

Austar Coal Mine

**Baseline Ecological Monitoring
Report for Stage 2 Longwalls,
Austar Mine, Quorrobolong**

June 2009

Baseline Ecological Monitoring Report for Stage 2 Longwalls, Austar Mine, Quorrobolong

Prepared by
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on behalf of
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1.0 Introduction

This report documents the methods and results of the baseline ecological monitoring surveys undertaken in the Stage 2 underground mining area (hereafter referred to as the Study Area) of Austar Coal Mine near Cessnock in the Hunter Valley, NSW. The baseline autumn survey was conducted in May 2008 and the baseline spring survey was conducted in November 2008. The location of the Study Area is shown in **Figure 1.1**.

A riparian endangered ecological community (EEC), the River-flat Eucalypt Forest on Coastal Floodplains (River-flat Eucalypt Forest), occurs within the Study Area, along Quorrobolong and Cony Creek. A monitoring program specifically focusing on this EEC was recommended in the Austar Stage 2 Subsidence Management Plan (Umwelt 2007) to document impacts caused by the underground mining operations. If such impacts are identified remediation measures will be recommended.

2.0 Monitoring Methods

2.1 Summary

Baseline monitoring surveys were undertaken to document the pre-mining condition of the Study Area. The initial survey and establishment of monitoring sites was undertaken in autumn on 30 May 2008 while a second baseline survey in spring was undertaken on 4 October 2008. A multi-season approach was taken to ensure that seasonal variations in the floristics of the target vegetation community are captured.

Specific surveys targeting fauna groups were not undertaken given the minimal surface disturbances by the mine predicted (Umwelt 2007) and the extensive effort required to collect sufficient data for fauna impact analysis. Should the results of monitoring surveys reveal sufficient reason to conduct fauna surveys, the monitoring program should be appropriately adapted.

The monitoring program incorporates three key survey methods: (1) permanent vegetation plots; (2) vegetation condition assessment; and (3) photo monitoring.

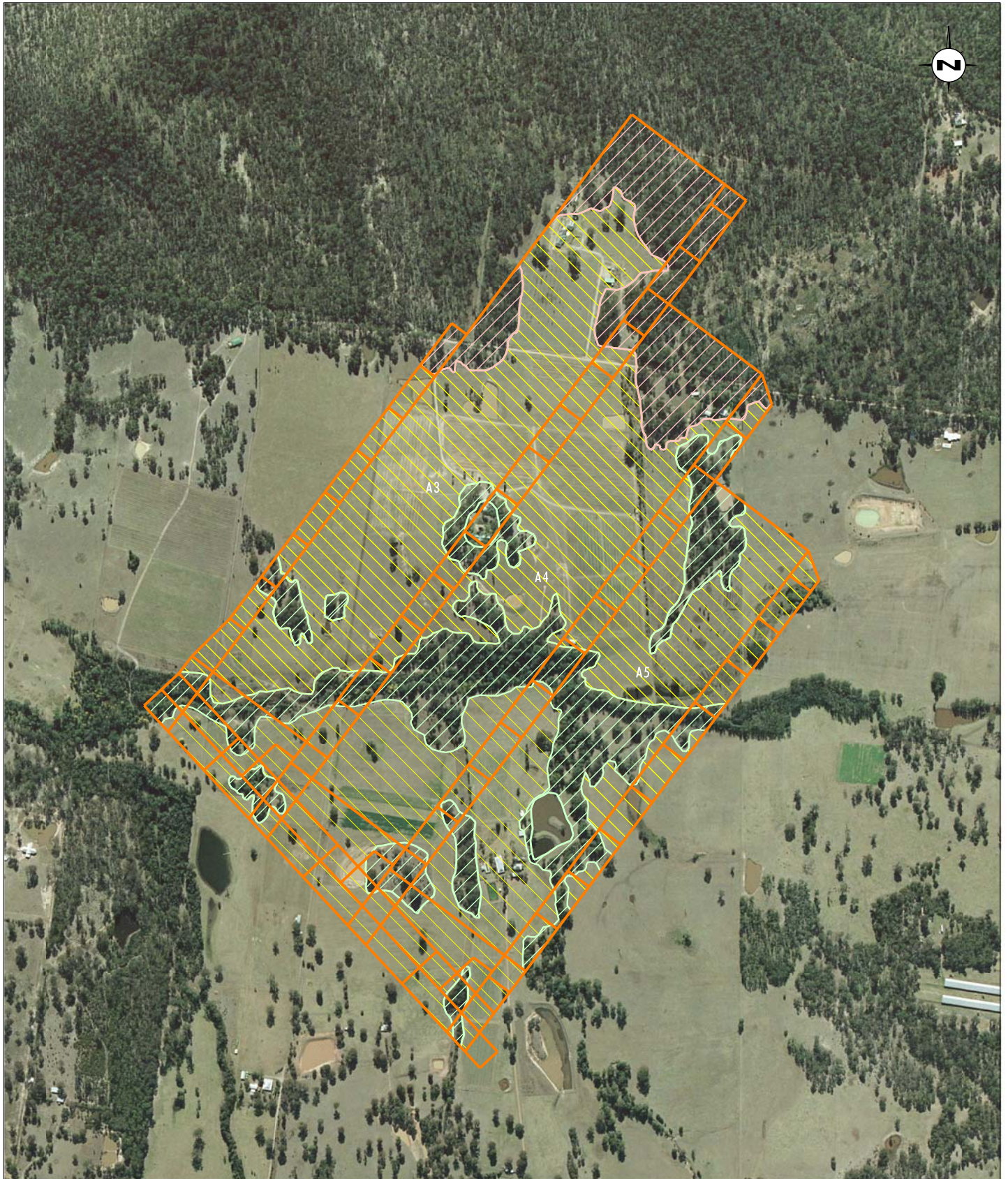
Three permanent sites were set up for full vegetation sampling (Sites 1, 2 and 3). One permanent site was set up for condition assessment and photo monitoring only (Site 4). Site 4 was unsuitable for vegetation survey due to significant modification of the vegetation at this location. Site 3 will not be re-sampled in future monitoring surveys due to access constraints. An alternative Site 3 and an additional site, Site 5 are proposed to be established for future work (described in more detail in **Section 4**).

