, however if displaced possums are encountered during clearance operations, we will seek expert advice to assist with their rescue. We understand that relocated brushtail possums have a low survival rate, so alternative options including (but not limited to) re-homing through wildlife sanctuaries or accredited private collectors will be considered. As new areas of SEB-offset vegetation are progressively created within and adjacent to the ML, it may become possible to create new home ranges for displaced possums through the use of nesting boxes and imported hollows. Should the opportunity arise, expert advice will be sought on the best way to implement this.

2.5 Distribution of Weed Species

Introduced Species

Forty-seven introduced plant species have been recorded in the ML area, including:

- **Grasses**. Wild oats (*Avena barbata* and *Avena fatua* are the most abundant grass species within the ML and are very common throughout the agricultural regions of South Australia. Within the ML area, they were most abundant within the *Austrostipa* sp. open tussock grassland, *L. effusa* open tussock grassland and abandoned cropping land, which is also prone to infestation by great brome (*Bromus diandrus*), annual ryegrass (Lolium rigidum), phalaris (Phalaris aquatica) and silver grass (Vulpia sp.)

- **Herbs.** Herb species include bridal creeper (*Asparagus asparagoides*), South African weed orchid *(Disa bracteata)*, artichoke thistle (*Cynara cardunculus ssp. flavescens*), blackberry nightshade (*Solanum nigrum),* Horehound (*Marrubium vulgare*), Sour-sob (*Oxalis pes-caprae),* spiny rush (Juncus acutus) and small amounts of Salvation Jane (*Echium plantagineum*).

- **Shrubs.** Shrub species include red-head cotton-bush (*Asclepias curassavica*), Flinders Ranges wattle (*Acacia iteaphylla*), western coastal wattle (*Acacia cyclops*), gorse (*Ulex euopaeus*) and boneseed (*Chrysanthemoides monilifera* ssp*. monilifera*).

- **Woody weeds.** Woody weeds recorded within the ML area include olive (*Olea europaea* ssp. *europaea*), Aleppo pine (*Pinus halepensis*), Cape Leeuwin wattle/Albizia (*Paraserianthes lophantha*), wild tobacco (*Nicotiana glauca*) and African boxthorn (*Lycium ferocissimum*).

3. MANAGEMENT AND MITIGATION MEASURES

Avoidance, management and mitigation measures have been developed to reduce the potential impacts on flora and fauna associated with the initial phase of mining operations as described in the approved PEPR and its NVMP. Mitigation measures are currently applied to all areas of remnant vegetation within the ML and will be similarly applied to the adjacent land areas available for SEB-offset as highlighted in Figs. 7 & 8.

Mitigation measures for the purpose of limiting the impact to native vegetation of disturbance associated with the LOM extension are as follows…

3.1 Vegetation Clearing

The management of the risks associated with additional areas of vegetation clearing will be based on the following hierarchy:

1. Avoiding areas with communities of conservation significance where possible and minimising approved vegetation clearance where this can be achieved
2. Avoiding disturbance in all other remnant native vegetation
3. Appropriately managing the approved clearance of native vegetation
4. Monitoring and reporting the clearance of all vegetation
5. Mitigating approved vegetation disturbance through the provision of corresponding SEB-offset areas

3.1.1 Avoiding Areas with Communities of Conservation Significance & Minimising Clearing where it is Deemed Necessary

The Hillgrove Environment Department works with mine planners and shift supervisors to ensure that the disturbance of native vegetation with conservation significance is minimised at all times and that staff are aware of the conservation value placed on patches adjacent to the mining footprint.

One example of this was the reduction in native vegetation disturbance necessary to proceed with the LOM extension. This was achieved by negotiating modifications to pit designs and subsequent disturbance footprints with the Mining Department. In this case, the area of native vegetation which would be disturbed by the LOM extension was reduced from approximately 12.8ha in earlier versions of the LOM extension plan to approximately 9.1 ha in its current form. The majority of this reduction was achieved by limiting the area of *E. odorata* woodland disturbance in patches 10, 11, 12, 14 & 15 from 5.2ha to 1.8ha. This change incorporates the concerns of our local community with regard to northern extension of the main pit and limits fragmentation of patches 10, 11 and 12 in particular (see Figs 5 & 6).

Approved native vegetation disturbance is strictly controlled and cannot proceed without HGO Environment Department Approval and issuing of Land Clearance Certificates together with an Excavation Permit, which is reviewed and countersigned by each of HGO's department Managers (see details below). The Hillgrove Environment Department will continue to work with mine planners to ensure that disturbance to remnant vegetation of conservation significance is avoided wherever possible and that mine staff remain aware of the importance of our remnant vegetation stands in all aspects of our operations.

3.1.2 Avoiding Disturbance in all Other Remnant Native Vegetation

Measures to minimise disturbance in all other remnant vegetation types, both within and adjacent to the ML on Hillgrove-owned properties include:

- Employing a strictly enforced land clearance permit system for all disturbance activities. This permit system requires detailed mapping of proposed disturbance by the proponent, sign-off by each of the Mine's operational Departments, an on-ground vegetation survey by Environment Department staff and final HGO Environment Department approval before disturbance is authorised.

  The HGO Environment Department routinely place restrictions on disturbance areas or request redesign of proposals to avoid sensitive vegetation where this can be practically achieved. The HGO Environment Department also walks cleared areas following earthmoving activities to ensure that Permit conditions have been followed. Any breaches of Permit conditions are formally reported and are followed up with the responsible HGO Department Manager.

- Strictly limiting any form of disturbance in all areas of native and non-native vegetation
- Limiting disturbance by locating access tracks, bunds and other mine infrastructure outside of vegetation remnants wherever possible.
- Minimising the length and number of access tracks in remnant vegetation. This includes closing off redundant tracks where feasible.

3.1.3 Appropriately Managing the Approved Clearance of Native Vegetation

Measures to appropriately manage the clearing of vegetation, where the above steps cannot avoid this, include:

- Educating workers in the importance of protecting native vegetation by:
  - Including information on the importance of threatened plant species, vegetation clearance restrictions and conservation aims in the induction process.
  - Ensuring staff are aware that plant identification charts, conservation information and plant identification expertise are readily available through Environment Department Staff.
- Protecting areas of vegetation to be retained by:
  - Ensuring areas of vegetation to be retained are clearly marked on site plans.
  - Clearly marking 'no go' zones (e.g., with fencing, bunding and/or instructions) to ensure areas to be protected are clearly defined, identified and avoided.
  - Avoiding introduction of soil pathogens to areas of remnant vegetation by identifying and clearly demarcating soil stockpile sites. This includes pre-entry inspections of all new vehicles and earthmoving equipment and issuing of Equipment Inspection Certificates to compliant plant before they can commence work within the ML
- Developing site-specific vegetation clearance protocols for all personnel to follow. These protocols include:

– A step-by-step process to follow prior to commencing the clearing of any native vegetation. This includes an Excavation Permit, which requires a separate Land Clearance Certificate to be completed and approved by Environment Department staff in cases where vegetation clearance is required. This process ensures that:

– Areas to be cleared are mapped, pegged and verified.

– Areas to be retained are mapped, pegged and verified.

– A continuous-checking system is employed to minimise the potential for inadvertent clearing of native vegetation.

– Areas are only cleared immediately prior to their development.

– Ground disturbance is only undertaken within designated and approved areas.

– Clearance activities are coordinated to allow topsoil recovery and stockpiling

- Plant rescue campaigns are scheduled for designated clearance areas within appropriate seasonal windows prior to the commencement of land clearance. Plant rescue campaigns are carried out by collaboration between local Landcare volunteers and HGO Environmental Staff, with assistance provided through qualified Contractors (e.g., EBS and COOE).

Disturbed areas are progressively rehabilitated and unnecessary future disturbance of these areas will be avoided.

3.1.4 Monitoring of all Vegetation Clearance

Total vegetation clearance within the ML will be regularly monitored through routine on-ground observations, aerial photography and GIS-based mapping. Monitoring results will be reported annually in the MARCR. Regular auditing will also be carried out to assess the compliance of all personnel with vegetation clearance protocols listed above.

3.1.5 Mitigation of Approved Vegetation Disturbance Through the Provision of Corresponding SEB-offset Areas

Where vegetation clearance must be carried out to progress mining operations and approval has been granted clearance, care will be taken to ensure that the provision of SEB-offsets will commence at the same time that vegetation clearance occurs. The following measures are undertaken to ensure that clearance is mitigated through the provision of corresponding SEB-offsets:

- Working with local interest groups and other stakeholders where possible to maximise the benefits of SEB-offset programs, both in terms of the results achieved and in terms of creating both interest by and benefit for local groups (for example, the Kanmantoo Callington Landcare Group (KCLG) and other similar parties).

- Revegetating, using appropriate local species and local provenance seed sources (wherever possible), to link isolated vegetation remnants within the ML and provide a degree of continuity to offset areas located on properties immediately adjacent to the ML (See Figs 7 & 8).

- Relocating any threatened flora species to be disturbed by approved mining activities.

- Ensuring in-house environmental capabilities have been established and are maintained to develop, apply and manage revegetation and SEB-offset programs associated with the LOM extension. To date this has included (but will not be limited to) the construction and operation of a 1.0ha irrigated, Seed Production Area (SPA) within the ML and the establishment of a 5ha Seed Multiplication Area (SMA) on land directly adjacent to the ML in 2013 (please see Plates1 & 2, below).

  The SPA has been populated using native seed collected within the ML and near ML region. The SMA was sown in July 2013 using a combination of SPA-grown and local provenance seed. It is expected that a blend of SPA, SMA and annual wild seed collection will provide sufficient stock for progressive rehabilitation through the LOM extension and for final closure operations following the conclusion of mining. SPA, SMA and wild-seed collection programs are currently conducted in association with staff from EBS-Restoration.

- Establishing methods to monitor and maintain progressively rehabilitated and revegetated areas, including:

  – Establishing 360º photo-monitoring points throughout the ML area and at adjacent ML vantage points.

  – Establishing a series of Landscape Function Analysis (LFA) transects through benchmark vegetation communities (after Tongway & Hindley 2004). Data has been collected in association with staff from EBS-Ecology since the commencement of mining operations and will be used to gauge the progress of SEB and Rehabilitation plantings through regular LFA transect monitoring in newly established patches (EBS, 2013).

  – Developing procedures for conducting post closure follow-up visits to the ML area on a regular basis (of a decreasing frequency with time) to monitor the success rate of seedling emergence and survival, weed invasion, browsing levels (i.e., insect and animal attack of regenerating vegetation) and erosion, using photo-monitoring points to track progress.

  – Ensuring that the monitoring program reflects agreed closure criteria established through consultation with stakeholders.

- Acting where monitoring has identified erosion, weed invasion, failure of revegetation (to a material degree) or excessive browser damage to regenerating vegetation. This may include:

  – Repairing eroded areas.
  – Controlling weeds (chemical, mechanical, and manual methods).
  – Controlling pests (baiting, fencing, ripping etc.).
  – Infill planting.
  – Spot sowing.
  – Reseeding.

4. SEB- OFFSET CALCULATION

4.1 Extent of Vegetation Clearance

Native vegetation was cleared within the Kanmantoo ML between late 2010 and 2013 in PEPR-approved areas to accommodate mining infrastructure associated with the initial phase of mining operations. Details associated with approved vegetation clearance areas and their respective SEB-offsets are discussed in the PEPR NVMP (2010) and won't be discussed further in this plan.

A further 9.1ha of native vegetation disturbance will be required to extend the life of the mine. This will involve additional native vegetation disturbance to the north-west and south-east of the open pit and to the south of Emily Star pit as follows (Please note Fig. 8, below):

4.1.1 *Eucalyptus odorata* low woodland

The LOM extension will disturb a total of 1.8ha of 8:1 *E. odorata* woodland in patch 10, rated as EPBC Category B by EBS (2013). This area is in very good condition and was classified as Class B due to the presence of more than 15 native species, more than 3 additional herbaceous species and more than 2 grass species over an area of more than 1ha.

4.1.2 *L. effusa ± Helichrysum leucopsideum* open tussock grassland

The LOM extension will disturb a total of 3.4 ha of 8:1 *L. effusa* grassland in patch 22, rated as EPBC Category C by EBS (2013). This area is in very good condition and was classified as Category C due to the presence of more than 5 native species and more than 1 grass species.

