APPENDIX J

WILPINJONG ECA FLORA AND REHABILITATION MONITORING REPORT

(Source: Landline Consulting, 2011)

PEABODY ENERGY

WILPINJONG ECA FLORA AND REHABILITATION MONITORING REPORT

2011

Summary

The objective of the monitoring program is to assess the rehabilitation status on the ECA areas (including Wilpinjong Creek) and Regrowth areas that have been set aside to allow natural regeneration by native species, and Rehabilitation areas. In September 2007, long term monitoring transects were established on land newly set aside to commence the assessment of the regeneration process, and therefore represent the baseline data status. Thirty-eight sites were established and assessed. These sites were revisited in September 2008 and September 2009 as part of the ongoing vegetation monitoring schedule. Five new sites along Wilpinjong Creek and five rehabilitation sites were added in 2009 and 2010; the rehabilitation mine sites include two new sites established in 2009 and a further three sites in 2010. In 2011 a further two Rehabilitation sites and seven Regrowth sites were established. In summary, thirty-eight ECA sites, seven Regrowth sites, five Wilpinjong Creek sites and seven Rehabilitation sites were monitored.

Cattle no longer graze ECA areas A (south of Cumbo Creek), B (north of Wilpinjong Creek) and C (valley west of the current mining activities), nor Wilpinjong Creek, though rabbits and kangaroos graze the ECA areas in increasing numbers.

For ECA and Regrowth areas tree density and species numbers are generally low compared with the tentative completion criteria. The most important factor restricting recolonisation by trees and shrubs in the Regrowth and Wilpinjong Creek areas is lack of a seed source close by. Whilst the ECA areas often have a seed source from nearby forests, rabbits continue to restrict seedling development. Rehabilitation areas generally have high numbers of trees and shrubs of a number of species that were sown. Clearly to encourage woody plant colonisation in the ECA areas, regrowth areas and Wilpinjong Creek seed sowing is required.

Soil fertility is generally poor in the ECA areas which probably have not been fertilized intensively in the past because they are located on the margins of the cleared land. In 2010, soil samples collected in the valley in which the ECA C sites are located have extremely low levels of Colwell phosphorus and this would normally retard regeneration, even though the native species are considered well adapted to low soil fertility. Soil fertility analysis is recommended for the monitoring program in 2012 to assess current levels of fertility and how that might be restricting growth.

The poor recolonisation of the ECA areas makes it necessary to consider seeding with tree and shrub species consistent with the species mix in that particular part of the landscape (as discussed below). Given the low yields of the herbage we believe that soil disturbance is not required to establish the tree and shrub species. However, phosphorus

fertiliser should be applied with the seed at a rate of 30 kg P/ha or 150 kg/ha triple superphosphate.

Wilpinjong Creek

Regeneration along Wilpinjong Creek has been poor. It is clear that heavy grazing by rabbit and kangaroo has reduced species development, particularly for rough-barked apple. Of the isolated apple trees along the creek there are often large numbers of seedling, but they fail to develop beyond 0.3m height due to the high fauna grazing pressure. Heavy seeding (1 kg/ha) with rough-barked apple, Blakely's red gum and yellow box in a broad band approximately 50–80 m either side of the creek should be trialled along with a program to cull rabbit and kangaroo to reduce grazing pressure. If this is successful, the tree canopy will shade the creek and reduce the reed population that currently smothers sections of the creek.

Spoil Rehabilitation Sites

Rehabilitation on the mine spoil areas is good with high groundcover and herbage yields and adequate density of tree and shrub species. The number of tree/shrub species is, however, limited and future seeding should aim to have at least 5 different species, including rough-barked apple, Blakely's red gum, yellow box, grey box (gum-topped box) and narrow-leafed ironbark in the longer term, together with *Acacia ixiophylla* sticky leaved wattle, *A. linearifolia* narrow-leaved wattle and *A. implexa*.

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1.0 Introduction

Wilpinjong Coal Mine has a program of setting aside previously cleared land, which has been closed off to allow the natural bushland to regenerate. This program is regarded as an act to compensate for land being mined. Generally the Enhancement and Conservation Areas (ECAs) adjoin undisturbed bushland on the lower slopes of the sandstone hills surrounding the coal mine.

The land in the valley had been cleared in the early part of the last century for grazing or cropping, which was only possible through the use of superphosphate fertilizer as the soils were inherently infertile. Pastures for cattle and sheep were based on the use of subterranean clover and superphosphate after the 1950s. Cattle no longer graze the ECA areas. Rabbit and kangaroo shelter in the bushland fringes adjacent to the ECA areas. Heavy grazing by these animals restricts natural regeneration of bushland species on the fringes of the cleared area.

In order to verify regeneration of these areas a monitoring program was established to assess changes in vegetation, soils and fauna. Fauna is reported separately. Landline Consulting was commissioned to conduct the ECA Monitoring Program in 2007, the first year of the monitoring program. Follow up surveys were conducted in September 2008 and September 2009. This report discusses rehabilitation status across the project area.

2.0 Methods

The monitoring program was conducted during September 2011 across 57 sites on three ECA areas designated A, B and C, including Wilpinjong Creek, Regrowth areas and mine spoil Rehabilitation area (R) (Map 1, Table 2). At each site a permanent transect of 50 metres length was established. The following measurements were taken:

- Tree and shrub density, height, species and health rating;
- Groundcover, biomass, species composition, and
- Soil erosion.

Within a three-metre band along each transect, trees and shrubs were counted and identified, and height and health assessed. Along the same transect, measurements of groundcover, biomass and species composition were also taken in a 0.25 m^2 quadrat placed at 5 metre intervals along the transect. Tree health rating ranged from 0 (dead) to

5 (live, healthy, well-structured tree). A photograph was taken along each transect as a long term visual record of vegetation performance.

An estimate of erosion was also made at 5 m intervals along each transect, with ratings 0 (no erosion), 1 sheet erosion, 2 rill erosion (<0.3m deep), 3 gully erosion (>0.3m<1m deep), 4 gully erosion (>1 m deep) and tunnel erosion adapted from rating of McDonald, *et al.* (1990).

Vegetation descriptors

In the text, descriptors are used to provide a word picture of the vegetation rather than repeating the raw numbers that are already given in the tables.

Trees and shrubs

Trees	mature height > 5 m
Shrubs	mature height < 5 m

Tree and shrub density (stems/ha)

Low	<100
Moderate	100-1000
High	1001-2000
Very high	>2000

Tree and shrub health (0-5 rating)

Poor	<2
Fair	2-3
Good	>3

Groundcover (% projected cover of the ground layer)

Low	<40
Moderate	40-80
High	>80

Herbage yield

Low	<200
Moderate	200-500
High	>500

Rehabilitation criteria

A set of tentative completion criteria has been developed in the Rehabilitation Management Plan and is presented here in Table 1. It contains criteria for assessing vegetation development in ECA sites and mine spoil rehabilitation. These will need to be modified as revegetation proceeds.


RG6
RG7
WT5
B1
B7
B2
B3
B4
B5
B6
B8
B10
B9
WT4
WT3
WT2
WT1
B11
B12
RG5
RG4
R6
R7
R2
R1
R5
R3
R4
C1
C2
C3
C4
C5
C12
C11
C10
C9
C7
C6
C8
RG3
RG1
A5
A4
A12
RG2
A3
A6
A8
A10
A2
A7
A13
A14
A9
A15
A1
N
0
1,000
2,000
metres
Landline Consulting
Drawn: MRM
Date: 18-11-11
WILPINJONG COAL PROJECT
LOCATION OF VEGETATION MONITORING SITES - 2011

Map 1. Location of ECA, Regrowth and Rehabilitation monitoring sites in 2011.

Table 1. Quantitative completion criteria

	Quantitative Completion Criteria		
Mine Component	**Year 1**	**Year 5**	**Year 15**
Rehabilitation Areas	• Groundcover >60% • Groundcover species >3 • Stem density of woody plants >3000 stems/ha • Woody plant diversity > 3 upper storey species and >3 under storey species	• Groundcover >60% • Groundcover species >3 • Stem density of woody plants >1000 stems/ha • Woody plant diversity > 3 upper storey species and >3 under storey species • Erosion less than score 3	• Groundcover >60% • Groundcover species >3 • Stem density of woody plants >800 stems/ha or similar to that in analogue site • Woody plant diversity > 3 upper storey species and >3 under storey species • Natural regeneration woody species >10 stem/ha • Erosion less than score 3 • Soil chemistry parameters similar to those on analogue sites
Regeneration Areas	• Groundcover >60% • Groundcover species >3 • Stem density of woody plants >1000 stems/ha • Woody plant diversity > 3 upper storey species and >3 under storey species	• Groundcover >60% • Groundcover species >3 • Stem density of woody plants >1000 stems/ha • Woody plant diversity > 3 upper storey species and >3 under storey species	• Groundcover >60% • Groundcover species >3 • Stem density of woody plants >800 stems/ha or similar to that in analogue site • Woody plant diversity > 3 upper storey species and >3 under storey species • Natural regeneration woody species >10 stem/ha • Similar species occurrence to adjacent reference sites
Enhancement and Conservation Areas -Enhancement of existing remnant vegetation (including the WBYBBRG EEC).	• Groundcover >60% • Groundcover species >4 • Stem density of woody plants >500 stems/ha • Woody plant diversity > 3 upper storey species and >3 under storey species	• Groundcover >60% • Groundcover species >4 • Stem density of woody plants >500 stems/ha • Woody plant diversity > 3 upper storey species and >3 under storey species	• Groundcover >60% • Groundcover species >4 • Stem density of woody plants >800 stems/ha • Woody plant diversity > 3 upper storey species and >3 under storey species • Natural regeneration woody species >10 stem/ha • Similar species occurrence to adjacent reference sites
– Establishment of woodland vegetation (excluding the WBYBBRG EEC).	• Groundcover >60% • Groundcover species >3 • Stem density of woody plants >500 stems/ha • Woody plant diversity > 3 upper storey species and >3 under storey species	• Groundcover >60% • Groundcover species >3 • Stem density of woody plants >500 stems/ha • Woody plant diversity > 3 upper storey species and >3 under storey species	• Groundcover >60% • Groundcover species >3 • Stem density of woody plants >800 stems/ha • Woody plant diversity > 3 upper storey species and >3 under storey species • Natural regeneration woody species >10 stem/ha • Similar species occurrence to adjacent reference sites
– Establishment of the WBYBBRG EEC.	• Groundcover >60%	• Groundcover >60%	• Groundcover >60%

	Quantitative Completion Criteria		
Mine Component	**Year 1**	**Year 5**	**Year 15**
	• Groundcover species >4 • Stem density of woody plants >500 stems/ha • Woody plant diversity > 3 upper storey species and >3 under storey species	• Groundcover species >4 • Stem density of woody plants >500 stems/ha • Woody plant diversity > 3 upper storey species and >3 under storey species	• Groundcover species >4 • Stem density of woody plants >800 stems/ha • Woody plant diversity > 3 upper storey species and >3 under storey species • Natural regeneration woody species >10 stem/ha • Similar species occurrence to adjacent reference sites

Table 2. ECA (A, B, C), Wilpinjong Creek (WT), Regrowth (RG) and Rehabilitation (R) areas monitored in September 2011.