The location details of the three baseline monitoring sites are provided in **Appendix 1**. Further details of the survey methods implemented are provided below.

2.2 Permanent Vegetation Sites

Two systematic vegetation survey sites were permanently established within the River-flat Eucalypt Forest EEC in representative vegetation as part of the baseline monitoring program.

The locations of the two established vegetation sampling sites are marked on **Figure 2.1**. The MGA grid co-ordinates for each site are provided in **Appendix 1**.



Base Source: AAM Hatch, 2006
Source: Auster Coal Mine

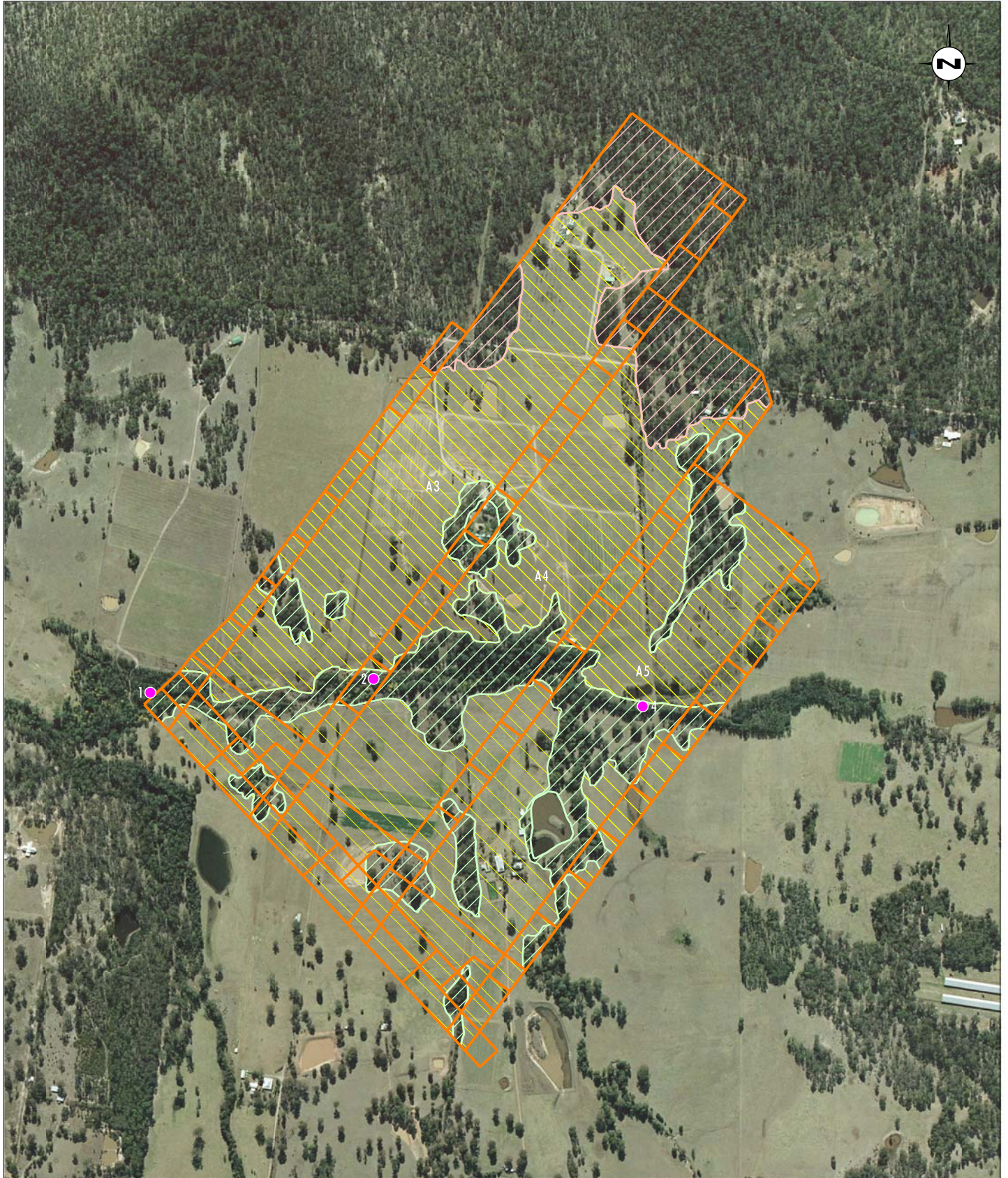
0 100 200 400m
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Legend

- Stage 2 Longwall Panels and Study Area Boundary
- ▨ Riparian Swamp Oak - Rough-barked Apple Open Forest (Possible River-flat Eucalypt Forest EEC)
- ▨ Spotted Gum - Ironbark Forest (Lower Hunter Spotted Gum-Ironbark Forest EEC)
- ▨ Derived Grassland

FIGURE 1.1

Location of Study Area and
Vegetation Communities



Base Source: AAM Hatch, 2006
Source: Austar Coal Mine

0 100 200 400m
1:10 000

Legend

- Stage 2 Longwall Panels and Study Area Boundary
- ▨ Riparian Swamp Oak - Rough-barked Apple Open Forest (Possible River-flat Eucalypt Forest EEC)
- ▨ Spotted Gum - Ironbark Forest (Lower Hunter Spotted Gum-Ironbark Forest EEC)
- ▨ Derived Grassland
- Monitoring Sites
- A3 Longwall Panel Numbers

FIGURE 2.1

Location of Monitoring Sites

Each monitoring plot is 400 m², with dimensions of 20 metres by 20 metres. The four corners of each plot are permanently marked with a metal tree tag nailed into the nearest tree, the label identifying the reference name of the plot and the corner. The use of metal stakes to mark the corners of a plot is a more accurate method, however permission to do this was not granted by private landholders. GPS readings of the location of the plots were recorded to ensure they can be readily re-located for subsequent monitoring surveys.