Other areas of *L. effusa* grassland disturbance attributable to the LOM extension include 0.01ha of 6:1 grassland in patch 29 and 1.0ha of 4:1 grassland in patches 25, 31 and 33.

2.2.3 *Austrostipa* sp. open tussock grassland

The LOM extension will disturb a total of 0.2ha of 8:1 Austrostipa sp. Grassland within patch 27.

2.2.4 *Acacia pycnantha* low woodland

The LOM extension will include 1.5 ha of 6:1 *A. pycnantha* woodland in patch 19 and 1.1ha of *A. pycnantha* woodland in patches 20 and 21

The additional native vegetation clearance required to achieve the LOM plan is detailed in Table 2 and is illustrated by Figs 7 & 8. SEB-offset calculations for new disturbance areas have not been discounted as mitigation efforts currently in place for existing PEPR approved operations are associated with previously approved vegetation disturbance and are not the subject of this NVMP.

Areas assigned for the provision of SEB-offsets on properties adjacent to the ML do not contain known areas of remnant native vegetation, so discounts to SEB-offset areas do not apply.

As previously outlined, higher SEB ratios have been applied to 6:1 and 8:1 patches to adjust for any species which may not have been evident at the time of the 2013 EBS survey.

Table 2. Summary of Native Vegetation Disturbance and SEB-Offset areas – LOM Extension.

		LOM Extension - Additional Disturbance Areas					
Vegetation Communities	**Patch Numbers**	**Condition (SEB Ratio)**	**SEB Offset Ratio Applied**	**Area to be Cleared (ha)**	**Offset Area (ha)**	**Mapped LOM Extension SEB Areas**	**Offset Patch Numbers (Fig 9)**
Eucalyptus odorata low woodland	10	8:1	10:1	1.8	18.0	18.0	41, 43, 48, 49
Lomandra effusa +/- Helichrysum leucopsideum open tussock grassland	22	8:1	10:1	3.4	34.2	34.2	42, 50, 51, 53, 55
	29	6:1	8:1	0.01	0.1	0.1	56
	25, 31, 33	4:1	4:1	1.0	4.1	4.1	57, 58, 59, 60, 61
Austrostipa sp. open tussock grassland	27	8:1	10:1	0.2	2.0	2.0	44, 46, 62
Acacia pycnantha low woodland	19	6:1	8:1	1.5	6.0	6.0	38, 39, 45, 47
	20, 21	4:1	4:1	1.1	4.4	4.4	40, 52, 54
				9.1	**68.8**	**68.8**	**24 Patches**

4.1.1 Significance of Vegetation to be Disturbed

The significance of threatened flora species and vegetation communities within the ML is described in Section 2. Vegetation disturbance associated with the proposed LOM extension will affect the four significant vegetation types described above, but in particular:

- ***Vegetation of state and national significance*** - *E. odorata* low woodland and *L. effusa* open tussock grassland.
- ***Vegetation of regional significance*** - *Austrostipa sp.* open tussock grassland.

Of these vegetation types, *E. odorata* low woodland in particular, is known to support threatened fauna species. Two plants of state conservation significance, *Diuris behrii* (Behr's cowslip orchid) and *Ptilotus erubescens* (hairy-tails) have been recorded in areas to be affected by mining activities (although the *Ptilotus erubescens* has not been located in any of the recent flora surveys or on-ground plant rescue campaigns).

4.1.2 Conservation Value of Vegetation

The Draft Native Vegetation SEB Guidelines (DWLBC, 2005) list five conservation values that should be considered in association with vegetation clearing (summarised from Table 3 of DWLBC, 2005):

- Threatened vegetation communities.
- Wetland environments.
- Remnant vegetation.
- Threatened flora.
- Threatened fauna habitat.

The vegetation to be cleared is of conservation value for four of the five points. Wetland environments of conservation value do not occur within the ML area.

Figure 6. Proposed Native Vegetation Disturbance for LOM Extension

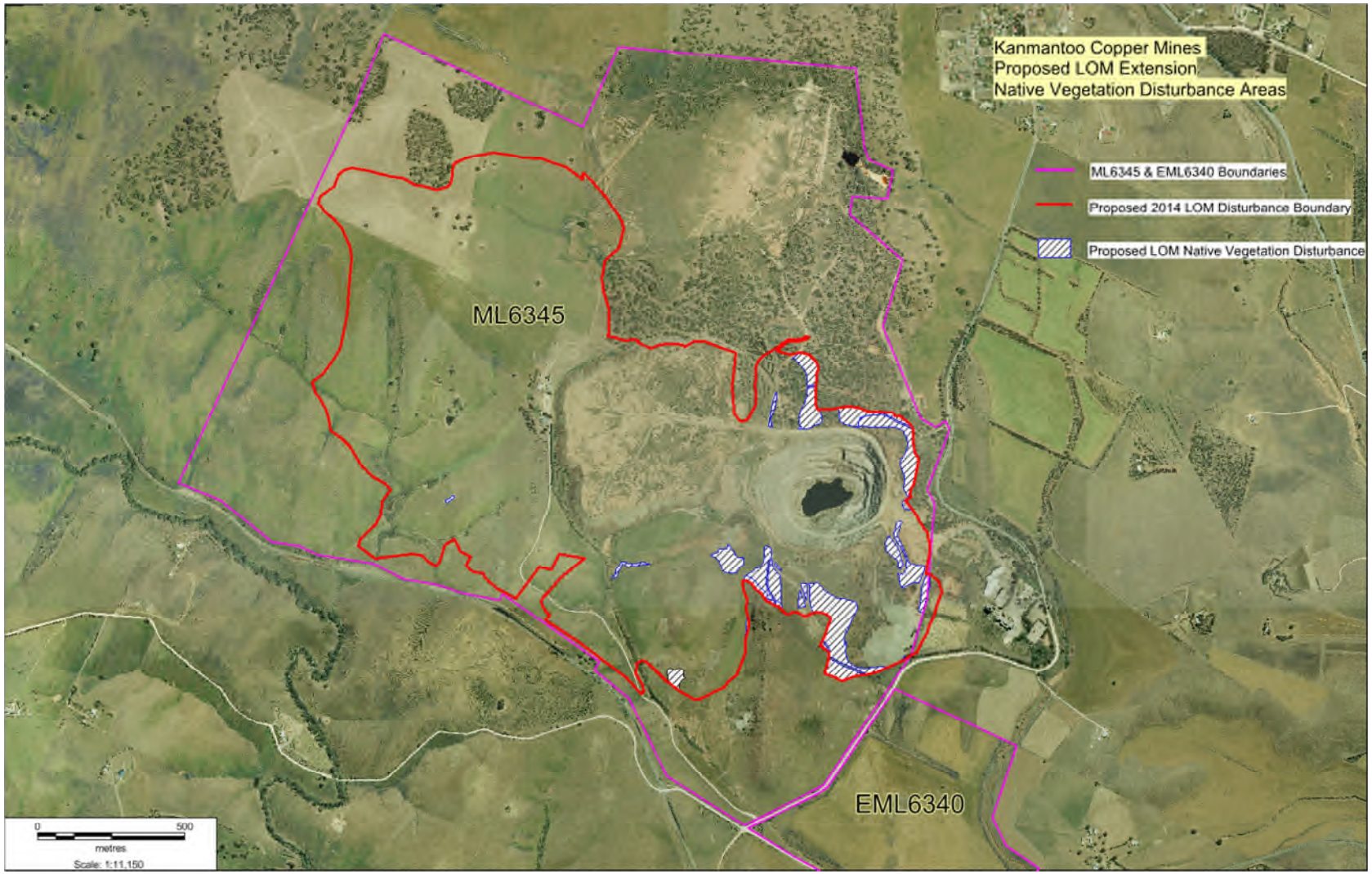


Figure 7. Proposed LOM Vegetation Disturbance & Corresponding SEB-Offsets on Nearby Hillgrove-Owned Properties

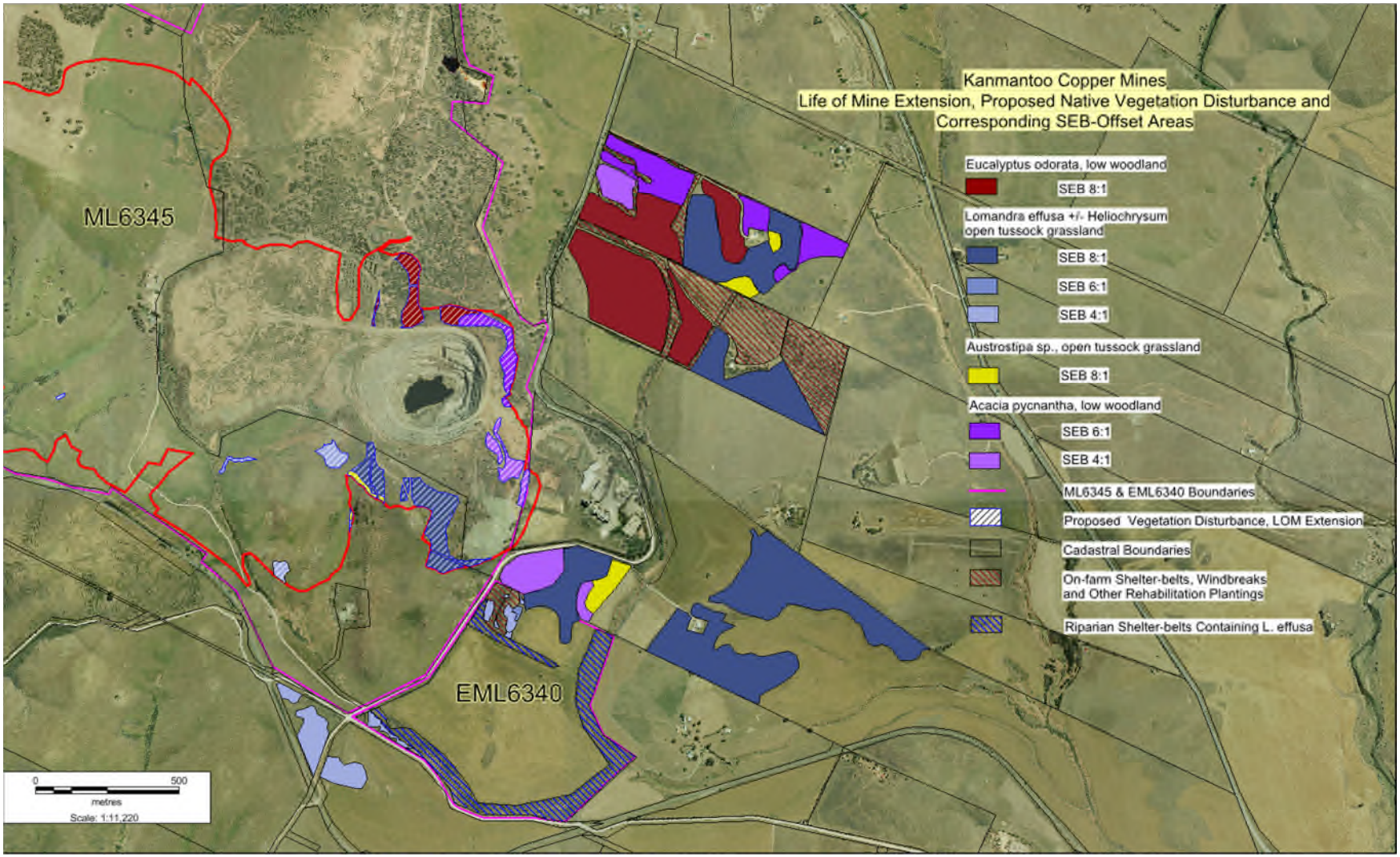
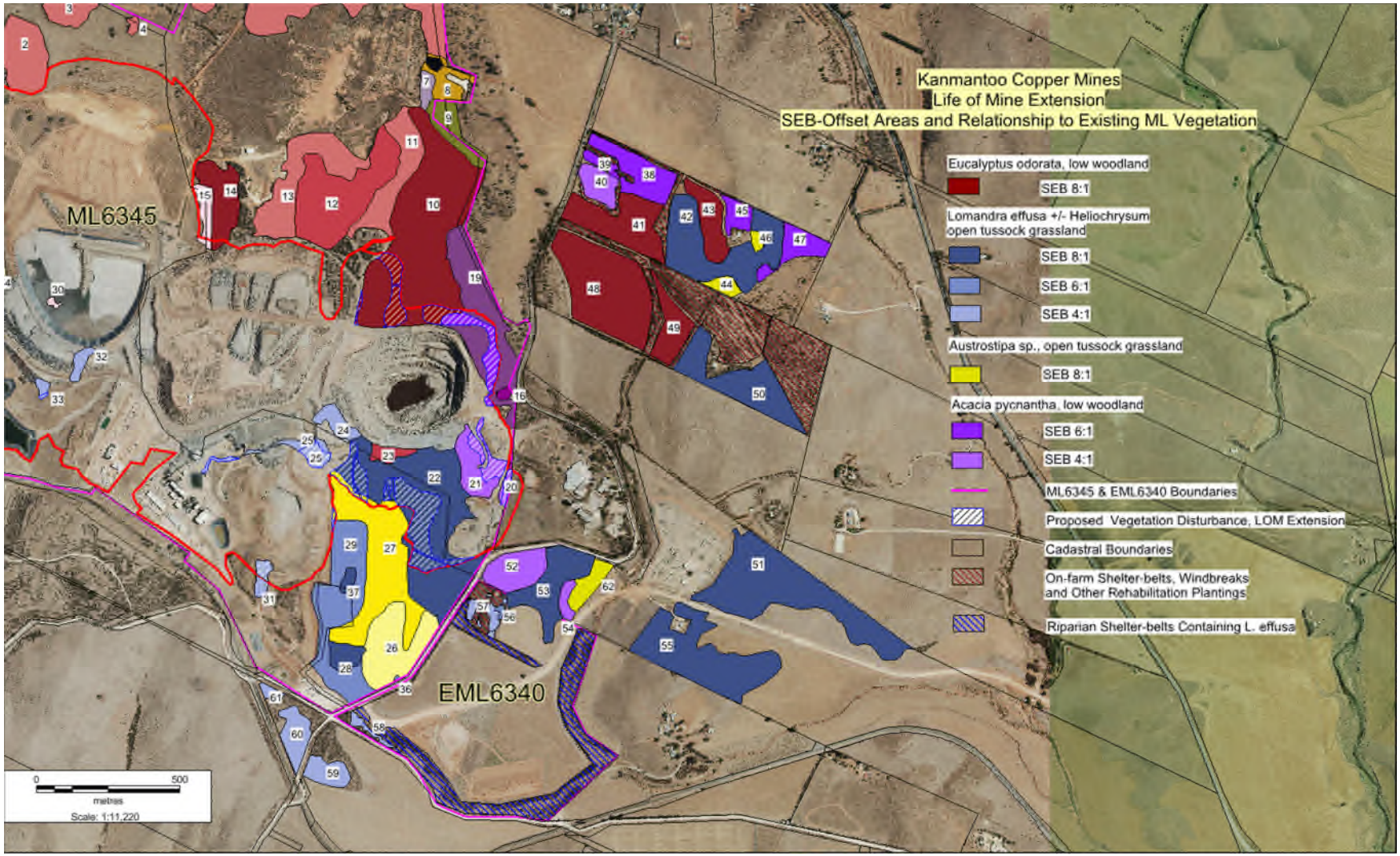