A	B	C	WT	R	RG
A1	B1	C1	WT1	R1	RG1
A2	B2	C2	WT2	R2	RG2
A3	B3	C3	WT3	R3	RG3
A4	B4	C4	WT4	R4	RG4
A5	B5	C5	WT5	R5	RG5
A6	B6	C6		R6	RG6
A7	B7	C7		R7	RG7
A8	B8	C8			
A9	B9	C9			
A10	B10	C10			
A12	B11	C11			
A13	B12	C12			
A14					
A15					

3.0 Results and Discussion

3.1 Rainfall

Rainfall at the Wilpinjong mine site is shown in Table 3 for the period 2006-11. Following the drier than average conditions in 2006, growing conditions have been favourable in 2007-2008 with rainfall generally well spread. January, May and August 2009, however, were noticeably drier than the long term averages. Rainfall in 2010 was well above average due to heavy February rainfall and good winter-spring rainfall.

Table 3. Monthly rainfall at Wilpinjong Coal Mine and long term rainfall at nearby Gulgong Post Office (1881 – 2007)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
2006	67	77	9	21	1	37	51	7	16	2	70	NA	(357)
2007	26	35	57	39	49	187	15	29	0	39	149	171	797
2008	76	115	16	12	10	61	28	69	28	70	91	117	694
2009	11	68	42	25	7	45	48	8	36	43	24	103	461
2010	61	140	67	41	56	34	81	71	62	60	150	231	1054
2011	114	34	43	32	38	17	6	42	93	38	-	-	(457)
Long term	70	61	55	45	46	51	49	46	46	56	59	65	649

3.2 Vegetation data

This section describes vegetation in each transects. The text description concentrates on changes and trends, where these are possible to infer. The tables give absolute values. In the case of height and health, the graphs show the distributions that make up the averages.

Identification to species level for summer-growing grasses was generally difficult for the ground cover grasses as seed heads had fallen. However, the importance of grasses is not which species they are but whether they are annual or perennial, the latter lending stability to the sward.

The photographic record is provided for 2007, 2008, 2010 and 2011 to show visual changes in vegetation. The photograph for 2009 is omitted simply to reduce the size of the document.

The detailed data for each site is provided in Appendix 1. That data has been summarized for simplicity in Table 4 to demonstrate changes in vegetation characteristics and rehabilitation of the sites. Highlighted values suggest where improvement would be desirable. Individual aspects are discussed below.

ECA and Regrowth areas have the following characteristics

- High levels of groundcover which provide adequate protection from erosion.
- Groundcover is often in the form of litter and this is a reflection of the age of the groundcover.
- Groundcover species are predominantly perennials, even though annual species such as sub clover and annual ryegrass have been sown in these areas in the past.
- Generally there are at least 4 groundcover species, not including weeds.
- Tree and shrub densities were generally greater than the ideal value of >25 stems/ha, though some sites have no tree or shrub recruitment
- The number of tree species was generally less than the ideal value of 3 species.
- Erosion was not a problem

The Wilpinjong Creek monitoring sites are characterized as follows:

- High groundcover percentage dominated by perennial species
- Few trees and number of species
- Little erosion

The Rehabilitation areas have the following characteristics:

- High groundcover percentage represented by high yielding live plants, and little litter
- Groundcover yield high and dominated by three or more perennial species
- Moderate densities of tree and shrub species, but variable species number
- Little erosion

Table 4 Summary of rehabilitation parameters and completion criteria

ECA A Sites

ECA A	Ideal value	1	2	3	4	5	6	7	8	9	10	12	13	14	15	20th perc.	80th perc.	Average
Ground cover: live+litter+rock	> 68%	90	84	97	98	90	68	92	77	95	92	95	83	90	80	82	95	88
Ground cover: dry season litter	< 50%	20	58	11	58	65	39	81	36	72	49	32	41	57	41	34	61	47
Ground vegetation > 5 years: perennials, not weeds	> 50%	46	82	56	99	100	100	100	100	100	100	92	100	99	100	88	100	91
Ground vegetation > 5 years: species, not weeds	=> 5	6	5	5	9	4	4	7	7	4	6	8	3	5	4	4	7	6
Herbage DM yield end of growing season	250 kg/ha	250	255	190	395	216	23	21	325	117	485	435	535	365	189	160	411	272
Erosion	<2	0.2	0	0	0	0	0.1	0	0	0	0	0.1	0	0	0	0	0	0
Tree and shrub density	> 25 stems/ha	0	0	0	4867	13467	2333	2733	67	1935	667	200	267	2200	267	40	2493	2072
Shrub density (<2m height)		0	0	0	0	0	0	0	0	755	0	0	0	0	67	0	0	59
Number of tree species	=> 3	0	0	0	3	4	2	1	1	4	2	1	2	2	1	1	2	2

Table 4 (continued) Summary of some rehabilitation parameters and completion criteria

ECA B Sites

ECA B	Ideal value	1	2	3	4	5	6	7	8	9	10	11	12	20th perc	80th perc	Average
Ground cover: live+litter+rock	> 68%	99	100	99	92	99	93	98	100	98	97	99	100	97	100	98
Ground cover: dry season litter	< 50%	50	54	57	43	22	64	60	93	39	42	22	50	40	59	50
Ground vegetation > 5 years: perennials	> 50%	97	83	99	99	98	100	98	100	97	88	60	68	84	99	91
Ground vegetation > 5 years: species	=> 5	6	6	6	6	6	4	6	2	6	7	8	4	4	6	6
Herbage DM yield end of growing season	250 kg/ha	116	166	140	775	395	118	72	5	255	390	257	935	116	394	302
Erosion	<2	0	0	0.4	0.7	0	0.1	0	0	0	0	0	0	0	0	0
Tree and shrub density	> 25 stems/ha	4600	933	1333	333	600	1734	1134	3293	1533	133	0	0	173	1694	1302
Shrub density (<2m height)		2806	336	800	0	600	971	261	2042	1288	133	0	0	27	1225	770
Number of tree and shrub species	=> 3	3	3	3	1	1	4	4	7	1	1	0	0	1	4	2

Table 4 (continued) Summary of some rehabilitation parameters and completion criteria

ECA C Sites

ECA C	Ideal value	1	2	3	4	5	6	7	8	9	10	11	12	20th percentile	80th percentile	Average
Ground cover: live+litter+rock	> 68%	94	83	91	100	100	92	98	94	98	86	92	89	89	98	93
Ground cover: dry season litter	< 50%	27	27	32	9	28	34	41	24	52	25	59	62	25	50	35
Ground vegetation > 5 years: perennials	> 50%	94	100	94	99	99	87	90	75	67	88	95	97	87	99	90
Ground vegetation > 5 years: species	=> 5	11	6	7	6	7	9	7	10	5	8	7	5	6	9	7
Herbage DM yield end of growing season	250 kg/ha	245	122	405	490	615	370	265	345	580	161	260	133	178	473	333
Erosion	<2	0.3	1.8	0.7	0	0	0.3	0	0.3	0	1.3	0.3	0	0	1	0
Tree and shrub density	> 25 stems/ha	267	5407	407	67	67	200	0	0	0	1267	400	334	13	406	701
Shrub density (<2m height)		200	5245	65	67	67	200	0	0	0	1165	64	67	13	200	595
Number of tree species	=> 3	2	2	2	1	1	1	0	0	0	0	1	3	0	2	1

Table 4 (continued) Summary of some rehabilitation parameters and completion criteria

Wilpinjong Creek (WT) Sites

WT	Ideal value	1	2	3	4	5	20th percentile	80th percentile	Average
Ground cover: live+litter+rock	> 68%	91	88	98	94	98	90	98	94
Ground cover: dry season litter	< 50%	39	15	19	20	37	18	37	26
Ground vegetation > 5 years: perennials	> 50%	100	100	99	99	100	99	100	100
Ground vegetation > 5 years: species	=> 5	5	6	6	5	6	5	6	6
Herbage DM yield end of growing season	250 kg/ha	1929	1600	1371	1250	2011	1347	1945	1632
Erosion	<2	0.6	0	0	0.4	0	0	0	0
Tree and shrub density	> 25 stems/ha	0	133	444	0	0	0	195	115
Shrub density (<2m height)		0	0	444	0	0	0	89	89
Number of tree species	=> 3	0	1	1	0	0	0	1	0

Table 4 (continued) Summary of some rehabilitation parameters and completion criteria

Rehabilitation Sites

REHAB	Ideal value	1	2	3	4	5	6	7	20th percentile	80th percentile	Average
Ground cover: live+litter+rock	> 68%	98	89	96	74	78	50	75	74.2	94.6	80.0
Ground cover: dry season litter	< 50%	19	15	12	12	10	0	1	2.8	14.4	9.9
Ground vegetation > 5 years: perennials	> 50%	96	99	98	87	92	100	100	92.8	99.8	96.0
Ground vegetation > 5 years: species	=> 5	3	5	3	6	5	5	5	3.4	5.0	4.6
Herbage DM yield end of growing season	250 kg/ha	2110	1610	2110	896	1110	526	950	907	2010	1330
Erosion	<2	0	0	0	0.6	0	0	0	0.0	0.0	0.1
Tree and shrub density	> 25 stems/ha	601	1133	134	1467	2600	67	0	80.4	1400	857
Shrub density (<2m height)		457	1065	134	1467	2600	67	0	80.4	1386	827
Number of tree species	=> 3	4	3	2	5	4	1	0	1.0	2.0	1.4

Table 4 (continued) Summary of some rehabilitation parameters and completion criteria

Regrowth Sites

REGROWTH	Ideal value	1	2	3	4	5	6	7	20th percentile	80th percentile	Average
Ground cover: live+litter+rock	> 68%	93	100	98	99	97	93	98	93.8	98.8	96.9
Ground cover: dry season litter	< 50%	13	29	81	32	49	38	47	29.6	48.6	41.3
Ground vegetation > 5 years: perennials	> 50%	79	64	84	70	57	45	82	58.4	81.4	68.7
Ground vegetation > 5 years: species	=> 5	8	9	7	5	7	7	8	7.0	8.0	7.3
Herbage DM yield end of growing season	250 kg/ha	220	220	465	310	440	190	630	220	460	353
Erosion	<2	0	0	0	0	0	0	0	0	0	0
Tree and shrub density	> 25 stems/ha	0	0	0	0	0	0	0	0	0	0
Shrub density (<2m height)		0	0	0	0	0	0	0	0	0	0
Number of tree species	=> 3	0	0	0	0	0	0	0	0	0	0

4.0 Conclusions

The objective of the monitoring program is to assess progress towards a set of completion criteria that has been established in the Rehabilitation Management Plan for the Project. Generally the ECA areas are close to native vegetation areas and could be expected to rehabilitate progressively from the fringes of the undisturbed woodland. Regrowth areas and the areas along Wilpinjong Creek are not located in proximity to undisturbed woodland areas

Initially thirty-eight sites were established and assessed. In September 2010 assessment of progressive vegetation change over the previous twelve months period was conducted over these sites as well as five additional sites along Wilpinjong Creek. Two rehabilitation sites (R1 and R2) were added in 2009 and a further 3 rehabilitation sites (R3 - R5) were monitored in 2010. In 2011 there were thirty-eight ECA sites, seven regrowth sites, five sites along Wilpinjong Creek and seven mine rehabilitation sites.