Within each plot, all vascular plants found were recorded, along with the cover-abundance of each species. A modified Braun-Blanquet 6-point scale (Braun-Blanquet 1927, with modifications by Poore 1955 and Austin et al. 2000) was used to estimate the cover-abundances of each species (**Table 2.1**). The nature of these plots enables collection of semi-quantitative data which can facilitate comparisons of temporal changes.

Table 2.1 - Modified Braun-Blanquet Crown Cover-abundance Scale

Class	Cover-abundance*	Notes
1	Few individuals (less than 5% cover)	Forbs, sedges and grasses: < 5 individuals Shrubs and small trees: < 5 individuals
2	Many individuals (less than 5% cover)	Forbs, sedges and grasses: 5 or more individuals Shrubs and small trees: 5 or more individuals Medium-large overhanging tree
3	5 – less than 20% cover	N/A
4	20 – less than 50% cover	N/A
5	50 – less than 75% cover	N/A
6	75 – 100% cover	N/A

Note: * Modified Braun-Blanquet scale (Braun-Blanquet 1927; Poore 1955; Austin et al. 2000).

2.3 Condition Assessment

Within each of the two established vegetation sites, the condition of the vegetation was assessed using key indicators to facilitate comparison between the results from different monitoring events. An additional site, Site 4, was established for a condition assessment and photo monitoring point only. The understorey vegetation was highly disturbed here and not representative of the target community, therefore semi-quantitative vegetation sampling was inappropriate. This site is marked by a metal tag nailed to a tree positioned on the north bank of the creek and a GPS co-ordinate was taken.

A number of indicators were considered in the condition assessment, each of which were allocated a score using a three-point scoring system of 1 to 3. Relevant comments on condition indicators were also recorded to supplement this. The scoring system will enable broad comparison over time between the results, however, due to the subjective nature of the method, the scores are indicative only.

The nature of many of the key indicators for the condition assessment is such that they will not change over the short term. Some examples of these include time since last flood, fire history, connectivity and remnant shape. The attributes most likely to change over time include dieback, weed invasion and native diversity of lower strata.

A standard recording proforma will be used to document the condition assessment to ensure consistency across subsequent monitoring events. This proforma is provided in **Appendix 2**.

2.4 Photo Monitoring

Photo monitoring was undertaken at the three monitoring sites. The photos will be used to identify any observable changes in the vegetation condition and creek bed and bank stability over time.

At Sites 1 and 2, the photos were taken from two corners of the plot. The two corners selected were those on the creek bank, to ensure that the creek banks were included in the photographs. Four photos were taken at each of the two corners, along the four compass bearings, north, south, east and west. The details of which corners the photo points were located for each site are provided in **Appendix 1**.

Photos were also taken at Site 4 from the marked tree, along eight compass points: north, north-east, east, south-east, south, south-west, west, north-west.

3.0 Results

3.1 Site 1

3.1.1 Vegetation Description

As mapped by Umwelt (2007), the vegetation community at Site 1 is River-flat Eucalypt Forest (**Figure 2.1**), however has been modified from its original composition through clearing, grazing and introduction of weed species. The vegetation is characterised by a low open canopy of swamp oak (*Casuarina glauca*) at a cover of 20% and a height range of 14-20 metres. A tall mid-stratum comprising regenerating swamp oak (*Casuarina glauca*), corkwood (*Duboisia myoporoides*), blackthorn (*Bursaria spinosa* subsp. *spinosa*) and coffee bush (*Breynia oblongifolia*) is present which is 1.5 to 3 metres in height and is moderately dense (40% cover). The lower mid-stratum is sparse (20% cover) and occurs at 0.5-1.5 metres height. This stratum is dominated by bracken fern (*Pteridium esculentum*) and blady grass (*Imperata cylindrica* var. *major*). The dense ground stratum (60% cover) includes basket grass (*Oplismenus aemulus*), wiry panic (*Entolasia stricta*) and weeping grass (*Microlaena stipoides* var. *stipoides*).

There were no distinct changes in the structural characteristics of the vegetation at Site 1 between the autumn and spring 2008 results.

3.1.2 Floristic Results

The full list of flora species recorded in Site 1 in both 2008 monitoring seasons is provided in **Appendix 3**. A total of 29 flora species were recorded in Site 1 during the autumn baseline monitoring, 18 of which are native and 11 are introduced species. This compares with the results of the spring monitoring, where 37 species were recorded, 24 native and 13 introduced. A summary of the floristic results across both seasons is provided in **Table 3.1**.