Figure 8. Proposed SEB-Offset Areas Illustrating Relationship to Existing ML Native Vegetation and LOM Extension Disturbance Areas



4.2 Impacts of Vegetation Clearance

The residual impacts of the proposed levels of disturbance to flora and fauna may include:

- Impacts to threatened vegetation communities.
- Impacts to threatened flora and fauna species.
- Reduced conditions favourable for plant growth due to dust.
- Reduced abundance of individual species (both flora and fauna).
- Increased abundance of introduced species (pest plant and animals).

4.3 Estimated Significant Environmental Benefit

4.3.1 Initial SEB Assessment

An SEB offset area of 125.25 ha was originally calculated to offset vegetation disturbance associated with the initial phase of mining operations. These areas rest within the yellow disturbance boundary and intersect native vegetation communities as highlighted by Fig. 4 (above). Disturbance areas and their corresponding offset sites for the initial phase of mining operations are described by the PEPR and will not be discussed by this NVMP.

The vegetation assessment criteria for the assignment of SEB Offset condition scores are listed in Attachment A, below. Details of the 2013 EBS vegetation survey are provided below in Attachment B.

When assessing the condition of native vegetation for SEB-offset purposes, the Native Vegetation Council advocates the substitution of 6:1 SEB ratios with an 8:1 ratio and an 8:1 ratio with a 10:1 ratio. This convention compensates for species which may not have been present during on-ground surveys of proposed disturbance sites. This convention has been applied to SEB-offset calculations for the LOM extension presented in Table 2 (above).

As outlined in Table 2, a total of 9.1ha of native vegetation disturbance will be associated with the LOM extension, requiring the establishment of 67.6ha of mixed SEB-offset vegetation (see Figs 7 & 8). As much of the ML has been previously allocated to SEB-offsets for PEPR-approved native vegetation disturbance, SEB-offsets associated with the LOM extension are proposed on Hillgrove-owned land, directly to the east of the ML. Table 4 lists the properties owned by Hillgrove and indicates which offset patches are earmarked for each property.

4.3.2 SEB Credit for On-site Restoration Activities

Basis

DWLBC (2005) guidelines allow for the initial SEB offset requirement to be reduced by approximately 50% where on-site ecological restoration activities will be achieved on completion of mining.

Ecological restoration is achieved by: ‘Returning the ecosystem to as a close approximation of its natural condition prior to disturbance’. The goal is to emulate a natural, functioning self-regulating system that is integrated with the landscape in which it occurs’ (DWLBC, 2005).

Application to the LOM Extension.

SEB-credits have already been applied to on-site restoration areas as assigned and approved in the PEPR. There is insufficient additional land within the ML to accommodate SEB-offsets for

additional vegetation disturbance associated with the LOM extension. Subsequently, SEB-offset areas associated with the LOM extension have been located as near as possible to the ML on suitable Hillgrove-owned land parcels. SEB-offset reductions associated with on-site restoration have not been applied to calculations associated with the LOM extension.

4.3.3 SEB Credit for Mitigation of Impacts

Basis

As with on-site restoration activities, the SEB ratio may be reduced by 50% when a project is likely to impact upon one or more of the conservation values, e.g., threatened flora and fauna and vegetation communities, but the proponent will commit to mitigating these impacts through measures additional to on-site ecological restoration (DWLBC, 2005).

As is the case for on-site restoration activities, on-site mitigation programs are already in place within the ML and there are no additional ML areas to which mitigation allowances can be claimed.

The adjacent Hillgrove-owned land parcels do not contain known areas of remnant native vegetation. Where revegetation has been attempted by previous landowners, many of the species chosen are non-provenance and would be largely unsuitable for enhancement to ML vegetation types without structural change. The remaining areas have been significantly modified by agricultural activity and have no significant native vegetation present.

Application to the LOM Extension

The reduction of SEB-offset areas for mitigation programs on Hillgrove-owned land parcels has not been applied to SEB-offsets associated to the LOM extension.

4.3.4 Calculated SEB Offset Requirement

The calculated SEB offset required for the proposed LOM extension is 68.8 ha (see Table 2).

The SEB offset area has been determined in accordance with the minimum area of vegetation disturbance required to achieve the LOM extension.

5. PROVISION OF SEB

5.1 Rationale

The rationale for provision of an SEB Offset is based on the premise that the clearance of native vegetation will result in a loss of biological diversity values (which include flora and fauna habitat), with the degree of loss dependent on the quality and amount of vegetation to be cleared (PIRSA, 2004).

To compensate loss of biological diversity values, the SEB offsets should not only replace the environmental values lost through clearing, but also lead to a net gain that contributes to improving the condition of the environment, either on the site of the operations or within the same region of the state. Alternatively, an appropriate sum can be paid into the SEB Offset Fund administered by the SA Government for disbursement to other offset creating programs.

An SEB-offset is intended to commence at the time of vegetation clearance and should be located on land as near as possible to the site of clearance.

It is intended that the conversion of farming and grazing land adjacent to the ML will provide a significant benefit to the environment as outlined below. Table 3 provides a list of properties owned by Hillgrove immediately adjacent to the ML. It highlights which properties have been earmarked to host SEB offset areas for corresponding new areas of native vegetation disturbance within the ML.

Table 3. Hillgrove-owned properties adjacent to the ML and Assignment of SEB Offsets

Property Name	**CT Reference/ Owner**	**Allocated offset Patches (see Fig 8)**	**Offset Types**
141 Mine Rd	F160800 A61/ Hillgrove	38, 39, 40, 41, 42, 43, 44, 45, 46, 47	*E. odorata* – 8:1; *L. effusa* – 8:1, *Austrostipa* – 8:1, A. pycnantha – 6:1 & 4:1
Mullewa	F1636 A1/ Hillgrove	48, 49, 50	*E. odorata* – 8:1; *L. effusa* – 8:1,
Ferguson's	D80644 A21/ Hillgrove	51, 55	*L. effusa* – 8:1
Lot 25	D60948 A25 (EML6340)/ Hillgrove	52, 53, 54, 56, 57, 58, 62	*L. effusa* – 8:1, 6:1 & 4:1; Austrostipa – 8:1
Back-Callington Rd/ Éclair Mine Rd	D47967 A4 and D30934 Q1/ Hillgrove	59, 60, 61	*L. effusa* – 4:1

It is intended that an SEB offset will be created on the assigned areas through the following means;

- Removing agricultural activity from allocated areas
- Installing rabbit-proof fencing and controlling rabbits/hares/foxes within fenced areas
- Carrying out ongoing weed control programs to remove introduced plant species
- Carrying out erosion mitigation works within assigned areas where possible
- Planting local plant species derived from local provenance seed within designated vegetation areas to create areas of high-value vegetation
- Following up planting programs with infill plantings where required
- Progressively providing nesting boxes, perches and/or refuges for local fauna within revegetated patches as they become increasingly capable of supporting local fauna populations.
- Involving local community groups and local contractors in all work where possible (to create both regional interest and regional employment)
- Protecting SEB-offset patches through appropriate Heritage Agreements

These steps are described in detail by Section 5.2 and Table 4, below.

It is important to note that successful implementation of the intended SEB offset program on agricultural land currently owned by Hillgrove and the subsequent protection of planted areas through Heritage Agreements will remove these areas from future agricultural production in perpetuity. This requires considerable investment by Hillgrove as the assigned land parcels will lose their real-estate value as productive agricultural land and will have a limited future niche market value if they are sold at a later date. This will be particularly so if plans to build a new water supply pipeline to the ML are realized and the land could have been sold as productive areas with associated irrigation licences.

5.2 Implementation

Hillgrove proposes to meet the SEB requirements of the LOM extension at the Kanmantoo Copper Mines by implementing the following SEB-Offset program on the land areas illustrated in Figs. 7 & 8 and highlighted by Table 4 (above):

Please note:

- SEB-offsets are provided on a 'like for like' basis with an area of vegetation disturbance being offset by the establishment of a corresponding area of offset vegetation
- The area of offset vegetation is proportionately larger than the area of vegetation to be disturbed. The size of the offset area is governed by the patch condition of the disturbed area and its assigned SEB offset ratio as highlighted by Table 2 (above)
- Work on the establishment of SEB-offsets (as outlined below) will commence at the same time as approved clearance occurs
- The floristic composition and plant density of the offset area will be the same as the disturbance area it offsets as illustrated by Fig. 8
- *Should the results of 'investigative studies' as discussed in point 5.2.7, below, prove that the provision of SEB Offsets on any particular allocated land parcel is impractical or financially unreasonable, Hillgrove reserves the right to directly fund the establishment of an equivalent SEB offset on private land in the near-mine region by third-party providers, following an appropriate Government approval process*

Table 4. Proposed SEB-Offset Work Program

		Year 1				Year 2				Year 3				Year 4... onwards			
Item No.	Description	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring
1	Removal of grazing/cropping pressure																
2	Schedule offset programs																
3	Survey revegetation plots																
4	Install rabbit-proof fencing																
5	Source equipment/ engage contractors																
6	Weed (W) and feral animal control (F)	F	W/F	W	W	F	W/F	W	W	F	W/F	W	W	F	W/F	W	W
7	Investigative Studies																
8	Enhancement of Native Veg Remnants																
9	Adjustment of boundaries & resurvey																
10	Build up seed reserves/order seeds																
11	Land preparation																
12	Planting programs																
13	Assess results and adjust methods																
14	Replanting program																
15	Establish Heritage Agreement																
16	Inspect & maintain fences																

Notes: *'Year 1' commences at the time of native vegetation disturbance associated with the LOM extension. The precise date of commencement will vary in accordance with variations to the mine plan. Conclusion of the SEB Offset program will occur when the offset communities are considered to be representative of the vegetation disturbance they offset (as determined by LFA and vegetation surveys) and the offset patches have become stable and self-sustaining. We understand that his may occur some years after Hillgrove's mining operations finish within ML 6345.*

5.2.1 Sharefarmer Negotiations – Removal of Grazing & Cropping Pressure from Designated SEB-offset Areas

Objective

To halt farming and livestock grazing activity within areas allocated for SEB-offset plantings as a first step to re-establishing native vegetation within assigned allotments on Hillgrove-owned land immediately adjacent to the Kanmantoo Mining Lease.