ECA and Regrowth areas
The results show a marked variation in the status of the sites, as would be expected considering the fact that some sites were disturbed some 30-50 years ago and have not been re-disturbed; and other sites where pasture development has been maintained intensively over the past 30 years and there is little or no regeneration of native species. Continued grazing in some areas by domestic stock, and at most sites by rabbits and marsupials will continue to slow re-establishment of the perennial grasses that mark successful rehabilitation of the ground layer. Tree density and species numbers are generally low compared with the tentative completion criteria. The most important factor restricting recolonisation by trees and shrubs in the Regrowth and Wilpinjong Creek areas is lack of a seed source close by. Whilst the ECA areas often have a seed source from nearby forests, rabbits continue to restrict seedling development. Rehabilitation areas generally have high numbers of trees and shrubs of a number of species that were sown. Clearly to encourage woody plant colonisation in the ECA areas, regrowth areas and Wilpinjong Creek seed sowing is required.

Soil fertility is generally poor in the ECA areas which probably have not been fertilized intensively in the past because they are located on the margins of the cleared land. In 2010, soil samples collected in the valley in which the ECA C sites are located have extremely low levels of Colwell phosphorus and this would normally retard regeneration, even though the native species are considered well adapted to low soil fertility. Soil fertility analysis is recommended for the monitoring program in 2012 to assess current levels of fertility and how that might be restricting growth.

Previous low rainfall will have also contributed to the poor spread of the native trees, shrubs and herbage. However, the summer and winter of 2010 and 2011 have been exceptional for rainfall, and it was expected that an abundant flowering and seed-set for acacias, eucalypts, rough barked apple and cypress would have impacted on

establishment of woody species in the ECA areas fringing the natural woodland. This has not occurred so far, but may become evident in 2012.

The poor recolonisation of the ECA areas makes it necessary to consider seeding with tree and shrub species consistent with the species mix in that particular part of the landscape (as discussed below). Given the low yields of the herbage we believe that soil disturbance is not required to establish the tree and shrub species. However, phosphorus fertiliser should be applied with the seed at a rate of 30 kg P/ha or 150 kg/ha triple superphosphate.

Wilpinjong Creek

Regeneration along Wilpinjong Creek has been poor. It is clear that heavy grazing by rabbit and kangaroo has reduced species development, particularly for rough-barked apple. Of the isolated apple trees along the creek there are often large numbers of seedling, but they fail to develop beyond 0.3m height due to the high fauna grazing pressure. Heavy seeding (1 kg/ha) with rough-barked apple, Blakely's red gum and yellow box in a broad band approximately 50–80 m either side of the creek should be trialled along with a program to cull rabbit and kangaroo to reduce grazing pressure. If this is successful, the tree canopy will shade the creek and reduce the reed population that currently smothers sections of the creek.

Spoil Rehabilitation Sites

Rehabilitation on the mine spoil areas is good with high groundcover and herbage yields and adequate density of tree and shrub species. The number of tree/shrub species is, however, limited and future seeding should aim to have at least 5 different species, including rough-barked apple, Blakely's red gum, yellow box, grey box (gum-topped box) and narrow-leafed ironbark in the longer term, together with *Acacia ixiophylla* sticky leaved wattle, *A. linearifolia* narrow-leaved wattle and *A. implexa*.

It is recommended that soil monitoring occur in 2012 to assess trends in soil fertility with time.

LANDLINE CONSULTING

Dr Mike Gilbert Ron Hendricksen

APPENDIX 1

DETAILED SITE DATA

Grid: GDA94 Zone 55 772033 6416232	**Location:** Slightly elevated rise in an undulating landscape	Site: *A1*

Site Description

Area previously cleared of native vegetation for grazing of improved pasture. Area previously grazed by horses and cattle; stock excluded in 2010.

2010

2008

2007

2011

Ground layer characteristics at A1

	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	69	20	1	10	250	0.2
2010	40	51	0	9	464	0.4

Species %	2011
Lolium rigidum annual ryegrass	40
Sporobolus creber slender rat's tail grass	24
Eragrostis curvula African lovegrass	19
Trifolium subterraneum sub clover	10
Taraxacum officinale dandelion	3
Geranium solanderi native geranium	2
Plantago lanceolata lamb's tongue	2

Tree and shrub layer characteristics at A1

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	0	0	0	0	-	-

Grid: GDA94 Zone 55 772151 6416822	**Location:** Valley floor in a undulating landscape	Site: *A2*

Site Description

The area has been cleared in the past for the grazing of improved pastures based on subterranean clover and ryegrass.

2010

2008

2007

2011

Ground layer characteristics at A2

	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	26	58	0	16	255	0.0
2010	49	51	0	0	1164	0.0

Species %	2011
Phalaris aquatica	70
Lolium rigidum annual ryegrass	15
Paspalum dilatatum paspalum	12
Taraxacum officinale dandelion	2
Plantago lanceolata lamb's tongue	0
Onopordum acanthium Scotch thistle	0

Tree and shrub layer characteristics at A2

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	0	0	0	0	-	-

Grid: GDA94 Zone 55 772460 6417040	**Location:** Lower slope within a gently undulating valley.	Site: *A3*

Site Description
The area has been cleared of native vegetation in the past and is now used for grazing of improved pasture.

2010

2008

2007

2011

Ground layer characteristics at A3

	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	87	11	0	3	190	0.0
2010	75	19	0	6	441	0.0

Species %	2011
Phalaris aquatica phalaris	46
Lolium rigidum annual ryegrass	41
Plantago lanceolata lamb's tongue	8
Onopordum acanthium Scotch thistle	2
Geranium solanderi native geranium	1
Aristida ramosa purple wiregrass	1

Tree and shrub layer characteristics at A3

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	0	0	0	0	-	-

Grid: GDA94 Zone 55 772634 6417351	**Location:** Mid slope site to the south of the mine site	Site: *A4*

Site Description

The site has been partially cleared in the past but has not been developed for pasture, and now has much regrowth. The original vegetation was Blakely's red gum, rough barked apple and yellow box.

2010

2008

2007

2011

Ground layer characteristics at A4

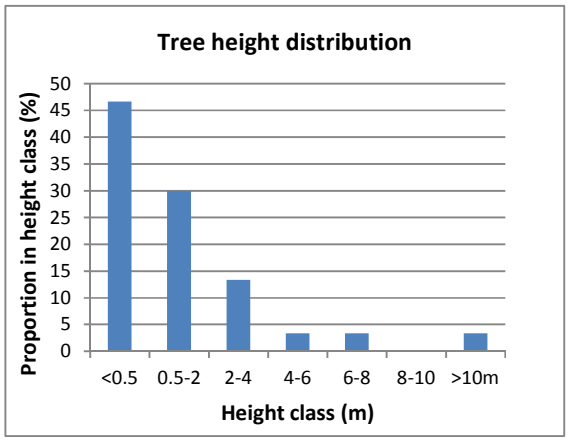
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	40	58	0	2	395	0.0
2010	56	40	0	4	268	0.0

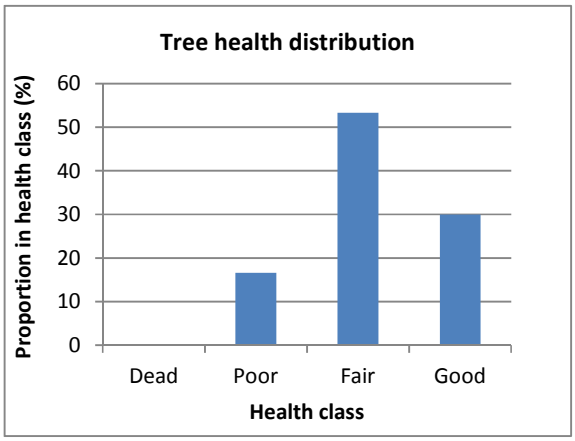
Species %	2011
Aristida vagans Three awned speargrass	42
Cassinia arcuata sifton bush	19
Austrostipa scabra slender speargrass	15
Lomandra longifolia tall mat grass	10
Themeda australis kangaroo grass	5
Cymbopogon refractus barbed wire grass	4
Aristida ramosa purple wiregrass	3
Sporobolus creber slender rat's tail grass	2
Anagallis arvensis Pimpernel	1
Taraxacum officinale dandelion	1

Tree and shrub layer characteristics at A4

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	4867	0	0	4867	1.9	2.8

Tree layer composition %	2011
Angophora floribunda rough-barked apple	70
Eucalyptus blakelyi Blakely's red gum	29
Eucalyptus melliodora yellow box	1





Grid: GDA94 Zone 55 773117 6417709	**Location**: Gently undulating country to the south of the mine site	Site: *A5*

Site Description

The native woodland (rough-barked apple and Blakely's red gum) area has not been disturbed by clearing activities in the past.

2010

2008

2007

2011

Ground layer characteristics at A5

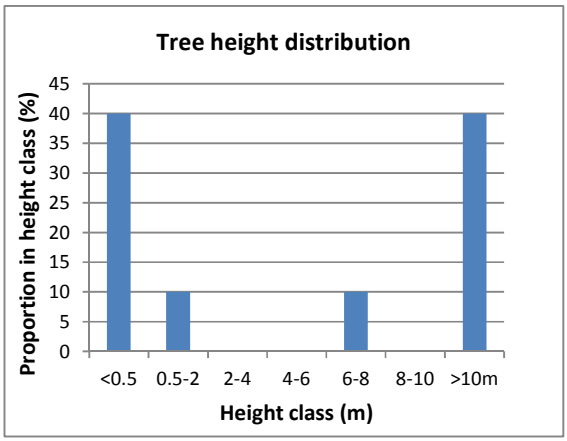
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	25	65	0	10	216	0.0
2010	22	55	0	24	135	0.0

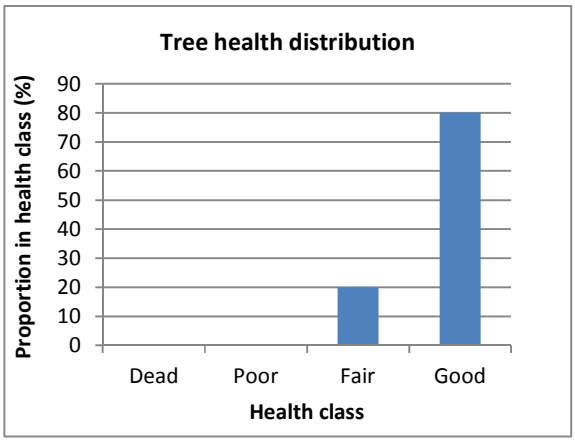
Species %	2011
Angophora floribunda rough-barked apple	58
Aristida vagans three-awned speargrass	20
Cassinia arcuata sifton bush	15
Melichrus erubescens ruby urn heath	7
Austrostipa scabra slender speargrass	0

Tree and shrub layer characteristics at A5

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	13467	0	0	13467	6.4	3.9

Tree layer composition %	2011
Angophora floribunda rough-barked apple	98
Eucalyptus blakelyi Blakely's red gum	1
E. caleyi drooping ironbark	0
E. moluccana grey box	0





Grid: GDA94 Zone 55 773261 6416962	**Location:** Flat stony plateau area to the east of the mine site	Site: *A6*

Site Description
The site has not been disturbed in the past except for selective timber cutting.