Table 3.1 – Summary of Floristic Results, Site 1, Autumn and Spring 2008

Floristic Attribute	Autumn 2008	Spring 2008	TOTAL over both seasons
Native species	18	24	29
Weed species	11	13	19
Total species	29	37	48
No. of families	21	21	24
Most speciose plant families	Asteraceae Poaceae	Asteraceae Poaceae	Asteraceae Poaceae

As can be seen from **Table 3.1**, eight more species were recorded in spring than in autumn. There were 11 species that were recorded in autumn but were not recorded again in spring; while 19 species were recorded in spring but not in autumn. These differences in floristics across the two survey periods can largely be attributed to introduced annual species which aren't detectable at all times of the year such as wild aster (*Aster subulatus*), scarlet pimpernel (*Anagallis arvensis*), fireweed (*Senecio madagascariensis*) and stinking Roger (*Tagetes minuta*). The seasonal variations in floristic composition will become more evident over time as more data is collected.

3.1.3 Condition Assessment Results

The results of the Condition Assessment for both autumn and spring 2008 are provided in **Appendix 4**. There was no difference in the scores recorded for the two seasons.

Site 1 is not currently fenced from grazing by livestock (horses), however the dense blackberry (*Rubus fruticosus* sp. agg.) present at the site is likely to be a deterrent to grazing. No evidence of grazing was observed in either monitoring event at this site. The site has been cleared in the past for agriculture and the vegetation is now regenerating, with very few mature trees present. Despite a history of disturbance to the vegetation there is a reasonable diversity of native flora species in the mid and lower strata. Some dieback was evident in the swamp oak (*Casuarina glauca*), however this was not severe.

Significant bank slumping is present on the south bank of the creek at this location. This slumping is likely to be due to the lack of stabilising vegetation on this section of the bank.

A number of weed species were recorded in Plot 1, the most widespread and invasive being blackberry (*Rubus fruticosus* sp. agg) and wandering Jew (*Tradescantia fluminensis*). The former species was recorded at a cover score of 5 to less than 20% in autumn 2008, which increased to a 20 to less than 50% cover score in spring 2008. The latter species was recorded with a cover score of less than 5% in autumn which increased to 5 to less than 20% in spring. The increasing dense growth of these species is resulting in the suppression of native flora diversity in the lower and mid strata.

Other weed species recorded in this plot include scarlet pimpernel (*Anagallis arvensis*), panic veldtgrass (*Ehrharta erecta*), spear thistle (*Cirsium vulgare*) and dandelion (*Taraxacum officinale*).

Overall, the vegetation at Site 1 is relatively disturbed. It has a history of clearing and is currently threatened by weed species. Additionally, the bank is unstable, with areas of severe bank slumping evident. There is also low evidence of dieback in the canopy trees, which in some cases may indicate a tree's response to stress.

3.1.4 Photo Monitoring Results

All photos taken for the photo monitoring at Site 1 are provided in a digital album format on a CD included with this document. The autumn and spring replicates of one representative photo are provided in **Plates 1** and **2**.

3.2 Site 2

3.2.1 Vegetation Description

As mapped by Umwelt (2007), the vegetation community at Site 2 is River-flat Eucalypt Forest (**Figure 2.1**), however has been modified from its original composition through clearing, grazing and introduction of weed species. The vegetation has a sparse (15% cover), 12-15 metre high canopy dominated by swamp oak (*Casuarina glauca*) and black wattle (*Acacia decurrens*). There are two mid-strata, the taller one being 8-10 metres in height and dominated by corkwood (*Duboisia myoporoides*), lemon-scented tea tree (*Leptospermum polygalifolium*), swamp oak (*Casuarina glauca*) and the introduced wild tobacco (*Solanum mauritianum*). The lower mid-stratum is dense at 50% cover and is dominated by bracken fern (*Pteridium esculentum*), spiny-headed mat-rush (*Lomandra longifolia*) and the introduced blackberry (*Rubus fruticosus* sp. agg). The lower stratum is very dense at 80% cover, and is dominated by blady grass (*Imperata cylindrica* var. *major*), basket grass (*Oplismenus aemulus*), maidenhair fern (*Adiantum aethiopicum*) and the introduced wandering Jew (*Tradescantia fluminensis*).

There was an increase in the density of weed species at Site 2 between the autumn and the spring 2008 surveys. In particular, wandering Jew (*Tradescantia fluminensis*) and blackberry (*Rubus fruticosus* sp. agg) both increased by approximately 10% cover.

3.2.2 Floristic Results

The full list of flora species recorded at Site 2 in both 2008 monitoring seasons is provided in **Appendix 3**. A total of 34 flora species were recorded in Plot 2 during the autumn baseline monitoring, 19 of which are native and 15 are introduced. This compares with the results of the spring monitoring, where 41 species were recorded, 19 native and 22 introduced. A summary of the floristic results across both seasons is provided in **Table 3.2**.

Table 3.2 – Summary of Floristic Results Site 2, Autumn and Spring 2008

Floristic Attribute	Autumn 2008	Spring 2008	TOTAL (both seasons)
Native species	19	19	25
Weed species	15	22	28
Total species	34	41	54
No. of families	20	22	26
Most speciose plant families	Asteraceae Poaceae Solanaceae	Asteraceae Poaceae Solanaceae	Asteraceae Poaceae

As can be seen from **Table 3.2**, almost 50% of species recorded (for both autumn and spring) are introduced species. This is mirrored by a relatively low recorded native species diversity.



PLATE 1
Site 1 North Corner Bearing 180 Autumn



PLATE 2
Site 1 North corner Bearing 180 Spring

Seven more species were recorded in spring than in autumn. There were 12 species that were recorded in autumn but were not recorded again in spring; while 19 species were recorded in spring but not in autumn. These differences in floristics across the two survey periods can largely be attributed to introduced annual species which aren't detectable at all times of the year such as comcko sow thistle (*Sonchus oleraceus*), fleabane (*Conyza sumatrensis*), greater beggars ticks (*Bidens subalternans*), Paddys lucerne (*Sida rhombifolia*) and curled dock (*Rumex crispus*). The seasonal variations in floristic composition will become more evident over time as more data is collected.