Discussion

One of the most significant drivers to the loss of regional biodiversity over the last 150 years has been the introduction of cropping and livestock grazing to the detriment of native woodlands and grasslands in the Kanmantoo area and other arable areas within Australia.

Historically, opening land to agriculture required extensive land clearance, generally through chaining and burning, followed by European-style cultivation including deep ripping and deep ploughing using mouldboard ploughs in early years. This effectively destroyed biodiversity and removed native fauna habitat throughout much of the Kanmantoo region.

Subsequent cropping activity and intensive cultivation destroyed regrowth, caused extensive erosion of our fragile, often dispersive soils and depleted native seed reserves over time. Northern-hemisphere weed seeds and other species from Southern Africa were unwittingly introduced as crop seed contaminants or as seed within fodder imported during droughts. This significantly altered the region's flora and as a consequence, the native wildlife it could support. Introduced fauna, including hares and rabbits followed, further acting to deplete regrowth of native seedlings and herbaceous plants and erode diversity within remnant native vegetation stands.

The removal of agricultural activity from land parcels assigned to SEB-offset rehabilitation will not in its-self reverse this progress. However, when coupled with rabbit-proof fencing and feral animal control, it will allow the land to commence rehabilitation and will permit the accumulation of native seed reserves once offset plantings begin to mature. In time, this will support natural recruitment driven by microclimate niches within the landscape and will aid in the establishment of self-sustaining native vegetation communities.

Activities

To meet this objective, Hillgrove proposes to:

- Negotiate with our neighbour and share-farmer to cease agricultural activities within the Hillgrove-owned allotments highlighted in Fig. 8 and Table 3
- Provide appropriate compensation to our neighbour to offset loss of income, either through employment or monetary means
- Eventually establish Heritage Agreements over assigned areas to prevent reintroduction of alternate land uses in later years.

5.2.2 Scheduling Offset Programs for Each Offset Patch

Objective

Schedule the commencement of SEB-offset work to coincide with corresponding approved land clearance areas within the ML as dictated by the Mine Plan.

Discussion

Work towards the establishment of SEB-offsets for approved native vegetation clearance should commence at the time that the clearance occurs on a '1 for 1 basis'. This is to ensure that there will be no net-loss of biodiversity or habitat in the long-term and the region's environment is delivered a net gain or 'significant benefit' to counteract loss of remnant vegetation areas.

While mining plans are broadly predicted and scheduled, variations to those plans may occur as a result of new resource information, operational variances or climatic events. Variations are reported to DMITRE in the annual MARCR (Mining and Rehabilitation Compliance Report) and may be the subject of both revisions to, and approval of, a revised PEPR if significant variances are required.

The current mine plan allows the commencement of land clearance within specific areas to be broadly predicted and correspondingly, work on the establishment of SEB-offset areas to be commenced at the appropriate time. Annual review of this program will be required to adjust for periodic changes in the mine plan. This will ensure that the seed, tube stock, physical and budgetary resources are available when needed and that planting will occur within seasonal windows of opportunity for each SEB-offset area. It is expected that the first areas of native vegetation disturbance associated with the LOM extension will occur in the 3rd quarter of 2014, which currently corresponds with 'Year 1' of Table 4, for the offset-patches related to this disturbance.

Activities

To meet this objective, Hillgrove proposes to:

- Work with mine planners to ensure that land clearance schedules are known and are updated in accordance with changes to the mine plan
- Periodically adjust the commencement of SEB-offset work and related work schedules to correspond with the timing of approved vegetation clearance
- Ensure that land preparation, budgetary resources, seed reserves and physical resources are available when required

5.2.3 Surveying proposed revegetation plots within assigned SEB-offset land parcels

Objective

Conduct detailed surveys of designated SEB-offset patches to ensure that they meet initial requirements in terms of area, land class and aspect for their intended offset vegetation type. If any area is determined as unsuitable, survey and allocate equivalent land parcels within Hillgrove-owned land immediately adjacent to the ML.

Discussion

The areas assigned to specific SEB-offset patches, as illustrated in Fig 8, are well known but they haven't been surveyed in detail at the time of writing this NVMP. The selection of SEB-offset patches for each vegetation class and community is based on current knowledge the aspect, terrain and soil type being broadly suitable for its intended end-use.

Detailed ground-based survey of each patch may identify localised features which exclude portions of designated areas from their intended rehabilitation purpose, or conversely confirm their suitability. If so, detailed survey will allow unsuitable areas to be identified and mapped. Any variance to the area available for SEB-offset patch establishment will be compensated by the assignment of alternate areas of appropriate size within the same land parcel or on an adjacent Hillgrove-owned land parcel.

Activities

To meet this objective, Hillgrove proposes to:

- Conduct a detailed ground-based survey of designated SEB-offset patches
- Delineate patch boundaries
- Map areas within delineated patches which are unsuitable for their intended end use
- Identify alternative areas of a suitable size within the same land parcel or on Hillgrove-owned land adjacent to the ML
- Survey, map and delineate alternate patch boundaries
- Modify NVMP maps and program plans as appropriate

5.2.4 Install and maintain rabbit-proof fencing to protect land parcels or individual SEB-patches as appropriate

Objectives

Contain and control feral herbivores and other feral animals within designated land parcels or SEB-offset patches. Prevent reintroduction of feral pests into designated offset areas from surrounding properties. Protect new offset vegetation from grazing by feral and domestic animals. Allow native seed reserves to accumulate within offset patches, both in the short and long term. Regularly inspect and maintain fences to ensure that pest reintroduction does not occur following control.

Discussion

Hares rabbits, goats and deer can devastate new plantings of native vegetation during the summer months when they are often the only source of palatable green feed. Similarly, unintended grazing by escaped livestock due to poor perimeter fences can significantly retard offset patch development. This is particularly so for direct-seeded areas, where tree guards can't be used cost-effectively.

Intensive, prolonged baiting programs with Pindone or 1080 are effective and can reduce rabbit and hare numbers in the short-term. However, such programs are expensive and poor perimeter fencing can lead to the ongoing reintroduction of feral pests from surrounding properties.

Numerous studies over the last 50-years have demonstrated the ability for native vegetation to re-establish within fenced exclosures, where the only driving forces for re-establishment are appropriate seasonal conditions and the removal of all grazing pressure. While areas of long-term cropping land are unlikely to contain significant quantities of remnant native seed, the exclusion and eradication of rabbits from newly planted rehabilitation areas can significantly aid seedling survival and establishment.

In the long-term, rabbit proof fencing allows feral animals to be controlled within fenced areas through baiting and other means. Once feral animals have been removed, appropriate fencing significantly reduces ongoing feral animal control costs by preventing the reintroduction of pests from surrounding properties. The absence of grazing pressure by rabbits in particular, will aid plant establishment, canopy development, seed accumulation, natural recruitment and ultimately, the establishment of self-sustaining vegetation communities.

Once fences have been established it will be necessary to carry out regular fence inspections and repairs throughout the life of the SEB offset program.

Activities

To meet this objective, Hillgrove proposes to:

- Survey land parcels to establish the most cost-effective means of installing rabbit proof fences to contain and protect designated SEB-offset patches
- Seek quotes for fence installation and reserve budgets for capital programs
- Engage contractors to complete fencing ahead of land preparation
- Regularly inspect and maintain fences throughout the life of the SEB Offset program

5.2.5 Purchase of specialist equipment and/or engagement of Contractors

Objectives

When SEB-offset plans for the LOM extension have been approved, ensure that planned SEB-offset programs are appropriately resourced through internal budget allocations and executed either through direct employment of staff and purchase of specialist equipment or through engagement of appropriately skilled and equipped contractors or other groups.

Discussion

The delivery of SEB-offset on former farming and grazing land requires specialist skill sets and equipment to be achieved successfully and cost effectively. The details of this are discussed in sections 5.2.10 to 5.2.14 below.

Activities

To meet this objective, Hillgrove proposes to:

- Discuss proposed SEB-offset patches and intended outcomes with our current contractor group and other specialist groups
- Seek quotes for the delivery of SEB-offsets on designated areas from our current contractors and other specialist groups (which could include the Kanmantoo/Callington Landcare Group, Goolwa to Wellington LAP, State Flora etc.)
- Review quotes and perform a cost-benefit analysis to determine if offset is best delivered in-house, or through external agents
- Engage staff and acquire equipment, or engage contractors or other specialist groups

5.2.6 Commence weed control and feral animal control programs within designated SEB-offset areas prior to planting and through the establishment phase

Objectives

Control feral animal populations within fenced SEB-offset areas prior to the commencement of planting operations. Maintain population control through ongoing feral animal control programs during the life of the SEB-offset program.

Control pest plants within designated SEB-offset areas. Begin weed population reduction prior to SEB-offset planting and continue weed control throughout the establishment phase.

Discussion

Significant populations of rabbits, hares cats and foxes currently occupy farming land around the Kanmantoo ML and within the Kanmantoo ML. Ongoing baiting programs within the ML have proven to be successful in reducing feral animal numbers for a short time, however the populations are resilient and we suspect that they are replenished by influx from surrounding areas when numbers are reduced within the ML.

Direct seeded rehabilitation areas within the ML have proven to be successful in terms of seedling germination and plant establishment; however they are prone to grazing by rabbits, particularly in drier months when seedlings offer a source of green feed at a time when introduced annual plants have senesced. This can slow the accumulation of biomass in rehabilitation areas and promote seed loss and slower recruitment as rehabilitation plants mature.

The commencement of feral animal control programs prior to planting within designated SEB-offset areas will act to significantly reduce damage to rehabilitation plantings during the establishment phase. When coupled with rabbit proof fencing, sustained feral animal control within protected areas will reduce grazing pressure to acceptable levels and will significantly assist the establishment and development of SEB-offset plantings.

Weed control within former cropping land is essential for the successful establishment of SEB-offset vegetation and will need to be carefully managed throughout the life of the offset program. A number of weed control strategies can be used and these will necessarily vary depending on the planting situation, the composition of the intended foundation seed mix and the ongoing program aims for each offset patch. Weed control programs will capitalize on herbicide selectivity for different species at differing developmental stages or physical treatments, such as pre cultivation burning or topsoil removal where this is warranted.

Typically, preparation of planting areas through the use of systemic herbicide sprays on fallowed areas as summer weed control can be followed by cultivation, pre-sowing herbicide application, post sowing-pre-emergent selective herbicide application and selective post emergent herbicide application. If a foundation seed mix containing perennial C3 and C4 native grasses is used to initially colonise farming land, contact desiccants can be used to control annual weeds and reduce vigour in perennial weeds. Once the foundation seed mix achieves canopy closure, selective herbicides and spot-spray programs can be used to further reduce weed numbers or create planting nodes for direct seeding and/or tube plantings

Activities

To meet this objective, Hillgrove proposes to:

- Commence feral animal control programs within designated SEB-offset areas as soon as possible and maintain feral animal control programs within SEB-offset patches throughout the life of the program
- Commence pre-sowing control of crop and pasture weeds and other pest plants as soon as possible. Maintain selective control programs post-planting and throughout the establishment phase

5.2.7 Investigative studies to quantify the parameters for successful revegetation on specific SEB-offset patches

Objectives

Conduct a range of detailed site-specific studies to define and understand the significance of parameters which may have a direct impact on the establishment and success of SEB-offset vegetation in particular offset patches.