2010

2008

2007

2011

Ground layer characteristics at A6

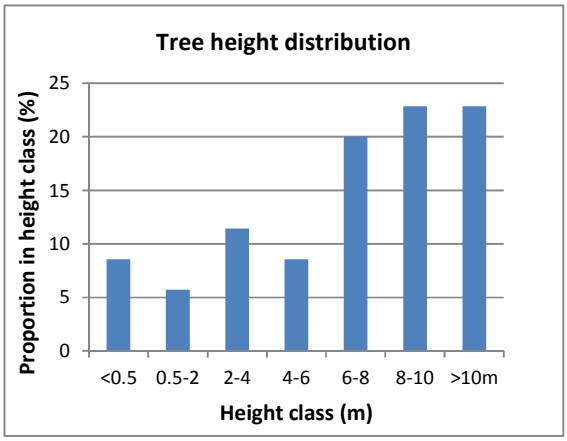
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	24	39	7	32	23	0.1
2010	18	36	6	40	3	0.1

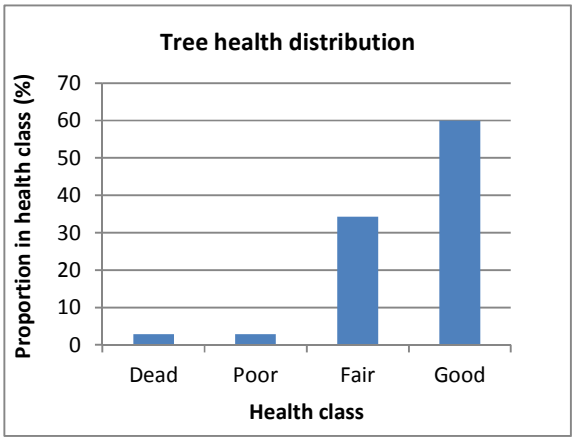
Species %	2011
Lichen	75
Austrostipa scabra slender speargrass	9
Melichrus erubescens ruby urn heath	9
Cheilanthes seiberi rock fern	7
Diurus sp. ground orchid	1

Tree and shrub layer characteristics at A6

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	600	0	1733	2333	7.3	3.7

Tree layer composition %	2011
Callitris endlicheri black cypress pine	74
Eucalyptus caleyi drooping ironbark	26





Grid: GDA94 Zone 55 773222 6416771	**Location:** Sloping country to the east of the mine site	Site: *A7*

Site Description
The site has not been cleared of its native vegetation (rough barked apple and narrow leafed ironbark) in the past.

2010

2008

2007

2011

Ground layer characteristics at A7

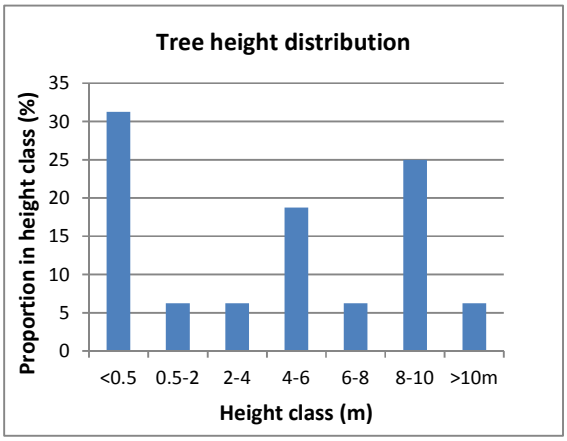
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	10	81	2	8	21	0.0
2010	7	86	2	4	6	0.0

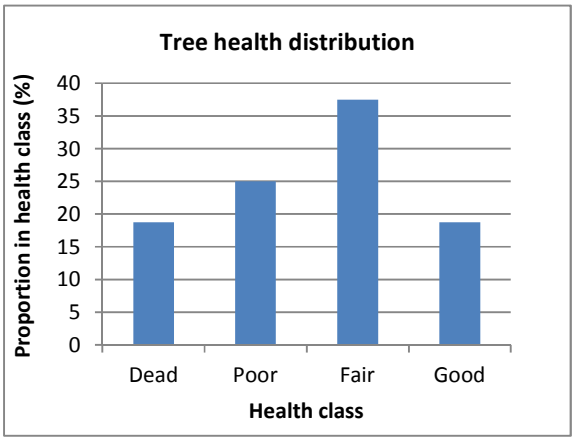
Species %	2011
Aristida vagans Three awned speargrass	72
Geranium solanderi native geranium	11
Melichrus erubescens ruby urn heath	7
Templetonia sp.	4
Austrostipa scabra slender speargrass	3
Cassinia arcuata sifton bush	3
Cheilanthes seiberi rock fern	0

Tree and shrub layer characteristics at A7

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	2733	0	0	2733	5.7	1.8

Tree layer composition %	2011
Angophora floribunda rough-barked apple	100





Grid:GDA94 Zone 55	Location:	Site:
773420 6416971	Sloping land to the east of the mine site	*A8*

Site Description

The site has been cleared of the native vegetation (grey box, narrow leafed ironbark and grey gum) possibly 30 years ago.

2010

2008

2007

2011

Ground layer characteristics at A8

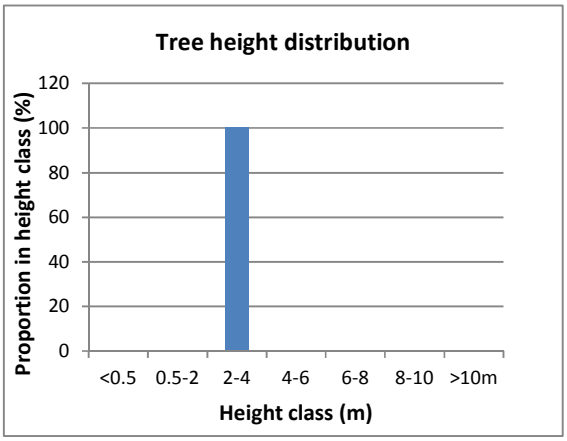
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	41	36	0	23	325	0.0
2010	55	19	0	27	232	0.0

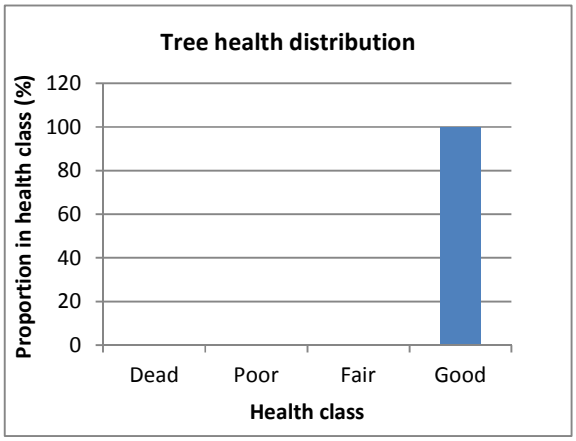
Species %	2011
Cassinia arcuata sifton bush	44
Aristida vagans Three awned speargrass	36
Eragrostis brownii Brown's lovegrass	9
Austrostipa scabra slender speargrass	3
Cheilanthes seiberi rock fern	3
Sporobolus creber slender rat's tail grass	3
Aristida ramosa purple wiregrass	2

Tree and shrub layer characteristics at A8

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	67	0	0	67	2.5	4.0

Tree layer composition %	2011
Eucalyptus blakelyi Blakely's red gum	100





Grid: GDA94 Zone 55 773485 6416607	**Location:** Low sloping land to the east of the mine site	Site: *A9*

Site Description

The site has not been cleared of its native vegetation (narrow leafed ironbark, rough barked apple and grey gum) in the past or burnt for many years.

2010

2008

2007

2011

Ground layer characteristics at A9

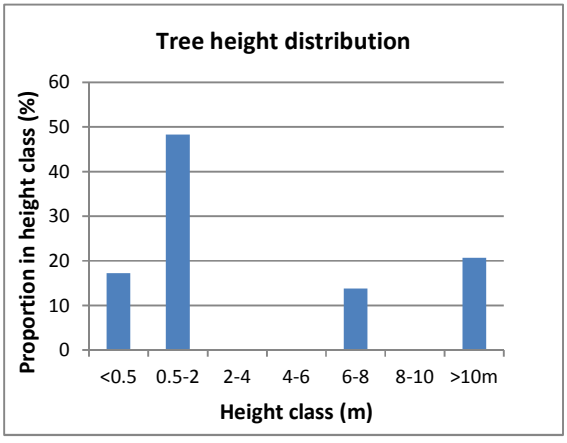
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	24	72	0	5	117	0.0
2010	30	63	0	7	35	0.0

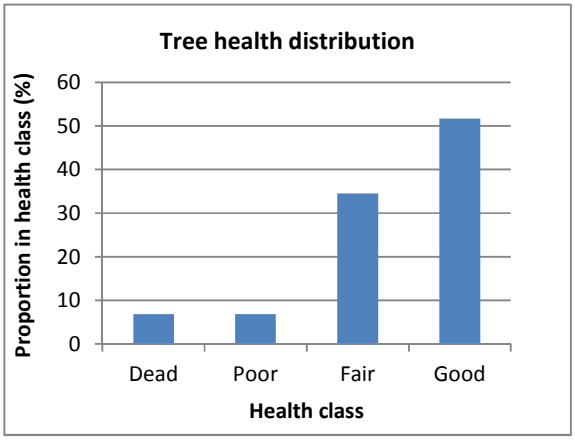
Species %	2011
Cassinia arcuata sifton bush	42
Aristida vagans Three awned speargrass	34
Austrostipa scabra slender speargrass	18
Cheilanthes seiberi rock fern	4
Angophora floribunda rough-barked apple	3

Tree and shrub layer characteristics at A9

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	1201	735	0	1935	4.6	3.1

Tree layer composition %	2011
Eucalyptus caleyi drooping ironbark	38
Acacia ixiophylla sticky leaved wattle	21
Angophora floribunda rough-barked apple	17
Acacia linearifolia narrow-leaved wattle	14
Acacia implexa hickory wattle	4
E. moluccana grey box grey box	3
E. fibrosa red ironbark	3





Grid: GDA94 Zone 55 773538 6416979	**Location:** Flat undisturbed drainage area to the east of the mine site	Site: *A10*

Site Description

The site appears to have been undisturbed by clearing and has not been burnt for many years.