3.2.3 Condition Assessment Results

The results of the Condition Assessment for both autumn and spring 2008 are provided in **Appendix 4**. The only change to the condition assessment scores for the two seasons is a slight increase in weed invasion from 10-30% in spring to over 30% in autumn.

Site 2 is currently not grazed, however it is unfenced and cattle are present in the adjacent paddock. As was the case for Site 1, the dense understorey which supports dense thickets of blackberry (*Rubus fruticosus* sp. agg.) may be a deterrent to livestock grazing.

There has been clearing of the riparian vegetation in the past with subsequent grazing. Consequently the current vegetation is in a state of regeneration, with few mature trees and simplified understorey structure and floristics. No evidence of crown dieback was observed at this site. Slight bank undercutting is present along this reach of the creek. This erosion is likely due to the lack of stabilising vegetation on the banks.

A number of weed species were recorded in Site 2, the most widespread and invasive being blackberry (*Rubus fruticosus* sp. agg) and wandering Jew (*Tradescantia fluminensis*), both of which were also recorded in similar densities at Plot 1. Both species have increased in cover since the autumn monitoring surveys. The increasing dense growth of these species is resulting in the suppression of native flora diversity in the lower and mid strata.

Other weed species recorded in this plot include wild tobacco (*Solanum mauritianum*), spear thistle (*Cirsium vulgare*), moth vine (*Arauja hortorum*), panic veldtgrass (*Ehrharta erecta*) and gin case (*Verbena brasiliensis*).

Overall, the vegetation at Site 2 is relatively disturbed. It has a history of clearing, and is currently threatened by introduced species. The bank is reasonably stable, however there is evidence of minor bank erosion/undercutting.

3.2.4 Photo Monitoring Results

All photos taken for the photo monitoring at Site 2 are provided in a digital album format on a CD included with this document. The autumn and spring replicates of one representative photo are provided in **Plates 3** and **4**.

3.3 Site 4

3.3.1 Vegetation Description

As mapped by Umwelt (2007), the vegetation community at Site 4 is River-flat Eucalypt Forest (**Figure 2.1**), however has been modified from its original composition through clearing, grazing and introduction of weed species. The vegetation is characterised by a very narrow riparian forest of swamp oak (*Casuarina glauca*) of one to two trees wide. The grassy understorey has grazed and is consequently low in height, with a low native species



PLATE 3
Site 2 West Corner Bearing 180 Autumn 2008



PLATE 4
Site 2 West Corner Bearing 180 Spring 2008

diversity. There is some in-stream vegetation, predominantly the floating aquatic water ribbons (*Triglochin procera*). The vegetation adjacent to the riparian band is pasture, dominated by introduced grasses and herbs.

Given the highly modified state of the vegetation at this location, survey was limited to a condition assessment and photo monitoring.

3.3.2 Condition Assessment Results

The results of the Condition Assessment for both autumn and spring 2008 are provided in **Appendix 4**. As previously described in **Section 3.3.1**, the vegetation at Site 4 is highly modified, and is currently impacted by grazing. The native flora species diversity is very low, in both the mid and the lower strata.

There is no evidence of canopy dieback at this location. There is limited evidence of erosion along the bank, however slight undercutting was observed.

3.3.3 Photo Monitoring Results

All photos taken for the photo monitoring at Site 4 are provided in a digital album format on a CD included with this document. The autumn and spring replicates of one representative photo are provided in **Plates 5** and **6**.

4.0 Management Recommendations

Given that this is the baseline monitoring only and mining has not yet commenced, there are no recommendations relevant to the management of impacts on vegetation or stream condition. However, the following sections provide recommendations in relation to the ongoing monitoring program.

4.1 Proposed Additional Sites

While the current monitoring sites provide a good representation of the Study Area, it was determined that the scope of the monitoring surveys could be expanded without significantly adding to the monitoring survey time. In particular, additional photo monitoring sites would provide greater coverage of the creek lines to identify changes that may be associated with subsidence. This is proposed through the addition of three new monitoring sites, the approximate locations of which are indicated on **Figure 4.1**. These sites are proposed to be incorporated into the next round of monitoring. A replacement Site 3 is proposed as an additional vegetation plot, while an additional Site 5 is proposed and will be similar to Site 4 where only a condition assessment and photo monitoring is undertaken.