Use Landscape Function Analysis and vegetation surveys on assigned offset patches prior to the commencement of on-ground works to define the benchmark state of each patch as a means of objectively assessing progress towards required offset outcomes.

Apply the outcomes of investigative studies to pre-sowing land preparation, foundation seed mix compositions, planting methodologies, post sowing management and follow-up maintenance programs for specific SEB-offset patches.

Discussion

Small-scale variations in soil characteristics, weed flora composition, site aspect, site terrain, land-use history and location can have a significant impact on the ultimate success of offset-patch establishment. Understanding the viability of available native seed lots can have a significant influence on the best seed mix composition and sowing rates for offset patch establishment.

Similarly, understanding the best propagation and planting methods for recalcitrant species (for example *L. effusa*) is essential to ensure that species diversity can be delivered successfully and by the most cost-effective means.

Understanding the benchmark state of each offset patch prior to the commencement of ground works provides a basis for the objective assessment of progress towards the establishment of intended plant communities on each offset patch.

To define these parameters for each assigned offset area, a range of investigative studies will need to be completed for each patch and their allocated seed lots prior to land preparation (see below).

Activities

To meet this objective, Hillgrove proposes to carry out a range of site-specific investigative studies prior to land preparation and planting. These studies *may include, but will not be limited to* the following subject areas:

- Detailed site survey, mapping and planting niche identification for target plant communities
- Survey and mapping of weed populations and the location of any remnant native species
- Soil surveys and lab tests to define and map the physical characteristics, soil types profiles and nutrition status of soils in each offset patch
- Soil tests to establish freedom from critical soil pathogens which could cause offset patch failure, for example Phytophthora cinnamomi (or Dieback)
- Studies to determine the identity of weed seeds, their density and distribution through the soil profile
- Test patches to evaluate the efficacy of varying depths of topsoil removal to assist with weed seed bank depletion, detrimental nutrient removal (e.g., phosphate) and the establishment of direct-seeded patches
- Test patches to evaluate the direct seeding techniques best suited to assigned patches
- Specific studies through an alliance with the Adelaide Botanic Gardens Seed Conservation Centre (SCC), focussing in particular on the viability of foundation seed mix species and the relationship of this to optimal direct seeding rates for the establishment of representative offset vegetation communities
- Specific studies through the SCC to determine the best propagation, planting and establishment methods for recalcitrant species. For example continue investigating *Lomandra effusa* propagation, seed viability studies etc.

- Continue liaison with other mine sites to adapt successful niche-specific mine-site rehabilitation systems to Kanmantoo's SEB-offset and Rehabilitation program
- Surveying feral animal populations and rabbit warren distributions within each patch to tailor-make effective control programs
- Conducting Landscape Function Analysis (LFA) and vegetation surveys on each patch prior to the commencement of on-ground works. Survey temporary transect sites with a view to permanently establishing LFA transects following initial planting operations.
- Incorporating of site-specific knowledge into SEB Offset programs
- Conducting other studies as required, for example to determine optimal selective weed control, both pre and post planting for any previously unknown weed species located during site specific surveys
- *Where investigative studies identify a critical problem with an individual offset patch (for example, presence of Phytophthora cinnamomi), a suitable alternate offset patch will need to be located as near as practical to the ML. Appropriate investigative studies will need to be repeated on the alternate offset patch as required*

5.2.8 & 9 Commencement of vegetation enhancement programs for remnant native vegetation located during detailed site studies and adjustment of offset patch boundaries where necessary

Objectives

Delineate, protect and enhance any native vegetation remnants identified during detailed site studies. Incorporate any remnant native vegetation into the establishment of appropriate SEB offset patches

Discussion

The long-term selective pressures applied by cropping and grazing have degraded native plant populations within properties adjacent to the ML and in the surrounding region to a point where native species are either absent, or sparsely distributed. This is particularly so for cropping land where successive years of cultivation, the application of phosphate fertilizers, agricultural chemicals and inter-crop grazing have all but removed any remnant native species from seed banks.

This situation is similar on higher, rocky non-arable land where grazing by sheep and feral ruminants has progressively modified the flora to the detriment of native species. However, there may be a slow, currently indeterminate recovery of native flora through recruitment due to the germination of hard-seeded species and their subsequent survival in the absence of grazing pressure (for example, members of the Fabaceae, Sapindaceae and others).

It highly likely that irregular native seed germinations have occurred in the past during ideal conditions, but this process has been masked by grazing losses. Once areas of land have been earmarked for SEB offset establishment and external selective pressures have been removed, it is likely that areas of remnant native vegetation will be expressed.

Activities

- Survey allocated SEB offset areas and map any currently visible remnant native vegetation
- Incorporate vegetation remnants into appropriate SEB offset areas where appropriate
- Enhance identified native vegetation patches through ongoing weed suppression, direct seeding and infill plantings with specific tube stock lines to match known vegetation community compositions
- Continue to survey allocated areas for the expression of native vegetation remnants in future years. Map remnants, incorporate them into SEB offsets where possible and adjust offset-patch boundaries where necessary

5.2.10 Build up seed reserves and order specific seed supplies or tube stock to meet planting schedules

Objectives

Ensure that adequate seed supplies and tube stock are available for scheduled offset patch planting and replanting programs at the various stages of patch establishment. Ensure that only species represented in ML floristic communities are included in planting programs. Ensure that local provenance seed and tube stock sources are used wherever possible. If supplies of local species are needed and can't be obtained from local sources, ensure they are acquired from sources as near as practical to the ML in the first instance or from other sources within the same climatic conditions as a last resort.

Discussion

It is expected that the majority of seed required for successful offset patch establishment will be available through annual wild seed collection campaigns conducted both within the ML and in the near-mine region. Past collection programs have yielded significant quantities of seed from a wide range of local species and over 390kg of seed is currently in store at the EBS seed storage facility. Further seed lines collected during 2013/14 are yet to be processed and weighed. It is understood that wild seed collection programs can be (and have been) very successful in good seasonal conditions, but they can fall short of requirements where winter rainfall is inadequate.

The ML's Seed Production Area is a 1 ha irrigated intensive seed production facility populated with local native species and planted with local provenance seed sources (see Plate 1). It has been established to provide a predictable quantity of key species efficiently and independently of seasonal conditions. Following an initial establishment period, the SPA is beginning to produce commercial quantities of seed. For example, our first harvest of seed *Austrodanthonia* yielded over 98kg.

Early seed yields form the SPA, together with wild-seed collections have been used to establish a large-scale seed multiplication area (SMA) on a plot of former cropping land directly adjacent to the ML (see Plate 2). The SMA was planted in mid-2013 and contains plots of Austrodanthonia, Austrostipa, Chloris, Themeda and Vittadinia. Plot sizes vary from 0.25ha to nearly 1.0ha each. It

is anticipated that our first seed yields will be obtained in spring 2014, with seed being incorporated into SEB offset establishment programs shortly afterwards.

Where seed-derived establishment of particular native species within an offset plot is not possible by direct seeding, it will be necessary to propagate tube stock via reputable specialist nurseries (e.g., State Flora at Murray Bridge, or Provenance Indigenous Plants at Hendon SA etc.). Appropriate tube stock supplies will be sourced as required to meet ongoing planting and replanting schedules throughout the offset patch establishment program. Where possible, tube stock will be grown from seed derived through annual wild seed collection campaigns.

Activities

- Continue to conduct seasonal wild-seed collection programs on the ML, in the vicinity of the ML and near ML region, focussing on the quantities and range local native species required for SEB offset patch establishment programs
- Continue to propagate local provenance seed supplies through management of the ML's Seed Production Area (SPA – see Plate 1) and large-scale Seed Multiplication Area (SMA – see Plate 2).
- Purchase supplementary seed supplies from local suppliers if necessary.
- Order and purchase tube stock supplies

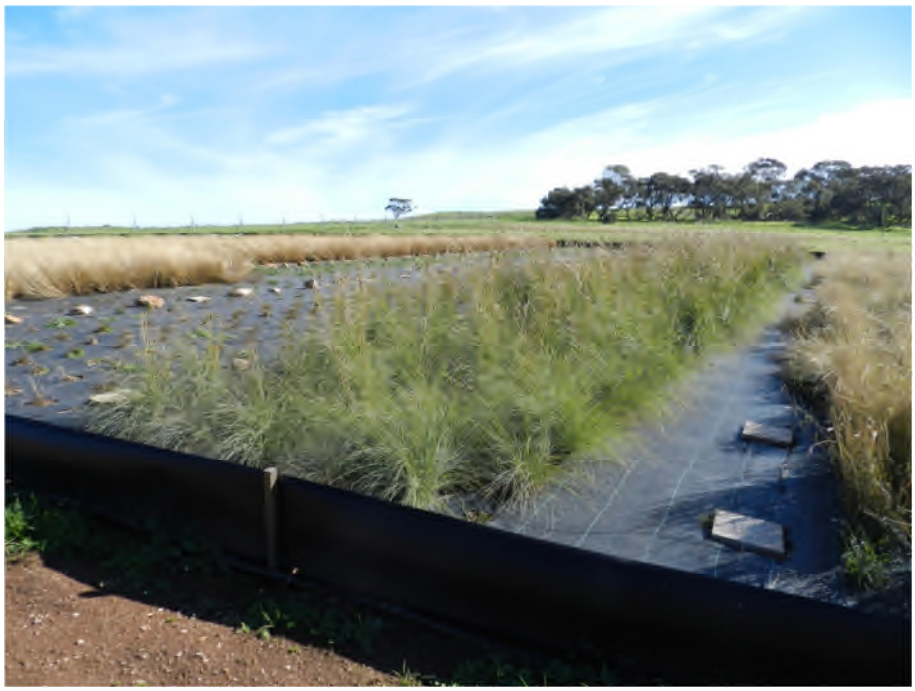


Plate 1. Seed Production Area highlighting diversity grass seed plots

Plate 2. Seed Multiplication Area established on former cropping land adjacent to the ML

5.2.11 Land Preparation

Objectives

Schedule and conduct land preparation activities to meet offset-patch establishment programs. Carry out pre-sowing and pre-planting weed reduction programs to reduce both the levels of weed competition in newly established plantings and subsequent weed contamination in mature offset vegetation patches. Carry out on-ground works necessary to prevent soil erosion during patch establishment or ameliorate current erosion features in patch areas where possible before planting. Cary out any cultivation or soil amelioration activities necessary for patch establishment prior to sowing.

Discussion

Inadequate land preparation will lead to offset patch failure, with weed competition being the greatest single risk to establishment success. Extensive soil seed banks have accumulated through decades of agricultural activity and a diverse range of weed species can be found on most land in the Kanmantoo area, including wild oats, brome grass, barley grass, wire weed, wild turnip, blackberry nightshade, horehound, Chenopodium, and salvation jane, to mention a few.

It is expected that the range of investigative studies discussed in point 5.2.7 (above) will provide the data necessary to define and program the necessary range of land preparation operations on a patch by patch basis. Pre-planting land preparation will be necessarily tailored to meet the specific needs of each offset patch and will vary dependant on previous site or cropping history, soil type, terrain and the intended end result for that patch.

For example, controlled burning, followed by a program of selective and non-selective herbicide applications will be necessary on higher rocky land with a history of grazing by sheep. Mechanical cultivation or direct seeding in these areas would is either impossible due to steep slopes and outcropping rock, or imprudent due to erosion risk. Where niche plantings are planned on rocky ground, small areas can be hand prepared, followed by a herbicide program prior to hand sowing or seed or planting tube stock. Ongoing weed control will be required to aid establishment.

Conversely, land preparation on former cropping land may involve the phased stripping of topsoil down to a carefully controlled depth with a wheel tractor-scraper, with the depth of topsoil removal determined by the seed bank studies cited in 5.2.7 (above). This practice acts to physically remove the soil weed-seed bank and accumulated phosphate fertilisers and some residual herbicides (e.g. metsulfuron-methyl), leaving prepared areas better able to support direct-seeding to a foundation seed mix (see 5.2.12, below). Topsoil removal was advocated during the 2012 Grassy Woodlands Establishment Forum, hosted by the City of Salisbury and has been subsequently used to successfully establish foundation seed mixes within the ML rehab area and on the former cropping land adjacent to the ML used to establish the SMA.