2010

2008

2007

2011

Ground layer characteristics at A10

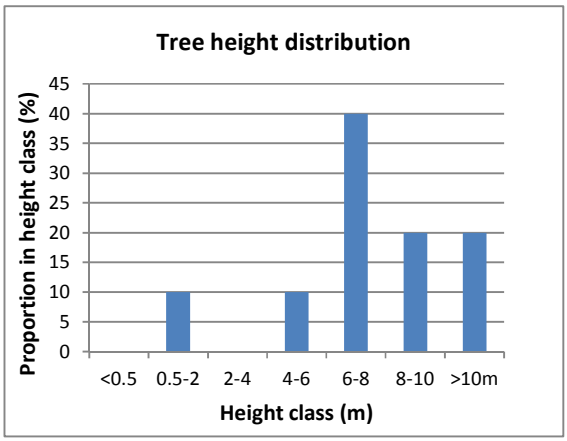
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	49	49	0	2	485	0.0
2010	43	56	0	1	125	0.2

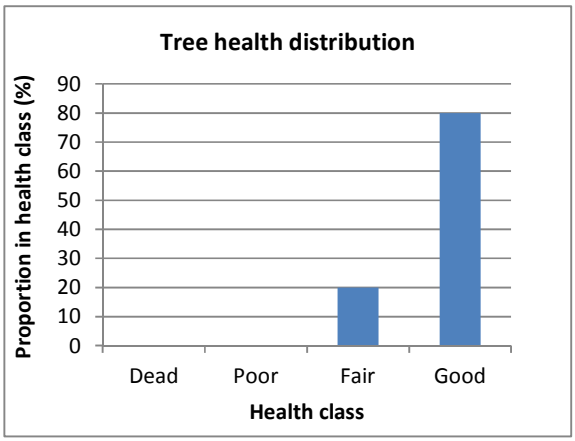
Species %	2011
Aristida vagans Three awned speargrass	34
Aristida ramosa purple wiregrass	25
Lomandra longifolia tall mat grass	22
Cassinia arcuata sifton bush	13
Eragrostis brownii Brown's lovegrass	5
Austrostipa scabra slender speargrass	1

Tree and shrub layer characteristics at A10

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	667	0	0	667	7.8	4.0

Tree layer composition %	2011
Eucalyptus blakelyi Blakely's red gum	70
E. moluccana grey box	30





Grid: GDA94 Zone 55 773573 6417252	**Location:** Lower slope in valley to the east of the mine site	Site: *A12*

Site Description

The site has been cleared of the native vegetation (grey gum and narrow leaf ironbark) in the past and there is scattered regrowth. It apparently has not been fertilized and sown to improved pasture species in the past. It lies down slope of a grove of black cypress.

2010

2008

2007

2011

Ground layer characteristics at A12

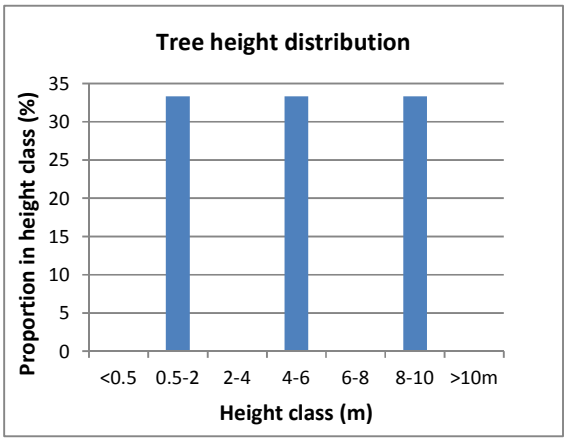
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	64	32	0	5	435	0.1
2010	58	37	0	5	345	0.1

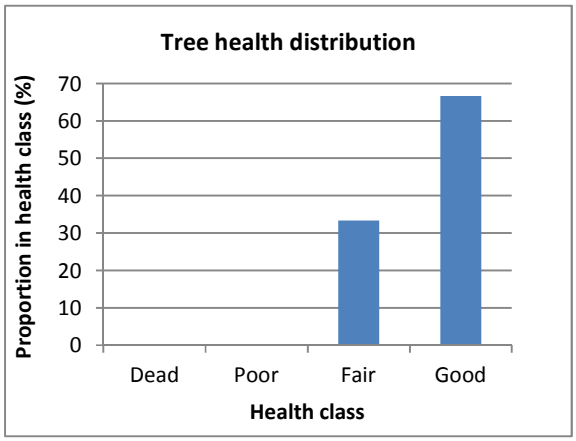
Species %	2011
Cassinia arcuata sifton bush sifton bush	63
Aristida vagans three awned speargrass	17
Cheilanthes seiberi rock fern	9
Drosera sp. sundew	4
Petalochilis sp. purple ground orchid	4
Angophora floribunda rough-barked apple	2
Melichrus erubescens ruby um heath	1
Eragrostis brownii Brown's lovegrass	0

Tree and shrub layer characteristics at A12

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	200	0	0	200	5.7	3.7

Tree layer composition %	2011
Eucalyptus blakelyi Blakely's red gum	100





Grid: GDA94 Zone 55 773763 6416773	**Location:** Low slope area to the east of the mine site	Site: *A13*

Site Description

The site has been cleared of native vegetation possibly 30 years ago, but now has regrowth of upper and lower storey trees and shrubs.

2010

2008

2007

2011

Ground layer characteristics at A13

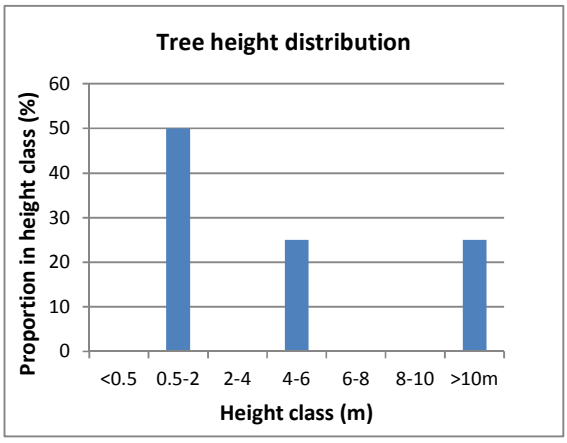
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	41	41	2	17	535	0.0
2010	40	31	0	29	245	0.0

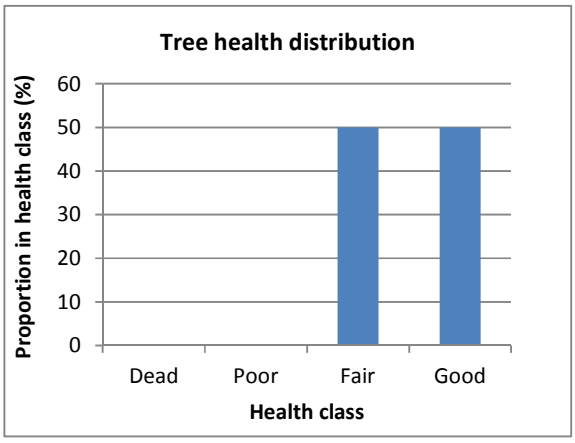
Species %	2011
Cassinia arcuata sifton bush	57
Aristida vagans Three awned speargrass	41
Eragrostis brownii Brown's lovegrass	2

Tree and shrub layer characteristics at A13

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	267	0	0	267	7.4	3.5

Tree layer composition %	2011
Eucalyptus blakelyi Blakely's red gum	75
E. moluccana grey box	25





Grid: GDA94 Zone 55 773817 6416670	**Location:** Grey box flat to the east of the mine site	Site: *A14*

Site Description
The native grey box vegetation has not been disturbed significantly in the past.

2010

2008

2007

2011

Ground layer characteristics at A14

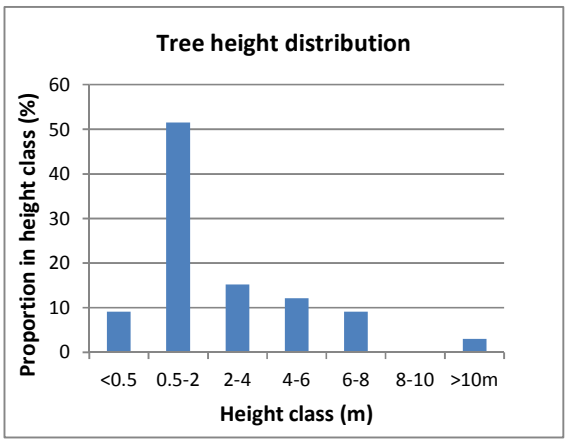
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	33	57	0	10	365	0.0
2010	34	56	0	10	73	0.0

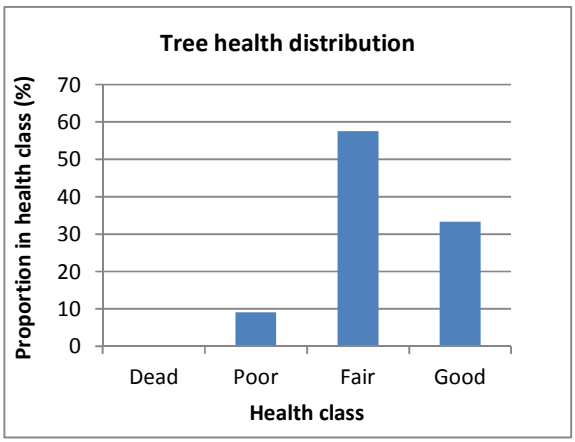
Species %	2011
Cassinia arcuata sifton bush	61
Aristida vagans Three awned speargrass	21
Austrostipa scabra slender speargrass	14
Aristida ramosa purple wiregrass	3
Anagallis arvensis Pimpernel	1

Tree and shrub layer characteristics at A14

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	2200	0	0	2200	3.1	2.9

Tree layer composition %	2011
Eucalyptus blakelyi Blakely's red gum	85
E. moluccana grey box	15





Grid: GDA94 Zone 55 773773 6416450	**Location:** Sloping undisturbed woodland to the east of the mine site	Site: *A15*

Site Description
The steeply sloping site has not been disturbed extensively in the past.

2010

2008

2007

2011

Ground layer characteristics at A15

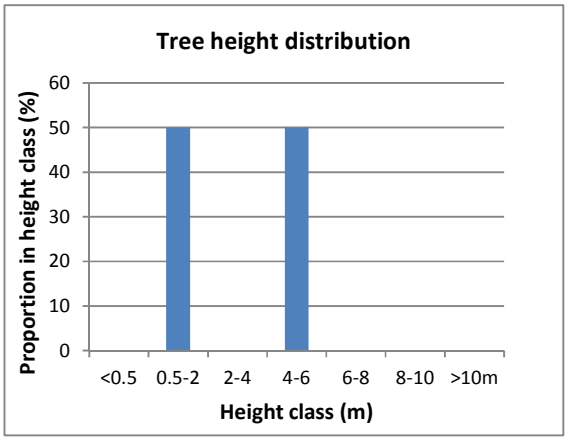
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	22	59	0	20	189	0.0
2010	10	76	1	13	85	0.0

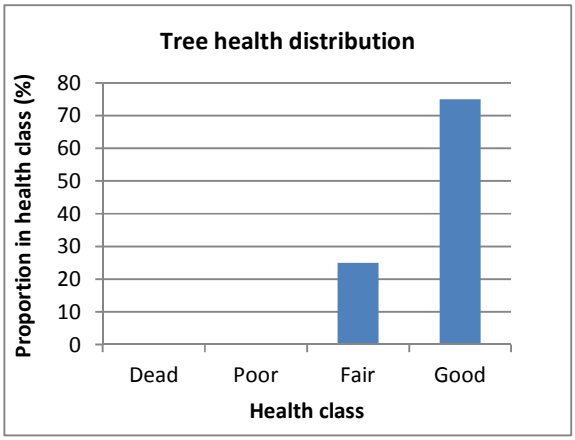
Species %	2011
Aristida ramosa purple wiregrass	35
Cassinia arcuata sifton bush	26
Aristida vagans Three awned speargrass	21
Austrostipa scabra slender speargrass	19

Tree and shrub layer characteristics at A15

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	200	67	0	267	2.9	4.5

Tree layer composition %	2011
Eucalyptus caleyi drooping ironbark	75
Acacia implexa hickory wattle	25





Grid: GDA94 Zone 55 770433 6420843	**Location:** Flat area to north of Wilpinjong Creek	Site: *B1*

Site Description
The site has been partially cleared of the native rough-barked apple and has been grazed heavily until cattle were removed in 2007.