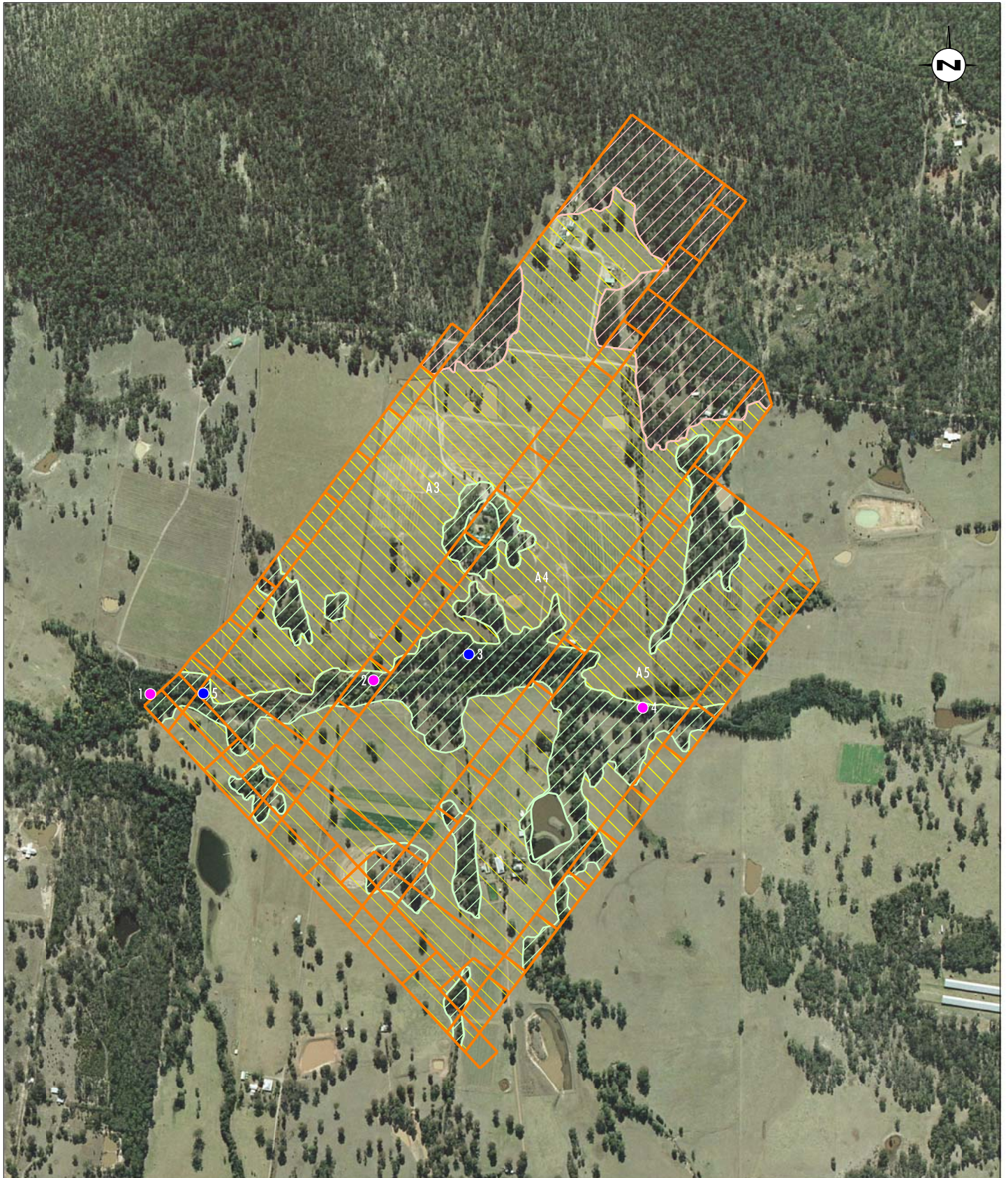
Over time, additional photo monitoring points may be established at other locations within the Stage 2 Mining Area, in particular to monitor any changes to creek geomorphology. Any additional photo monitoring points established should be permanently marked with a labelled, metal stake or another suitable method agreed to with the landholder.



PLATE 5
Site 4 Bearing 135 Autumn 2008



PLATE 6
Site 4 Bearing 135 Spring 2008



Base Source: AAM Hatch, 2006
Source: Austar Coal Mine

0 100 200 400m
1:10 000

Legend

- Stage 2 Longwall Panels and Study Area Boundary
- ▨ Riparian Swamp Oak - Rough-barked Apple Open Forest (Possible River-flat Eucalypt Forest EEC)
- ▨ Spotted Gum - Ironbark Forest (Lower Hunter Spotted Gum-Ironbark Forest EEC)
- ▨ Derived Grassland
- Established Monitoring Sites
- Proposed Additional Monitoring Sites
- A3 Longwall Panel Numbers

FIGURE 4.1

Location of Proposed
Additional Monitoring Sites

4.2 Ongoing Monitoring Schedule

Biannual monitoring will continue to be undertaken in autumn and in spring. Two monitoring events per year will sample seasonal variation in vegetation, enabling patterns of change to be more accurately attributed to cause.

Baseline monitoring in both seasons was undertaken in 2008 so that quantitative baseline information could be established prior to the commencement of mining. The results of subsequent monitoring surveys can then be compared effectively with the baseline data.

Biannual monitoring will be conducted for a period of five years after the commencement of mining. The need for and frequency of subsequent monitoring surveys will be reviewed after five years based on the results obtained up to that time.

5.0 Conclusions

This monitoring report documents the baseline results from monitoring sites in the Stage 2 Mine Area. The results include a description of the vegetation structure, floristics and condition in such a way that comparisons with post-mining data can be readily made to determine any possible impacts of the longwall mining. Photo monitoring further supplements this data, providing a visual reference of the baseline condition of the vegetation and creeklines.

All monitoring sites were found to be in varying states of disturbance, particularly due to past clearing and grazing practices and subsequent heavy weed invasion.

Because the longwall mining has not commenced in this area, no disturbance-related matters are a result of subsidence.

No management recommendations are required to be implemented at this point in time, however recommendations were put forward in relation to the monitoring program, being the incorporation of additional monitoring sites, and the schedule of the ongoing monitoring program.