Topsoil removal is essentially the same process as that is used by conventional direct-seeders, where an offset disk scrapes away a layer of topsoil and seeds are sown onto exposed subsoil – only this is carried out on a much larger scale. Care will be taken to strip alternate bands of topsoil in scraper-width rows, leaving intermediate areas untouched to act as erosion protection and dust prevention. The intermediate areas will be managed with a program of mowing, knockdown and selective herbicides before being stripped in a later season when initial direct sown areas have commenced establishment.

Land preparation may also involve the application of specific soil ameliorants as highlighted by the results of patch-specific investigative studies outlined above. For example, where the soil is shown to be sodic or dispersive, dressings of gypsum may be warranted to displace sodium, reduce soil dispersion and erosion and increase water infiltration. Other soil ameliorants will be applied as indicated by investigative studies.

Further soil pre-conditioning of former cropping land will be required following pre-stripping and immediately prior to planting. This may include ripping where warranted or cultivation as required. For example, seed bed preparation for direct seeding of pre-stripped land has been successfully carried out on the ML by EBS using a modified turf soil conditioner, which cultivates only the top 25mm of the soil surface immediately prior to direct seeding.

It is important to note that the examples provided above are not represent and exhaustive list of land preparation methodologies which can or will be used during the offset establishment program.

Activities

- Carry out land preparation operations tailored by investigative studies to establish specific offset patches on specific land areas
- Apply specific soil ameliorants to address issues identified in the investigative studies
- Prepare seed beds or planting sites ahead of planting programs as required

5.2.12 Planting Programs

Objectives

Schedule planting programs in accordance with seed and tube stock availability to meet land preparation, seasonal deadlines and SEB offset patch requirements. Tailor offset patch species lists and/or seed mixes to deliver the required floristic species range and planting densities necessary to successfully establish the required SEB offsets for the LOM extension. Use planting methods which are best suited to the terrain being sown and the vegetation type being established. Involve the local community, local groups and local contractors wherever possible to ensure benefit to our community and increase both interest in the SEB offset program and ownership by our communities.

Discussion

It cannot be overstressed that land preparation and forward planning are the keys to successful SEB offset area establishment. Pre-sowing land preparation for specific offset patches will be scheduled in accordance with seed and tube stock availability. Correspondingly, seed multiplication, collection and tube stock propagation programs will need to be planned to meet proposed planting schedules. The commencement of planting on specific offset patches will be governed by the time that successful land preparation is achieved and planting material is available during 'Year 1' for each SEB offset patch as outlined by the program presented in Table 4 (above). Planting will generally be commenced after opening rains in late April to late May and should conclude by late June. However, planting too late in the season or during adverse seasonal conditions will lead to poor success and the waste of limited seed resources; as such planting times may also be determined and varied by seasonal factors.

The specific species lists used to establish particular plant communities and conditions in all SEB offset patches will be governed by;

1) The EPBC Condition Class of the vegetation patch disturbed by clearance associated with the LOM extension
2) The species range observed within the disturbed vegetation patch during the 2007 EA survey and the subsequent 2013 EBS survey
3) The species densities described by LFA surveys conducted within the ML since 2011

As a general principle, direct seeding of appropriately prepared sites with a suitable 'Foundation Seed Mix' containing a tailor-made range of understorey coloniser species will be preferred to other planting methods on former cropping land. Typically, this mix will include Austrodanthonia, Austrostipa, Themeda, Enneapogon, Chloris and a range of other herbaceous and shrub species representative of the floristic community being established. The aim of this phase is to provide competitive pressure for remnant weed species through colonisation with a dense stand of appropriate native species and to allow a degree of understorey development prior to planting appropriate mid and canopy-level species.

Establishment of the foundation seed mix may be followed by a combination of direct-seeded and tube-stock plantings to introduce mid-level and canopy species in *E. odorata* and *A. pycnantha* woodlands, while direct seeding and tube stock planting may be used to introduce diversity into *L. effusa* grasslands. In all cases, the most appropriate planting methods will be varied to meet the needs of individual patches and the end result to be achieved.

Where essential species are difficult to propagate or are known to establish poorly (for example *L. effusa*), the results gained through specific investigative studies (e.g. the Botanic Gardens Alliance) will be used to solve propagation issues and implement appropriate large-scale propagation programs. This may be carried out by specialized providers (e.g. State Flora – Murray Bridge) and will be geared to provide sufficient planting material to meet program needs.

For example, Alcoa's Huntley operation in WA achieves near 100% species return to areas of rehabilitation in wet-sclerophyll forest through a combination of direct seeding and niche plantings of recalcitrant species propagated as a result of tissue-culture and other seed research conducted in liaison with Kings Park Botanic Gardens in WA. Tissue cultured plants are established through specialized planting and post-planting protection regimes for particular species (i.e. *Lomandra*). We expect that a similar alliance with the Adelaide Botanic Gardens SCC will greatly assist the overall quality and success of planting programs at the KCM.

Similarly, the reintroduction of rescued *Diuris behrii* following propagation by NOSSA will allow specific niche patches of *Diuris* to be reintroduced within *E. odorata* offset patches throughout the offset program. Of the 100 rescued *Diuris* plants, there are now more than 300 in the NOSSA nursery. This is expected to continue through successive daughter generations and will provide a continued stream of planting material of local provenance (see Plate 7, below).

There will be considerable scope for involvement of local community groups and service providers in offset patch planting programs throughout the life of the SEB offset program. This may take the form of planting days where school groups assist with tube stock plating into swards of established foundation species, funded planting campaigns assisted by volunteers from the local Kanmantoo Callington Landcare Group, through to funded planting programs by other providers (for example, possibly the Goolwa to Wellington LAP), where works are carried out either on designated offset patches or if the need arises, other Government approved near-mine areas.

Activities

- Integrate planting program timing with land preparation activities, seasonal windows of opportunity and the availability of appropriate seed reserves and tube stock
- Apply appropriate planting methodologies to individual offset patches in accordance with the vegetation community being established, past history of the patch and the land class available
- Engage in alliances to conduct research on the propagation and establishment of key recalcitrant species which prove to be unsuitable candidates for normal direct seeding or tube stock planting programs
- Engage appropriate expert assistance with large-scale propagation of recalcitrant species (for example State Flora – Murray Bridge & NOSSA)
- Engage the local community and community groups in offset patch planting programs
- Engage other specialist providers to provide planting program services where warranted
- *Directly fund Government approved offset patch establishment by 3rd party providers on other suitable near-mine areas, should offset patch establishment on allocated areas prove to be impractical or financially prohibitive*

5.2.13 Assess results and adjust methods

Objectives

Regularly objectively assess the establishment and development of offset patches against known patch analogues by recognised means. Continue with establishment methodologies where they are proven to be successful and adjust processes where they are proven to be inappropriate.

Discussion

The condition and functionality of native vegetation patches within the ML have been regularly assessed through a combination of both Landscape Function Analysis (LFA) transects in key vegetation patches and vegetation surveys conducted by EBS-Ecology over the past 3-years (Tongway and Hindley 2004), (EBS, 2013). We now have good volume of data to support the progressive improvement of remanent patch condition within the ML since 2011. This data also allows us to define the LFA characteristics of key vegetation communities and their respective SEB condition scores, with a view to providing analogue benchmarks for the structured assessment of SEB offset patch establishment on assigned areas.

The progress of SEB offset patch establishment will be objectively monitored against the characteristics exhibited by established analogue communities within the ML. This will be achieved by establishing and assessing a series of permanent LFA transects in each offset patch shortly after the first phase of planting is completed and regularly reassessing each patch during spring in subsequent years.

Where objective data proves the progression of offset patch condition and composition towards their intended outcome, management and planting programs will be continued. Where the data shows that poor progress is being made, supplementary actions will be scheduled to correct deficiencies (for example, improved weed control, different planting methods, additional planting programs or the application of supplementary soil ameliorants).

In extreme cases, patch failure may require reestablishment at an alternate approved site in the near-mine region. This would only be considered as a last resort if all other corrective measures have been exhausted, or a suitable alternate site offers a higher probability of success with fewer interventions.

Activities

- Continue LFA and vegetation surveys within key vegetation communities on the ML
- Establish permanent LFA transects in each offset patch over pre-planting transect sites
- Conduct regular LFA and vegetation surveys to objectively monitor development progress in each offset patch
- Continue and replicate patch establishment methodologies where LFA data shows promise
- Discontinue establishment methodologies where LFA data demonstrates poor progress
- Modify methods and address patch deficiencies where warranted
- In extreme cases, identify alternate offset patches near the ML, seek Government approval and re-establish offsets on alternate sites

5.2.14 Replanting and Amendment Programs

Objectives

Monitor and address poor offset patch establishment through appropriate replant programs. Identify and address plant losses caused by adverse seasonal events as required.

Discussion

Poor planting program success can be caused by inappropriate land preparation, poor timing of planting operations, poor seed viability, poor tube stock quality, inappropriate planting methods, inappropriate planting locations for specific species, inadequate follow-up maintenance or adverse seasonal events (to mention a few).

In order for intended SEB offset outcomes to be achieved, adverse establishment results identified through regular objective monitoring must be addressed through a schedule of amendment works. These may range from the complete re-work and replanting of failed SEB plantings, through to replacement of individual tube-stock plants as required.

Activities

- Evaluate routine site monitoring data to identify and schedule appropriate improvements
- Organise the propagation or collection of appropriate replacement planting material
- Carry out site preparation works as required
- Schedule planting, replanting or site replacement programs as required

5.2.15 Establishment of Heritage Agreements

Objectives

Protect successful SEB offset areas from future disturbance through the establishment of recognised Heritage Agreements defined as follows:

> "A Heritage Agreement is a private conservation area, established in perpetuity through an agreement (contract) between the landholder and the Minister for Sustainability, Environment and Conservation"

Discussion

Considerable investment will be required by Hillgrove Resources over many years to establish appropriately functioning SEB Offset vegetation communities on land currently owned by Hillgrove and assigned for this process. Once SEB Offsets have been demonstrated to be functioning as intended in a floristic and ecological sense, the land areas will need to be protected from future disturbance. It is conceivable that areas planted to SEB offsets could be sold at some point in the future and land use under a new owner cannot be guaranteed.

Heritage Agreements will prevent this by providing perpetual protection for SEB offset patches. The Heritage Agreement contract specifies that the indigenous plants and animals in the Agreement area are to be protected from the time the agreement is made. Heritage Agreements are binding on future landholders and are ongoing, i.e. perpetual.

It is understood by Hillgrove that entering into Heritage Agreement contracts for specific offset patches will have the potential to significantly alter the value of assigned allotments in the event of a future sale and may considerably restrict both future land use and the sale price which can be realized.

Activities

- Use the results of objective monitoring to determine when an SEB offset area is approaching its intended floristic composition and ecological function
- Enter into Heritage Agreements for assigned offset patches to prevent future disturbance and degradation

5.3 Additional Illustrations

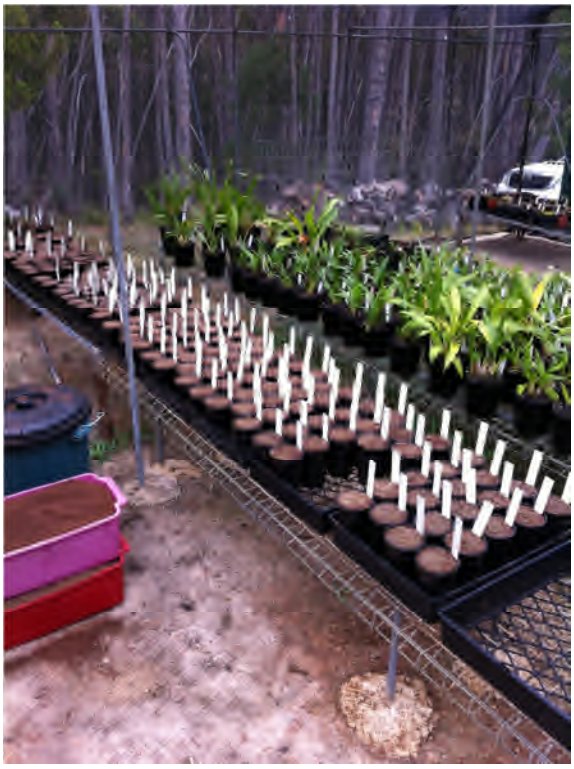
Plate 3. 8:1 *E. odorata* protected from disturbance by amendments to the LOM extension plan, Northern–end Patch 10

Plate 4. 4:1 *E. odorata* – woodland enhancement, Patch 2, NW corner of ML

Plate 5. Revegetating disturbed areas within the ML, Gate 1 near Patch 29

Plate 6. **Landcare Volunteers, COOE and EBS staff assisting with Plant Rescue in PEPR-approved Disturbance Area of Patch 10 (November 2011)**

Plate 7. **Diuris behrii Daughter-tubers (foreground) under Propagation in the Native Orchid Society of SA's Shadehouse near Mt George SA**



6. REFERENCES & SELECTED RESOURCES

Coffey Environments & Hillgrove Copper (2010) Native Vegetation Management Plan, Kanmantoo Copper Project ML6345, Appendix 9. Access via the link:

ftp://central.pir.sa.gov.au/Minerals/Kanmantoo_Appendix_Volume3_v7.pdf

BIRD. 2007. White-winged Chough. A WWW publication accessed on 6 September 2010 at http://bird.net.au//bird/index.php?title=White-winged_Chough Biodiversity Information, Resources and Data, Australia.