2010

2008

2007

2011

Ground layer characteristics at B1

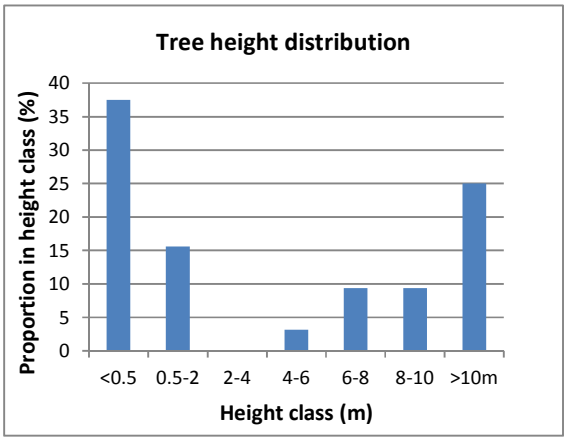
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	49	50	0	1	116	0.0
2010	34	62	0	4	19	0.0

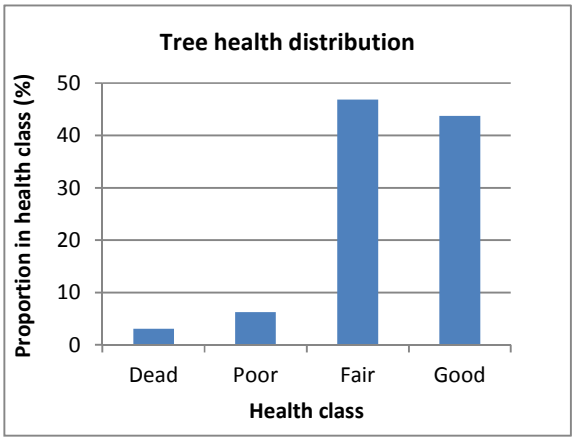
Species %	2011
Aristida ramosa purple wiregrass	45
Cassinia arcuata sifton bush	25
Plantago lanceolata lamb's tongue	11
Sedge - Cyperaceae	10
Taraxacum officinale dandelion	6
Cheilanthes seiberi rock fern	3

Tree and shrub layer characteristics at B1

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	1800	0	2800	4600	5.4	3.2

Tree layer composition %	2011
Melichrus urceolatus urn-heath	59
Angophora floribunda rough-barked apple	39
Melichrus erubescens ruby urn heath	1





Grid: GDA94 Zone 55 770350 6420516	**Location:** Hill crest to north of Wilpinjong Creek	Site: *B2*

Site Description

The site has apparently been partially cleared in the 1960s. Site has few mature yellow box trees with many mid to lower storey trees and shrubs.

2010

2008

2007

2011

Ground layer characteristics at B2

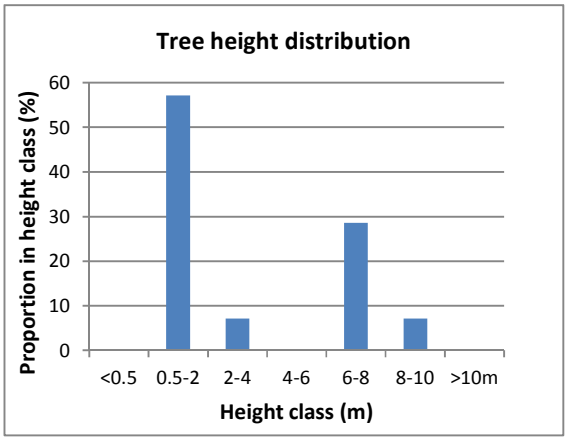
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	47	54	0	0	166	0.0
2010	38	57	0	5	56	0.0

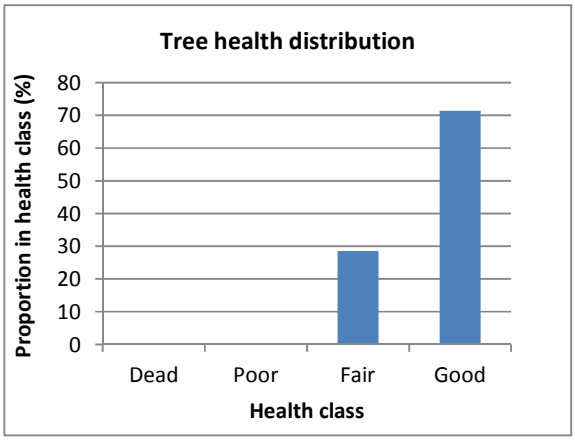
Species %	2011
Aristida vagans Three awned speargrass	43
Sedge - Cyperaceae	33
Lolium rigidum annual ryegrass	8
Cassinia arcuata sifton bush	7
Chrysocephalum apiculatum yellow buttons	6
Taraxacum officinale dandelion	3

Tree and shrub layer characteristics at B2

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	600	0	333	933	3.6	3.9

Tree layer composition %	2011
Eucalyptus melliodora yellow box	43
Templetonia stenophylla leafy templetonia	36
Angophora floribunda rough-barked apple	21





Grid: GDA94 Zone 55 770648 6420451	**Location:** Partially cleared, mid-slope area to north of Wilpinjong Creek	Site: *B3*

Site Description

The area has been partially cleared of native vegetation (broad leafed ironbark, grey gum and yellow box) in the past and has been used for grazing of improved pasture.

2010

2008

2007

2011

Ground layer characteristics at B3

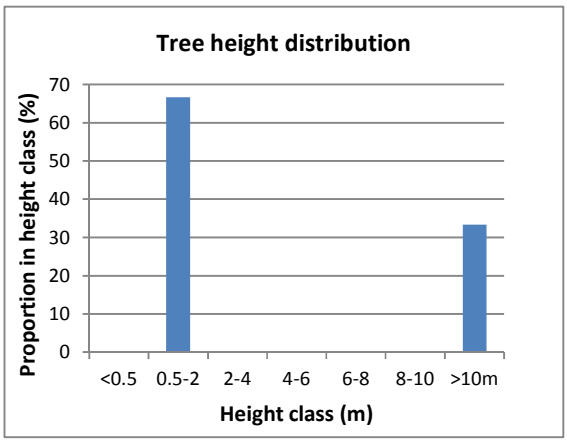
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	43	57	0	1	140	0.4
2010	42	49	0	9	93	0.5

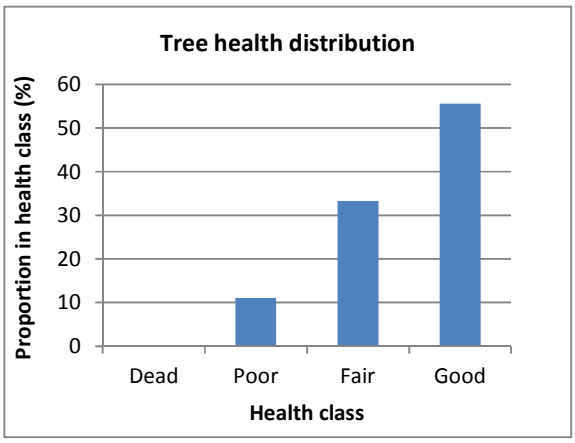
Species %	2011
Aristida vagans Three awned speargrass	40
Aristida ramosa purple wiregrass	23
Sedge - Cyperaceae	17
Cassinia arcuata sifton bush	16
Cheilanthes seiberi rock fern	4
Taraxacum officinale dandelion	0

Tree and shrub layer characteristics at B3

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	533	600	200	1333	4.5	3.3

Tree layer composition %	2011
Acacia ixiophylla sticky leaved wattle	45
Eucalyptus melliodora yellow box	40
Templetonia stenophylla leafy templetonia	10
Melichrus urceolatus urn-heath	5





Grid: GDA94 Zone 55 770695 6420487	**Location:** Mid slope on northern side of Wilpinjong Creek	Site: *B4*

Site Description
The area has been partially cleared of the yellow box vegetation in the past and is now used for grazing of improved pasture.

2010

2009

2007

2011

Ground layer characteristics at B4

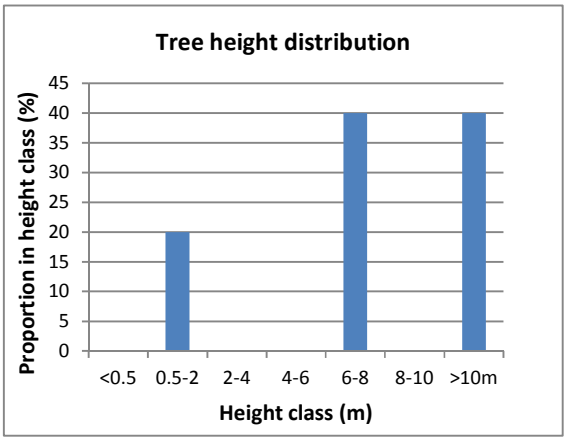
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	50	43	0	8	775	0.7
2010	48	36	0	15	826	0.6

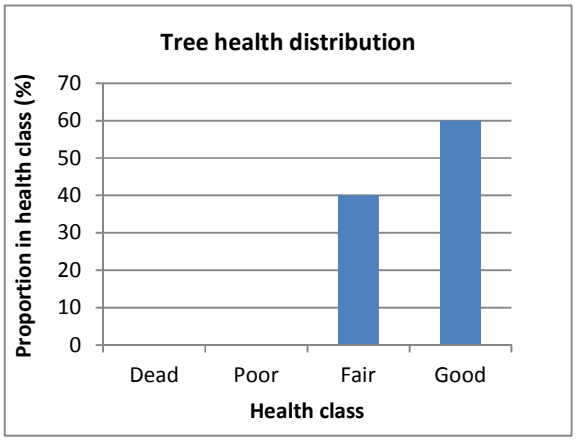
Species %	2011
Arundinella nephalensis reed grass	71
Cassinia arcuata sifton bush	15
Sedge - Cyperaceae	6
Aristida ramosa purple wiregrass	4
Aristida vagans Three awned speargrass	3
Taraxacum officinale dandelion	1

Tree and shrub layer characteristics at B4

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	333	0	0	333	8.5	3.6

Tree layer composition %	2011
Eucalyptus melliodora yellow box	100





Grid: GDA94 Zone 55 770735 6420393	**Location:** Mid slope area to the north of Wilpinjong Creek	Site: *B5*

Site Description

The area has been cleared of native vegetation in the past and has been used for low quality grazing of native pastures.