6.0 Reference

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APPENDIX 1

Monitoring Site Details

Appendix 1

Monitoring Site Details

Site	Eastings (MGA)	Northings (MGA)	Photo Monitoring Corner 1	Photo Monitoring Corner 2
Site 1	345230	6357280	north corner (N,S, E, W)	east corner (N,S, E, W)
Site 2	345653	6357306	east corner (N,S, E, W)	west corner (N,S, E, W)
Site 4	346163	6357254	tagged tree (N, NE, E, SE, S, SW, W, SW)	-

APPENDIX 2

Condition Assessment Proforma

Appendix 2 – Condition Assessment Proforma

Site No: _____ Recorder/s: _____ Date: _____

Location: GPS way pt. of site marker (if used) _____ Easting _____ Northing _____

Fencing: fully/ partial / not fenced _____ Current land use: _____

Monitoring Photos (taken from marker: stake or tagged tree)

Position of site marker in remnant:

Bearing	Photo No.	Bearing	Photo No.	Bearing	Photo No.	Bearing	Photo No.
0 deg		90 deg		180 deg		270 deg	
45 deg		135 deg		225 deg		315 deg	

Attribute of Remnant/Site	Score	Comments
Grazing by stock 1 = severe/heavy 2 = moderate (limited but evident) 3 = nil – very low		
Logging/Clearing 1 = severe/heavy 2 = moderate (selective) 3 = nil – very low		
Weed invasion 1 = 30%+ cover 2 = 10-30% 3 = <10%		
Clearing or mowing of understorey 1 = 30%+ cleared 2 = 10-30% cleared 3 = <10% cleared		
Dieback in crown 1 = 30%+ dead 2 = 10-30% dead 3 = <10% dead		
Canopy plants age diversity/regeneration 1 = 1-2 ages 2 = 3-4 ages 3 = 5+ ages		
Native diversity of mid strata 1 = <5 species 2 = 5-10 species 3 = 10+ species		
Native diversity of lower strata/ground cover 1 = <5 species 2 = 5-10 species 3 = 10+ species		
Erosion 1 = severe/impacting >30%of site 2 = moderate (limited but evident) 3 = nil – very low (minimal impact)		
Time since last flood (from records) 1 = over 10 years 2 = 5-10 years 3 = <5 years		
Fire history of remnant (from records) 1 = < 20 years 2 = 20-50 years 3 = >50 years		
Connectivity of Remnant 1 = isolated (over 50m from nearest neighbouring remnant) 2 = part of a local corridor (occurs within 50m of two or more similar sized or larger remnants) 3 = part of a regional corridor (connected to large tract of vegetation that extends across floodplain to catchment foothills)		
Remnant shape 1 = linear (1-3 trees wide) 2 = rectangle, oblong or narrow core (>3 trees wide) 3 = square, circle or large core (many trees wide)		

APPENDIX 3

Flora Species List

Appendix 3 – Flora Species List

The following list was developed from the autumn 2008 and spring 2008 monitoring surveys of the Stage 2 Mine Area detailed in **Section 2.1** of the main report. It includes all species of vascular plants observed during the monitoring. Not all species are readily detected at any one time of the year, therefore the list will not necessarily include all plant species likely to occur in the monitoring plots. Many species flower only during restricted periods of the year, and some flower only once in several years. In the absence of flowering material, many of these species cannot be identified, or even detected.

Names of classes and families follow a modified Cronquist (1981) System.

Any species that could not be identified to the lowest taxonomic level are denoted in the following manner:

- sp. specimens that are identified to genus level only;
- ? specimens for which identification was uncertain;
- prob. specimens for which identification was considered highly likely but not definite;
- poss. specimens for which identification was considered likely but not definite;

The following abbreviations or symbols are used in the list:

- asterisk (*) denotes species not indigenous to the study area;
- subsp. subspecies; and
- var. variety; and
- f. forma.

All vascular plants recorded or collected were identified using keys and nomenclature in Harden (1992, 1993, 2000 & 2002) and Wheeler et al. (2002). Where known, changes to nomenclature and classification have been incorporated into the results, as derived from *PlantNET* (Botanic Gardens Trust 2009), the on-line plant name database maintained by the National Herbarium of New South Wales.

Common names used follow Harden (1992, 1993, 2000 & 2002) where available, and draw on other sources such as local names where these references do not provide a common name.

Family	Scientific Name	Common Name	Site 1		Site 2	
			Win '08	Sum '08	Win '08	Sum '08
Filicopsida (ferns)						
Adiantaceae	<i>Adiantum aethiopicum</i>	common maidenhair	3	2	2	1
Dennstaedtiaceae	<i>Pteridium esculentum</i>	bracken fern	4	4	2	
Magnoliopsida (flowering plants) – Liliidae (monocots)						
Commelinaceae	<i>*Tradescantia fluminensis</i>	wandering Jew	1	3	2	4
Commelinaceae	<i>Commelina cyanea</i>	native wandering Jew				1
Cyperaceae	<i>Carex appressa</i>	tall sedge				2
Cyperaceae	<i>Cyperus enervis</i>		2			
Lomandraceae	<i>Lomandra longifolia</i>	spiny-headed mat-rush	1		2	2
Poaceae	<i>*Bromus catharticus</i>	prairie grass		2		1
Poaceae	<i>Cynodon dactylon</i>	common couch	2	2	2	2
Poaceae	<i>Digitaria</i> sp.				1	
Poaceae	<i>Echinopogon caespitosus</i> var. <i>caespitosus</i>	tufted hedgehog grass		2		1
Poaceae	<i>*Ehrharta erecta</i>	panic veldtgrass	2	3	4	4
Poaceae	<i>Entolasia stricta</i>	wiry panic	2	2		
Poaceae	<i>Imperata cylindrica</i> var. <i>major</i>	blady grass	3	2	2	2
Poaceae	<i>Microlaena stipoides</i> var. <i>stipoides</i>	weeping grass	2	4		2
Poaceae	<i>Oplismenus aemulus</i>	basket grass		2	1	2
Poaceae	<i>Oplismenus imbecillis</i>	basket grass	3			
Poaceae	<i>Panicum effusum</i>	hairy panic			1	
Poaceae	<i>Phragmites australis</i>	common reed		1		
Poaceae	<i>*Setaria gracilis</i>	slender pigeon grass			1	
Poaceae	<i>Themeda australis</i>	kangaroo grass			2	2
Magnoliopsida (flowering plants) – Magnoliidae (dicots)						
Asclepiadaceae	<i>*Araujia hortorum</i>	moth vine			2	2
Asteraceae	<i>*Aster subulatus</i>	wild aster		1		
Asteraceae	<i>*Bidens subalternans</i>	greater beggars ticks	1		1	
Asteraceae	<i>*Cirsium vulgare</i>	spear thistle		2	1	2