DEWR. 2007. EPBC Policy Statement 3.7 Nationally Threatened Species and Ecological Communities. Peppermint Box (*Eucalyptus odorata*) Grassy Woodland of South Australia and Iron-grass Natural Temperate Grassland of South Australia. Department of Environment and Water Resources, Government of Australia. June 2007.

DTEI. 2008. Valuation for LT 58 Eclair Mine Road Kanmantoo 5252 (LT 58 D20509). June. Provided by the Department for Transport, Energy and Infrastructure (Government of South Australia).

DWLBC. 2005. Guidelines for a Native Vegetation Significant Environmental Benefit Policy for the Clearance of Native Vegetation associated with the Minerals and Petroleum Industry. Prepared for the Native Vegetation Council. Department of Water, Land and Biodiversity Conservation, Government of South Australia. September 2005.

EBS-Ecology, 2012. Kanmantoo Mine Fauna Surveys, Spring 2012.

EBS-Ecology, 2013. Kanmantoo Mine LFA Monitoring – Autumn 2013.

EBS-Ecology, Brown T., et al, 2013. Vegetation Survey of Peppermint Box and Irongrass Communities at Kanmantoo Copper Mine. Letter-Report prepared for Coffey Environments on behalf of Hillgrove Resources.

Ecological Associates. 2006. Targeted survey for threatened species and weed species at Kanmantoo Mine. September. A report prepared by Ecological Associates for Hillgrove Resources.

Ecological Associates. 2007a. Final Report. Kanmantoo Copper Project Flora Assessment. May. A report prepared by Ecological Associates for Enesar Consulting, Abbotsford, Victoria.

Ecological Associates. 2007b. Final Report. Kanmantoo Copper Project Spring Flora Assessment. A report prepared by Ecological Associates for Enesar Consulting, Wayville, Adelaide. November 2007.

Enesar. 2007. Kanmantoo Copper Project Conceptual Mine Closure and Rehabilitation Plan. June. Report prepared by Enesar Consulting Pty Ltd for Hillgrove Resources Limited.

PIRSA. 2004. Earth Resources Information Sheet M30. Interim Guidelines on Requirements for Mineral Exploration and Mining under the *Native Vegetation Act 1991* and Regulations 2003. Mining Regulation and Rehabilitation Branch, Minerals Group, Minerals and Energy Resources, Primary Industries and Resources SA.

PIRSA. 2006. Mining Regulation and Rehabilitation Branch. 2006. Guidelines for the Preparation of a Mining and Rehabilitation Program (MARP). Version 3.12. Mining Regulation and Rehabilitation Branch, Minerals Group, Minerals and Energy Resources, Primary Industries and Resources SA.

Tongway, D.J. and Hindley, N.L. 2004. Landscape Function Analysis. Procedures For Monitoring and Assessing Landscalpes. CSIRO Sustainable Ecosystems, Canberra.

Attachment A

Initial SEB assessment guidelines

***Vegetation* Condition**	**Indicators for Condition**	**SEB Ratio**
Poor. Weed-dominated with only scattered areas or patches of native vegetation	Vegetation structure no longer intact (e.g., removal of one or more vegetation strata).	2:1
	Scope for regeneration, but not to a state approaching good condition without intensive management.	
	Dominated by very aggressive weeds.	
	Partial or extensive clearing (greater than 50% of area).	
	Evidence of heavy grazing (tracks, browse lines, species changes, no evidence of solid surface crust).	
Moderate. Native vegetation with considerable disturbance	Vegetation structure substantially altered (e.g., one or more vegetation strata depleted).	4:1
	Retains basic vegetation structure or the ability to regenerate it.	
	Very obvious signs of long-term or severe disturbance.	
	Weed dominated with some very aggressive weeds.	
	Partial clearing (10 to 50% of area).	
	Evidence of moderate grazing (tracks, browse lines, soil surface crust extensively broken).	
Good. Native vegetation with some disturbance	Vegetation structure altered.	6:1
	Most seed sources available to regenerate original structure.	
	Obvious signs of disturbance.	
	Minor clearing (less than 10 % of area).	
	Considerable weed infestation with some aggressive weeds.	
	Evidence of some grazing (tracks, soil surface crust patchy).	
Very good. Native vegetation with little disturbance	Vegetation structure intact (e.g., all structure intact).	8:1
	Disturbance minor, only affecting individual species.	
	Only non-aggressive weeds present.	
	Some litter build-up.	
Intact vegetation	All strata intact and botanical composition close to original.	10:1
	Little or no signs of disturbance.	
	Little or no weed infestation.	
	Soil surface crust intact.	
	Substantial litter cover.	

Source: Table 1 of DWLBC (2005).

Attachment B

2013 EBS Vegetation Survey of Peppermint Box and Irongrass Communities at Kanmantoo Copper Mines

Andy Harrison
Associate Environmental Consultant
Coffey Environments Australia Pty. Ltd.
Level 1, 33 Richmond Road
Keswick, SA 5035

3/107 Hayward Ave
Torrensville
SA 5031

T: 08 7127 5607
F: 08 8354 2403
E: info@ebsecology.com.au
W: www.ebsecology.com.au

Friday, 30 May 2014

Re: Vegetation Survey of Peppermint Box and Irongrass communities at Kanmantoo Copper Mine

Dear Andy,

Coffey Environments Australia Pty. Ltd. engaged EBS Ecology to undertake an assessment of the Peppermint Box Woodland and Irongrass Tussock Grassland communities mapped within the Hillgrove Resources Kanmantoo mining lease. Primarily this was to determine whether these remnant patches meet the criteria of the nationally threatened ecological communities (TEC), set out in the DEWHA document 'EPBC Act Policy Statement 3.7 Peppermint Box (*Eucalyptus odorata*) Grassy Woodland of South Australia and Iron-grass Natural Temperate Grassland of South Australia' (2007). A particular focus was placed on the relevant communities located within the proposed Life of Mine (LOM) disturbance increase area and these were assessed against the policy statement criteria.

Methodology

Field Survey

The field survey was undertaken by EBS Ecology staff on the 25th June, 2013.

Floristic Mapping

Previous floristic mapping was provided prior to the survey. The vegetation associations and boundaries were checked and corrected where necessary.

Extent of communities

The extent of *Lomandra* grassland patches and Peppermint Box Woodland were recorded using hand held Garmin GPS (Accuracy +/- 15m) units which are carried around the extent of the communities

present. The track log was saved with the relevant patch number and entered into Arc GIS software to enable the total area to be calculated.

Species diversity

Species diversity totals were obtained from a 50 x 50m quadrat for each representative area. All species observed within the quadrats were recorded with totals compared against benchmark criteria outlined in the *Commonwealth Listing Advice on Iron-grass Natural Temperate Grassland of South* Australia (Table 1) (TSSC 2007) and the Commonwealth Listing Advice on Peppermint Box (*Eucalyptus odorata*) Grassy Woodland of South Australia (Table 1) (TSSC 2007).

Table 1. Condition classes for Iron-Grass Natural Temperate Grassland of South Australia.

Condition Class	Minimum Size	Diversity of Native Species[1]	No. of Broad-leaved Herbaceous Species[1] in addition to identified disturbance resistant species[2]	No. of Perennial Grass Species[1]	Tussock Count[3]
Listed ecological community					
A	0.1 ha	> 30	+10	≥5	1/m
B	0.25 ha	> 15	+3	>4	1/m
Degraded patches amenable to rehabilitation					
C		> 5	No minimum	≥1	No minimum

[1] As measured in a 50m X 50m quadrat;

[2] The following species are identified as disturbance resistant species: *Ptilotus spathulatus* forma *spathulatus; Sida corrugata; Oxalis perennans; Convolvulus erubescens; Euphorbia drummondii;* and, *Maireana enchylaenoides;* and,

[3] As measured along a 50m transect.

Table 2. Condition classes for Peppermint Box (*Eucalyptus odorata*) Grassy Woodland of South Australia.

Condition Class	Minimum Size	Diversity of Native Species[1]	No. of Broad-leaved Herbaceous Species[1] in addition to identified disturbance resistant species[2]	No. of Perennial Grass Species[1]
Listed ecological community				
A	0.1 ha	> 30	+10	≥5
B	1 ha	> 15	+3	≥2
Degraded patches amenable to rehabilitation				
C		> 5	No minimum	≥1

[1] As measured in a 50m X 50m quadrat;

[2] The following species are identified as disturbance resistant species: *Ptilotus spathulatus* forma *spathulatus; Sida corrugata; Oxalis perennans; Convolvulus erubescens; Euphorbia drummondii;* and, *Maireana enchylaenoides*

Tussock Density

Tussock density was calculated by using a 50m transect through the centre of the 50m x 50m quadrat. This is used to quickly and accurately establish whether the density of tussocks meets the minimum criteria for the TEC which is 1/m^2. Tussocks bases or aerial parts of the plants need to be intersected by the tape to be recorded.

Survey Limitations

The survey was undertaken at a time of year which did not allow for the highest potential species diversity, which coincides with the emergence of annual herbaceous species and bulbous species from families such as Liliaceae (*Bulbine bulbosa, Wurmbea dioica,* and *Arthropodium* spp.), Stackhousiaceae (*Stackhousia monogyna*) and Orchidaceae.

Results

Thirteen sites were assessed in the Peppermint Box (*Eucalyptus odorata*) Woodland remnants across the mine site, whilst four sites were assessed in the Irongrass (*Lomandra* spp.) Grassland remnants. Seven Peppermint Box (*Eucalyptus odorata*) Woodland sites qualified as the TEC condition class B, whilst four qualified as condition class C which are regarded as degraded patches amenable to rehabilitation. Of the four Irongrass (*Lomandra* spp.) Grassland sites assessed, two qualified as the TEC condition class B, and r two qualified as condition class C which are regarded as degraded patches amenable to rehabilitation. Table 3 shows the species recorded for each of the sites. Table 4 and 5 displays the results of the assessment against the EPBC listing criteria for each site. Figure 1 shows locations of each site and condition rating assigned as assessed against the EPBC listing criteria. In addition, the mapping also displays the amendments to the vegetation mapping across the mine site.

Table 2. Species lists for Peppermint Box (*Eucalyptus odorata*) Woodland sites and Irongrass (*Lomandra* spp.) Grassland sites.