2010

2008

2007

2011

Ground layer characteristics at B5

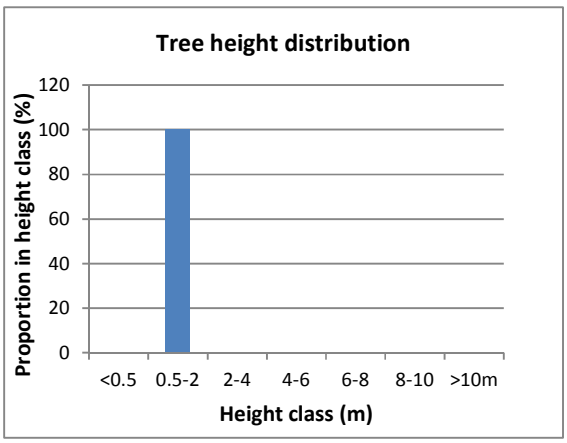
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	78	22	0	1	395	0.0
2010	81	18	0	1	277	0.0

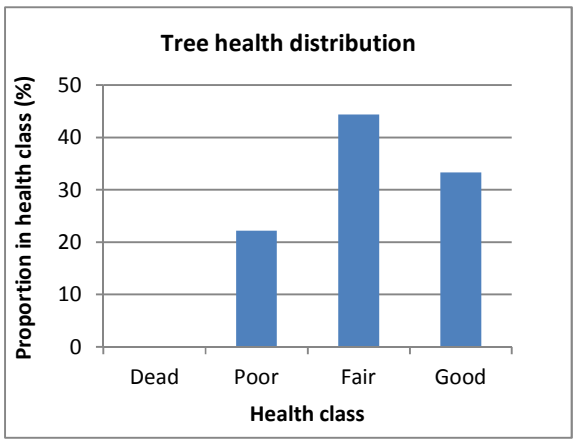
Species %	2011
Aristida vagans Three awned speargrass	74
Aristida ramosa purple wiregrass	16
Cheilanthes seiberi rock fern	5
Cassinia arcuata sifton bush	3
Taraxacum officinale dandelion	2
Other forbs	1

Tree and shrub layer characteristics at B5

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	0	600	0	600	1.0	2.8

Tree layer composition %	2011
Acacia ixiophylla sticky leaved wattle	100





Grid: GDA94 Zone 55 770890 6420435	**Location:** Grey box/yellow box forest on lower slope to north of Wilpinjong Creek	Site: *B6*

Site Description
The area has not been cleared of the native grey box and yellow box vegetation.

2010

2008

2007

2011

Ground layer characteristics at B6

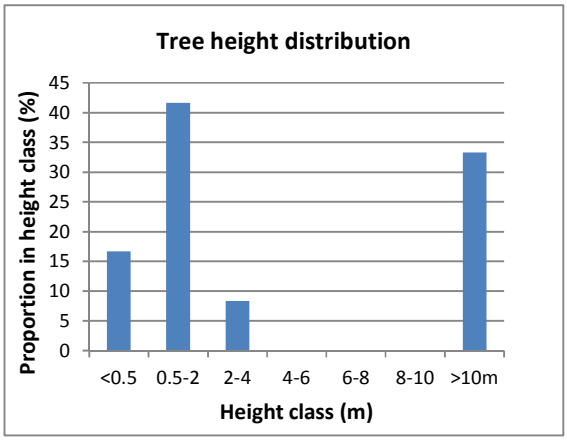
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	30	64	0	7	118	0.1
2010	15	77	0	9	57	0.1

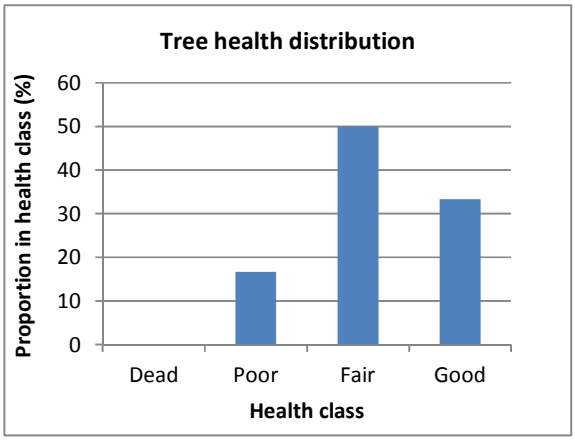
Species %	2011
Aristida vagans Three awned speargrass	61
Cassinia arcuata sifton bush	24
Sedge - Cyperaceae	11
Austrostipa scabra slender speargrass	5

Tree and shrub layer characteristics at B6

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	267	333	1133	1734	5.2	2.8

Tree layer composition %	2011
Melichrus urceolatus urn-heath	65
Eucalyptus melliodora yellow box	15
Acacia ixiophylla sticky leaved wattle	15
Acacia implexa hickory wattle	4





Grid: GDA94 Zone 55 771166 6420623	Location: Yellow box forest on upper slope to north of Wilpinjong Creek	Site: *B7*

Site Description
The area has not been cleared of the native yellow box vegetation.

2010

2008

2007

2011

Ground layer characteristics at B7

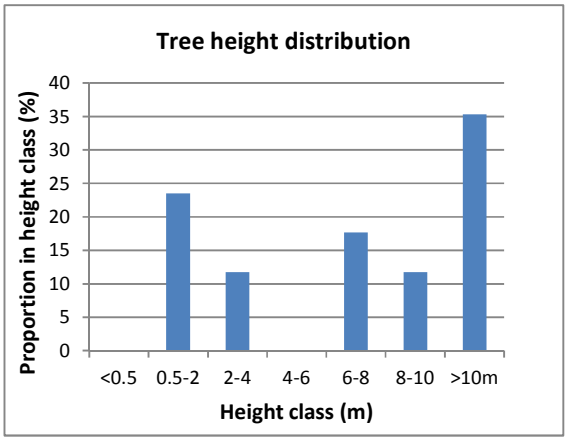
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	38	60	0	2	72	0.0
2010	27	68	0	5	69	0.0

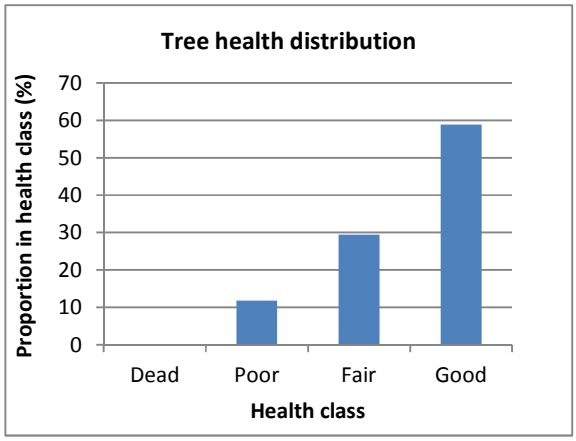
Species %	2011
Cassinia arcuata sifton bush	34
Aristida ramosa purple wiregrass	24
Melichrus urceolatus urn-heath	22
Austrostipa scabra slender speargrass	18
Other forbs	2
Chloris truncata windmill grass	1

Tree and shrub layer characteristics at B7

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	867	0	267	1134	7.1	3.4

Tree layer composition %	2011
Eucalyptus melliodora yellow box	71
Melichrus urceolatus urn-heath	18
Melichrus erubescens ruby urn heath	6
Eucalyptus blakelyi Blakely's red gum	6





Grid: GDA94 Zone 55 771091 6420279	**Location**: Mountain crest to north of Wilpinjong Creek	Site: *B8*

Site Description
The mountain top area has never been cleared of its native forest vegetation.

2010

2008

2007

2011

Ground layer characteristics at B8

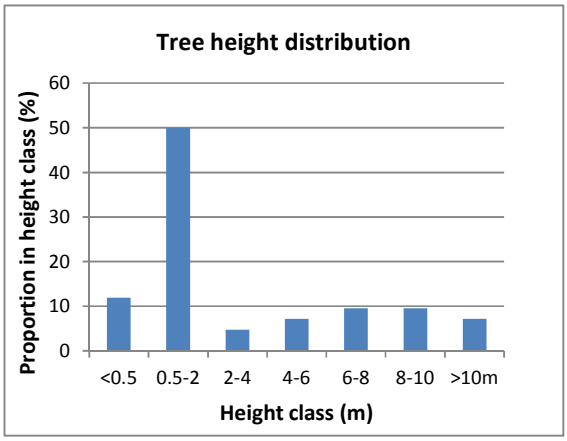
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	1	93	7	0	5	0.0
2010	0	93	7	0	50	0.0

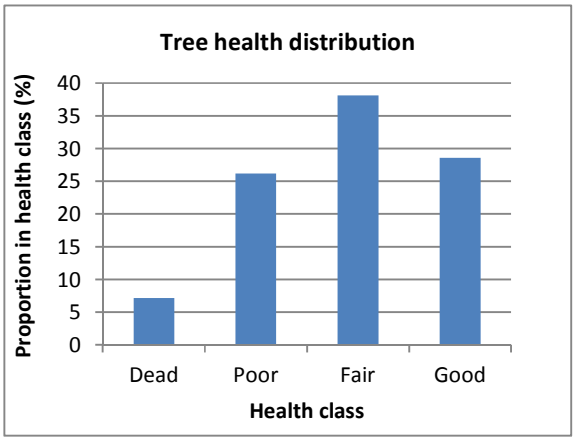
Species %	2011
Cassinia arcuata sifton bush	91
Aristida vagans Three awned speargrass	9

Tree and shrub layer characteristics at B8

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	680	200	2413	3293	3.4	2.4

Tree layer composition %	2011
Cassinia quinquefaria long leafed cassinia	63
Eucalyptus punctata grey gum	10
Callitris endlicheri black cypress pine	6
Eucalyptus fibrosa broad leaved ironbark	6
Acacia linearifolia narrow-leaved wattle	6
Eucalyptus macrorhyncha red stringybark	4
Melichrus urceolatus urn-heath	4





Grid: GDA94 Zone 55 770682 6419938	Location: Remnant rough barked apple woodland on Wilpinjong creek	Site: *B9*

Site Description
The creek flat and lower hill slopes have been partially cleared of the native vegetation in the past and has been used until recently for grazing of improved pasture.

2010

2008

2007

2011

Ground layer characteristics at B9

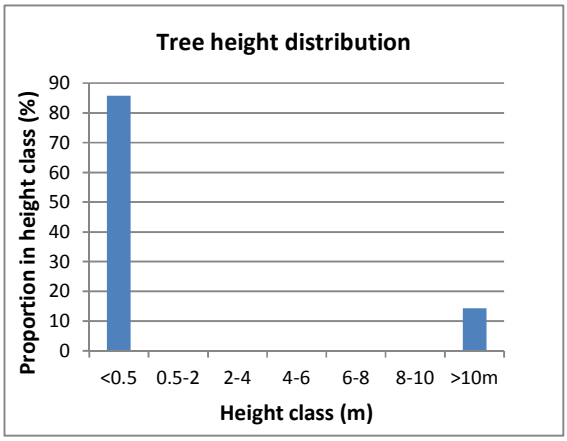
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	60	39	0	2	255	0.0
2010	60	37	0	3	232	0.0

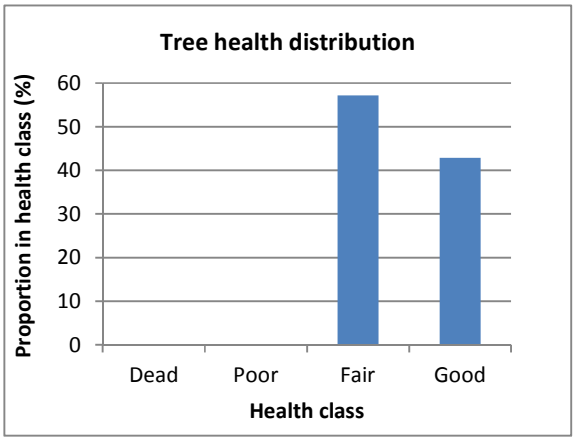
Species %	2011
Aristida ramosa purple wiregrass	65
Cynodon dactylon couch	11
Cyperus javanicus sedge	10
Themeda australis kangaroo grass	7
Taraxacum officinale dandelion	3
Arctotheca calendula capeweed	2
Lolium rigidum annual ryegrass	1
Plantago lanceolata lamb's tongue	1

Tree and shrub layer characteristics at B9

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	1533	0	0	1533	3.3	3.3

Tree layer composition %	2011
Angophora floribunda rough-barked apple	100





Grid: GDA94 Zone 55 771268 6420103	**Location:** Lower slope in valley to north of Wilpinjong Creek	Site: *B10*

Site Description

The area has been cleared of native vegetation in the past and has until recently been used for cattle grazing on improved pasture. The site was disturbed in the past year for wood-mulch stockpiling.