Family	Scientific Name	Common Name	Site 1		Site 2	
			Win '08	Sum '08	Win '08	Sum '08
Asteraceae	* <i>Conyza bonariensis</i>	flaxleaf fleabane	2		2	
Asteraceae	* <i>Conyza sumatrensis</i>	tall fleabane		2		2
Asteraceae	* <i>Senecio madagascariensis</i>	fireweed	1		1	1
Asteraceae	* <i>Sonchus oleraceus</i>	common sowthistle	1	2		2
Asteraceae	* <i>Tagetes minuta</i>	stinking Roger	1			
Asteraceae	* <i>Taraxacum officinale</i>	dandelion		2		1
Caryophyllaceae	* <i>Paronychia brasiliensis</i>	Chilean whitlow wort				1
Caryophyllaceae	* <i>Polycarpon tetraphyllum</i>	four-leaved allseed				1
Caryophyllaceae	* <i>Stellaria media</i>	common chickweed				2
Casuarinaceae	<i>Casuarina glauca</i>	swamp oak	4	2	2	3
Dilleniaceae	<i>Hibbertia linearis</i>			1		
Euphorbiaceae	<i>Breynia oblongifolia</i>	coffee bush	2	1		
Euphorbiaceae	<i>Phyllanthus gasstroemii</i>			2		
Fabaceae (Faboideae)	<i>Glycine microphylla</i>	small leaf glycine	2			
Fabaceae (Faboideae)	<i>Glycine tabacina</i>	love creeper		1		
Fabaceae (Mimosoideae)	<i>Acacia decurrens</i>	black wattle		1	2	2
Geraniaceae	<i>Geranium homeanum</i>			2	2	2
Geraniaceae	<i>Geranium</i> sp.		2			
Lamiaceae	<i>Plectranthus parviflorus</i>				1	
Lobeliaceae	<i>Pratia purpurascens</i>	whiteroot	2	2	3	2
Malvaceae	* <i>Sida rhombifolia</i>	Paddys lucerne			1	
Myrtaceae	<i>Leptospermum polygalifolium</i>	lemon-scented tea tree			3	3
Oleaceae	<i>Notelaea longifolia</i> forma <i>longifolia</i>	large mock olive	1	1		
Onagraceae	* <i>Oenothera mollissima</i>	evening primrose				1
Oxalidaceae	<i>Oxalis perennans</i>	wood sorrell		2		
Pittosporaceae	<i>Bursaria spinosa</i> subsp. <i>spinosa</i>	blackthorn	2	3		
Plantaginaceae	* <i>Plantago lanceolata</i>	lamb's tongues	2	2	1	1

Family	Scientific Name	Common Name	Site 1		Site 2	
			Win '08	Sum '08	Win '08	Sum '08
Polygonaceae	<i>Persicaria hydropiper</i>	water pepper			1	
Polygonaceae	* <i>Rumex crispus</i>	curled dock		1		2
Polygonaceae	<i>Rumex</i> sp.				2	
Primulaceae	* <i>Anagallis arvensis</i>	scarlet pimpernel		2	1	2
Ranunculaceae	* <i>Ranunculus sceleratus</i>	celery buttercup				1
Ranunculaceae	<i>Clematis glycinoides</i> var. <i>glycinoides</i>	headache vine	2	2	1	2
Rosaceae	* <i>Rubus fruticosus</i> sp. agg.	blackberry complex	2	4	2	3
Rosaceae	<i>Rubus parvifolius</i>	native raspberry		2		2
Rubiaceae	* <i>Richardia stellaris</i>					1
Scrophulariaceae	<i>Veronica plebeia</i>	trailing speedwell		2		
Solanaceae	* <i>Cestrum parqui</i>	green cestrum			1	
Solanaceae	<i>Duboisia myoporoides</i>	corkwood	3	3	2	1
Solanaceae	* <i>Solanum jasminoides</i>	potato climber	3		2	
Solanaceae	* <i>Solanum mauritianum</i>	wild tobacco bush			2	2
Solanaceae	* <i>Solanum nigrum</i>	black-berry nightshade		1		2
Verbenaceae	* <i>Verbena bonariensis</i>	purpletop	1			
Verbenaceae	* <i>Verbena brasiliensis</i>	gin case				2
Violaceae	<i>Viola hederacea</i>	ivy-leaved violet				1

APPENDIX 4

Condition Assessment Results

Appendix 4

Condition Assessment Results

Condition Attribute*	Site 1 – Aut '08	Site 1 – Spr '08	Site 2 – Aut '08	Site 2 – Spr '08	Site 4 – Aut '09	Site 4 – Spr '09
Grazing by stock	3	3	3	3	2	2
Logging/clearing	2	2	2	2	2	2
Weed invasion	2	2	2	1	1	1
Clearing/mowing of understorey	3	3	3	3	1	1
Dieback in crown	2	2	3	3	3	3
Canopy plants age diversity	2	2	1	1	1	1
Native diversity of mid strata	2	2	2	2	1	1
Native diversity of lower strata	3	3	3	3	1	1
Erosion	1	1	2	2	2	2
Time since last flood	3	3	3	3	3	3
Fire history of remnant	1	1	3	3	1	1
Connectivity of remnant	2	2	2	2	2	2
Remnant Shape	2	2	2	2	1	1

*Refer to **Appendix 2** for a description of the condition attribute scores.

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