TYPE	Scientific Name	Common Name	Comm. Status	SA Status	OD1	OD2	OD3	OD4	OD5	OD6	OD7	OD8	OD9	OD10	OD11	OD12	OD13	LOM1	LOM2	LOM3	LOM4
G	*Lomandra effusa*	Scented Mat-rush			✓	✓		✓	✓			✓						✓	✓	✓	✓
H	*Enchylaena tomentosa var.*	Ruby Saltbush			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		
	Acacia pycnantha	Golden Wattle			✓	✓	✓	✓	✓	✓	✓	✓		✓	✓				✓	✓	
G	*Austrostipa scabra ssp. scabra*	Rough Spear-grass			✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
G	*Austrostipa sp. 2*	Spear-grass												✓	✓				✓		
G	*Austrostipa sp. 3*	Spear-grass							✓		✓						✓	✓			
H	*Vittadinia cuneata var. cuneata f. cuneata*	Fuzzy New Holland Daisy			✓	✓	✓	✓	✓	✓				✓				✓	✓		✓
H	*Maireana enchylaenoides*	Wingless Fissure-plant			✓	✓	✓	✓	✓	✓	✓	✓	✓		✓			✓			
H	*Liliaceae sp.*	Lily Family			✓	✓	✓	✓	✓	✓				✓							✓
G	*Austrodanthonia setacea*	Small-flower Wallaby-grass			✓	✓	✓	✓	✓	✓											
G	*Austrodanthonia caespitosa*	Common Wallaby-grass												✓				✓	✓		✓
G	*Austrodanthonia sp.*	Wallaby-grass									✓										
G	*Elymus scaber var. scaber*	Native Wheat-grass			✓		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		
H	*Oxalis perennans*	Native Sorrel			✓	✓												✓	✓	✓	✓
H	*Gonocarpus tetragynus*	Small-leaf Raspwort			✓	✓	✓		✓	✓				✓					✓		✓
H	*Thysanotus patersonii*	Twining Fringe-lily			✓	✓	✓			✓				✓					✓		
H	*Einadia nutans ssp.*	Climbing Saltbush			✓		✓		✓	✓	✓	✓	✓								
H	*Senecio spanomerus*				✓	✓	✓		✓	✓		✓									✓
	Atriplex semibaccata	Berry Saltbush									✓	✓									
	Allocasuarina verticillata	Drooping Sheoak			✓	✓			✓					✓	✓						
H	*Cheilanthes austrotenuifolia*	Annual Rock-fern				✓	✓			✓		✓		✓					✓		✓
H	*Dianella revoluta var. revoluta*	Black-anther Flax-lily				✓													✓		
	Senecio quadridentatus	Cotton Groundsel					✓														
	Eutaxia microphylla	Common Eutaxia				✓	✓		✓	✓				✓							✓
H	*Dichondra repens*	Kidney Weed					✓	✓		✓											
H	*Plantago drummondii*	Dark Plantain					✓											✓			

TYPE	Scientific Name	Common Name	Comm. Status	SA Status	OD1	OD2	OD3	OD4	OD5	OD6	OD7	OD8	OD9	OD10	OD11	OD12	OD13	LOM1	LOM2	LOM3	LOM4
	Acacia microcarpa	Manna Wattle					✓			✓	✓										
H	*Vittadinia blackii*	Narrow-leaf New Holland Daisy					✓		✓									✓			
H	*Chenopodium desertorum* ssp.	Desert Goosefoot							✓		✓							✓			
	Maireana brevifolia	Short-leaf Bluebush							✓		✓	✓				✓					
	Rhagodia candolleana ssp. *candolleana*	Sea-berry Saltbush																			
H	*Lepidosperma viscidum*	Sticky Sword-sedge								✓				✓							
	Pittosporum angustifolium	Native Apricot							✓												
G	*Lomandra multiflora* ssp. *dura*	Hard Mat-rush							✓	✓		✓		✓					✓		
G	*Lomandra densiflora*	Soft Tussock Mat-rush								✓				✓					✓		
G	*Lomandra micrantha* ssp. *micrantha*	Small-flower Mat-rush																			
H	*Goodenia robusta*	Woolly Goodenia							✓										✓		
G	*Austrostipa elegantissima*	Feather Spear-grass								✓											
H	*Burchardia umbellata*	Milkmaids								✓											
H	*Goodenia pinnatifida*	Cut-leaf Goodenia								✓									✓		
H	*Prasophyllum* sp.	Leek-orchid																			
H	*Lagenophora* sp.	Bottle-daisy								✓											
H	*Compositae* sp.	Daisy Family								✓											
G	*Austrodanthonia* sp.																				
H	*Wahlenbergia stricta* ssp. *stricta*	Tall Bluebell										✓	✓					✓			✓
	Dodonaea viscosa ssp. *spatulata*	Sticky Hop-bush										✓		✓					✓		
H	*Calostemma purpureum*	Pink Garland-lily								✓		✓									
	Cryptandra amara var.	Cryptandra												✓					✓		
H	*Erodium* sp.	Heron's-bill/Crowfoot																✓			✓
H	*Acaena echinata*	Sheep's Burr																	✓	✓	✓
G	*Themeda triandra*	Kangaroo Grass																	✓		✓
	Pomaderris paniculosa ssp.																		✓		✓
H	*Haloragis aspera*	Rough Raspwort																	✓		

TYPE	Scientific Name	Common Name	Comm. Status	SA Status	OD1	OD2	OD3	OD4	OD5	OD6	OD7	OD8	OD9	OD10	OD11	OD12	OD13	LOM1	LOM2	LOM3	LOM4
G	*Amphipogon strictus*	Spreading Grey-beard Grass																	✓		✓
	Scaevola aemula	Fairy Fanflower																	✓		
	Bursaria spinosa ssp.	Bursaria																	✓		
H	*Asperula sp.*	Woodruff																	✓		
G	*Enneapogon nigricans*	Black-head Grass																			✓
H	*Diuris behrii*	Behr's Cowslip Orchid		V	✓					✓											
H	*Ptilotus erubescens*	Hairy-tails		R			✓														
H	*Stackhousia monogyna*	Creamy Candles			✓																
H	*Wurmbea dioica* ssp.				✓																
H	*Arthropodium strictum*	Common Vanilla-lily			✓							✓									
H	*Cynoglossum suaveolens*	Sweet Hound's-tongue			✓					✓											
H	*Ptilotus spathulatus*	Pussy-tails						✓													

Vegetation type, G = Grass, H = Broadleaf Herbaceous species (count excludes disturbance resistance species listed in Tables 1 & 2.)

Table 3. EPBC assessment against the criteria results.

Peppermint Box sites								
Site	**Easting**	**Northing**	**Size**	**Native species**	**Herbaceous species additional to disturbance resistant**	**Grass species**	**TEC? (ABC)**	**Patch**
A			**0.1ha**	**>30**	**10**	**≥5**		
B			**1ha**	**>15**	**3**	**≥2**		
C				**>5**	**no minimum**	**≥1**		
OD1	318098	6115279	17.454	20	12	4	B	10
OD2	318020	6115236	17.454	16	8	3	B	10
OD3	318060	6115367	17.454	20	12	3	B	10
OD4	318142	6115473	17.454	11	4	4	C	10
OD5	318025	6115659	7.657	21	9	6	B	12
OD6	318246	6115323	17.454	27	17	6	B	10
OD7	317505	6115534	2.83	11	3	3	C	14
OD8	317882	6115668	7.657	16	7	4	B	12
OD9	317710	6115563	5.331	6	3	2	C	13
OD10	318226	6115846	17.454	17	7	5	B	10
OD11	317954	6116352	11.137	7	1	3	C	6
OD12	316597	6116330	1.22	3	0	2	NO	1
OD13	316816	6116033	3.541	4	1	3	NO	2

Table 4. EPBC assessment against the criteria results.

Irongrass Grassland sites									
Site	**Easting**	**Northing**	**Size**	**Native species**	**Herbaceous species additional to disturbance resistant**	**Grass species**	**TEC? (ABC)**	**Patch**	**Tussocks per m²**
A			**0.1ha**	**>30**	**10**	**≥5**			**>1**
B			**1ha**	**>15**	**3**	**>4**			**>1**
C				**>5**	**no minimum**	**≥1**			**>1**
LOM1	318155	6114317	14.542	14	7	5	C	22	>1
LOM2	317930	6114029	0.98	27	10	9	B	28	>1
LOM3	317919	6114045	0.98	5	1	2	C	28	>1
LOM4	317932	6114303	0.337	17	8	6	B	30	>1

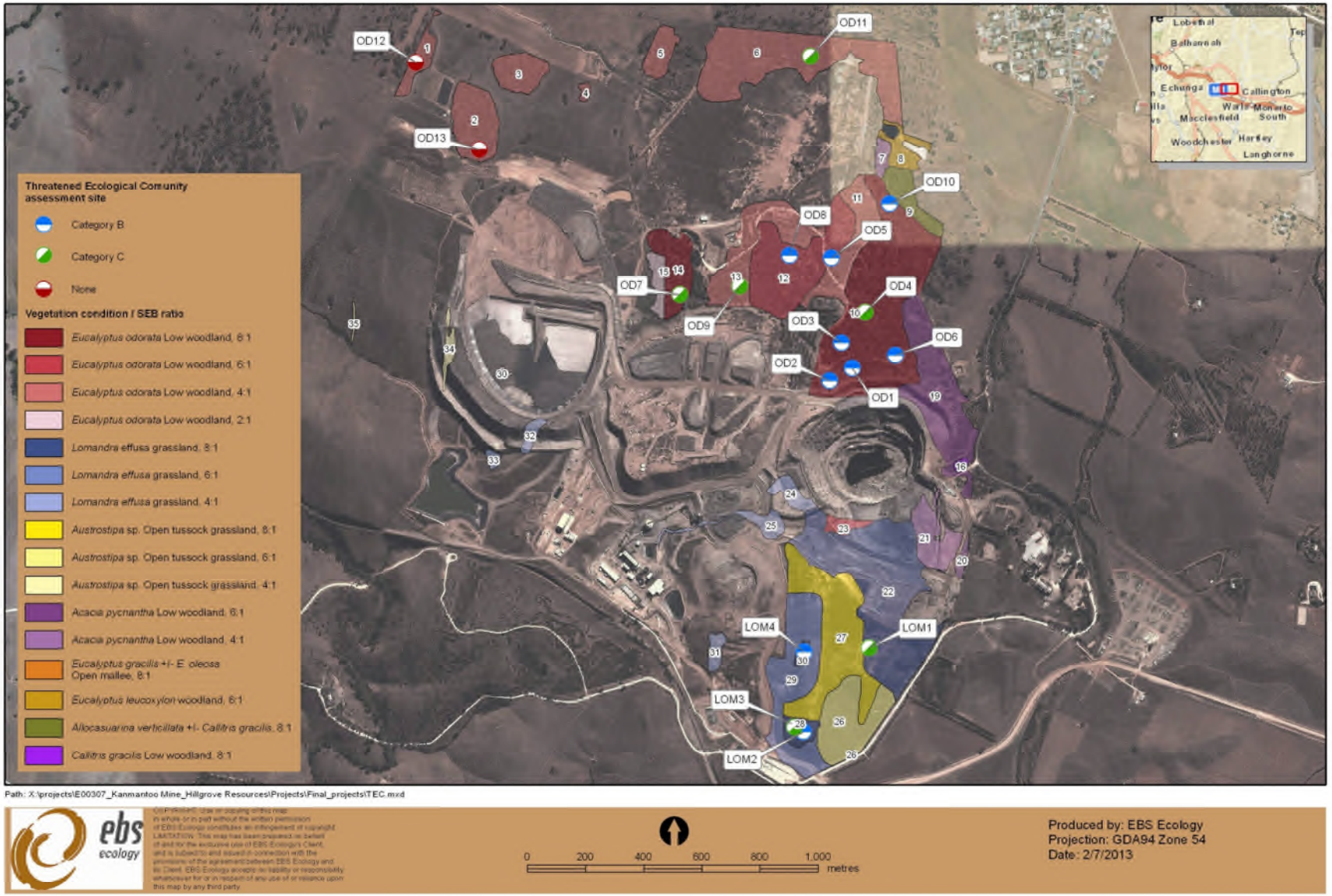


Figure 1. Vegetation mapping and EPBC assessment sites.

References

Department of the Environment and Water Resources (2007) *EPBC Act Policy Statement 3.7 Peppermint Box (Eucalyptus odorata) Grassy Woodland of South Australia and Iron-grass Natural Temperate Grassland of South Australia'*

Threatened Species Scientific Committee (2007) *Commonwealth Listing Advice on Iron-grass Natural Temperate Grassland of South Australia* [Listing Advice].

Threatened Species Scientific Committee (TSSC) (2007) *Commonwealth Listing Advice on Iron-grass Natural Temperate Grassland of South Australia* [Listing Advice].

Please let me know if you have any queries,

Yours sincerely,

Tonia Brown
Senior Ecologist
M: 0417877361
P: (08) 71275607
E: tonia.brown@ebsecology.com.au