2010

2008

2007

2011

Ground layer characteristics at B10

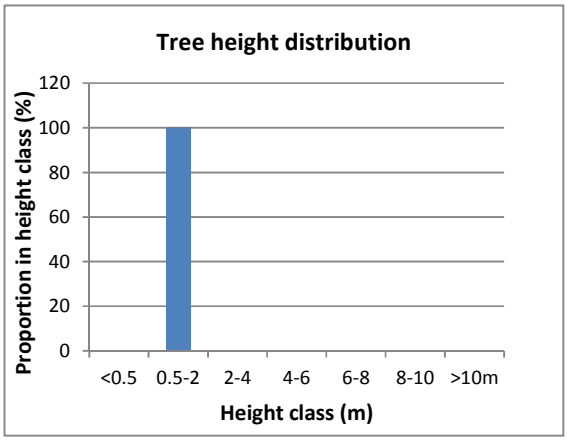
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	55	42	1	3	390	0.0
2010	51	45	0	3	255	0.0

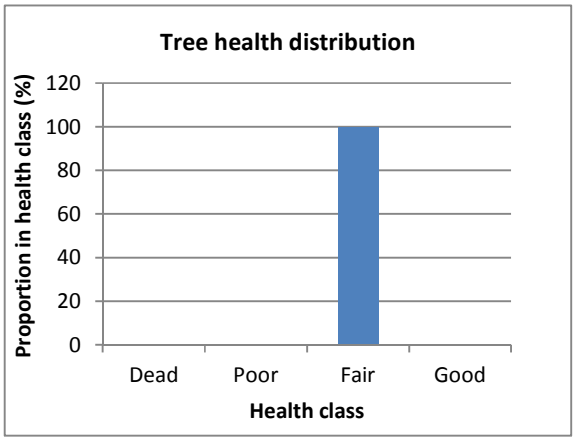
Species %	2011
Sporobolus creber slender rat's tail grass	40
Aristida ramosa purple wiregrass	17
Eragrostis brownii Brown's lovegrass	16
Sedge - Cyperaceae	10
Plantago lanceolata lamb's tongue	7
Taraxacum officinale dandelion	7
Onopordum acanthium scotch thistle	3
Other forbs	1
Trifolium subterraneum sub clover	0

Tree and shrub layer characteristics at B10

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	133	0	0	133	0.9	3.0

Tree layer composition %	2011
Angophora floribunda rough-barked apple	100





Grid: GDA94 Zone 55 772061 6420337	**Location:** Lower slope immediately to the north of Wilpinjong Creek	Site: B11

Site Description

The area has been cleared of native vegetation (probably rough barked apple) in the past and has been used for grazing of improved pasture.

2010

2008

2007

2011

Ground layer characteristics at B11

	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	77	22	0	1	257	0.0
2010	60	37	1	1	268	0.0

Species %	2011
Sporobolus creber slender rat's tail grass	25
Aristida vagans Three awned speargrass	18
Vulpia bromoides squirrel tail fescue	15
Conyza bonariensis flaxleaf fleabane	14
Plantago lanceolata lamb's tongue	8
Lolium rigidum annual ryegrass	6
Carthamus lanatus saffron thistle	5
Aristida ramosa purple wiregrass	3
Taraxacum officinale dandelion	2
Anagallis arvensis Pimpernel	2
Paspalum dilatatum paspalum	2

Tree and shrub layer characteristics at B11

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	0	0	0	0	-	-

Grid: GDA94 Zone 55 773065 6420508	**Location:** Low slope immediately to north of Wilpinjong Creek	Site: *B12*

Site Description

The area has been cleared of native vegetation (rough barked apple) in the past and has until recently been grazed by cattle on improved pasture.

2010

2008

2007

2011

Ground layer characteristics at B12

	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	50	50	0	0	935	0.0
2010	45	55	0	0	1150	0.0

Species %	2011
Aristida ramosa purple wiregrass	48
Conyza bonariensis flaxleaf fleabane	20
Aristida vagans Three awned speargrass	12
Anagallis arvensis Pimpernel	6
Carthamus lanatus saffron thistle	4
Vulpia bromoides squirrel tail fescue	3
Plantago lanceolata lamb's tongue	2
Taraxacum officinale dandelion	1
Geranium solari	1
Lolium rigidum annual ryegrass	1
Trifolium subterraneum sub clover	1

Tree and shrub layer characteristics at B12

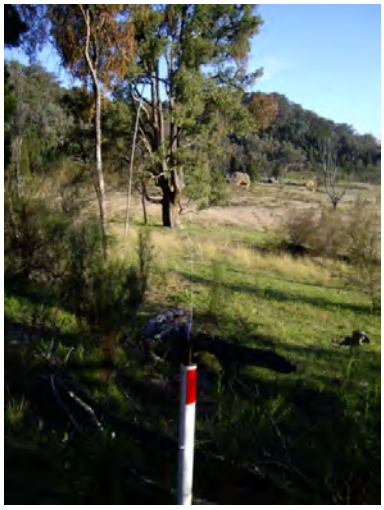
	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	0	0	0	0	-	-

Grid: GDA94 Zone 55 768634 6418562	**Location:** Lower slope of the valley to the west of the mine site	Site: *C1*

Site Description

The area has been partially cleared of native vegetation (rough barked apple situated below a black cypress grove) in the past and has been used until recently for grazing of improved pasture.

2010



2008

2007

2011

Ground layer characteristics at C1

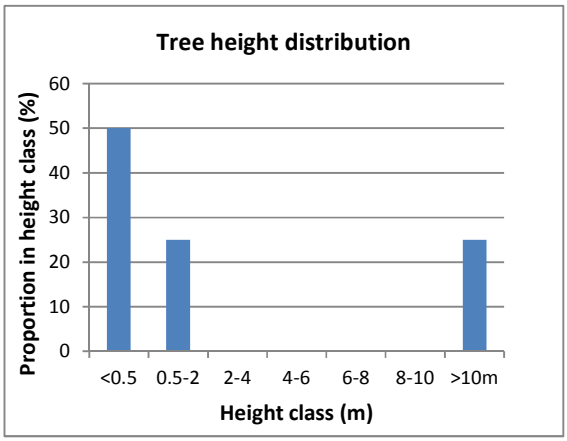
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	67	27	1	6	245	0.3
2010	62	25	5	8	115	0.2

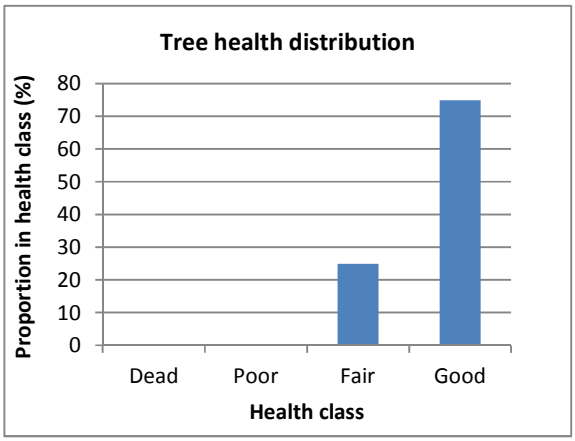
Species %	2011
Austrostipa scabra slender speargrass	28
Aristida vagans Three awned speargrass	26
Anagallis arvensis Pimpernel	15
Plantago lanceolata lamb's tongue	9
Aristida ramosa purple wiregrass	7
Sporobolus creber slender rat's tail grass	4
Themeda australis kangaroo grass	4
Cassinia arcuata sifton bush	2
Glycine sp.	2
Chrysocephalum apiculatum yellow buttons	2
Other forbs	1

Tree and shrub layer characteristics at C1

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	200	0	67	267	5.0	4.0

Tree layer composition %	2011
Angophora floribunda rough-barked apple	75
Bursaria spinosa	25





Grid: GDA94 Zone 55 768547 6418092	**Location:** Steep lower slope in the valley to the west of the mine site	Site: *C2*

Site Description

The area has been partially cleared of native vegetation in the past, is steeply sloping and dominated by black cypress pine. The soil is shallow and rocky.

2010

2008

2007

2011

Ground layer characteristics at C2

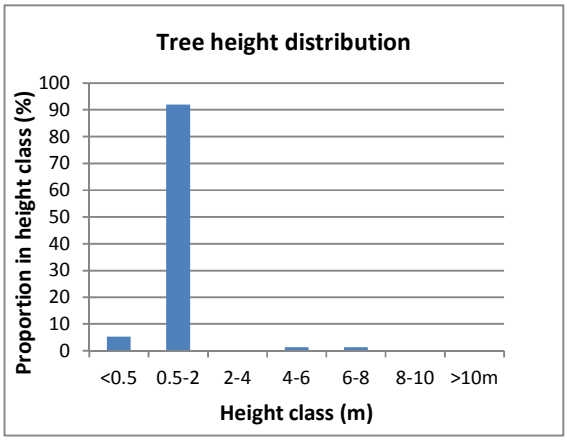
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	19	27	38	17	122	1.8
2010	10	29	40	21	100	1.7

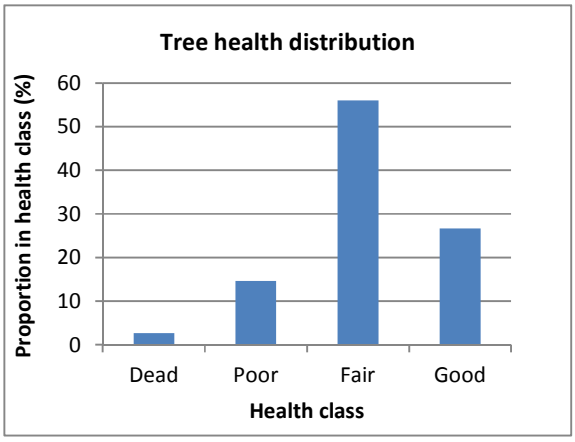
Species %	2011
Cassinia arcuata sifton bush	41
Aristida vagans Three awned speargrass	32
Lomandra longifolia tall mat grass	13
Acacia ixiophylla sticky leaved wattle	8
Dodonaea viscosa hop bush	3
Eragrostis brownii Brown's lovegrass	2

Tree and shrub layer characteristics at C2

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	0	3067	2340	5407	1.2	2.7

Tree layer composition %	2011
Acacia ixiophylla sticky leaved wattle	57
Dodonaea viscosa hop bush	25
Cassinia arcuata sifton bush	9
Eremophila debilis Amulla	7
Callitris endlicheri black cypress pine black cypress pine	1
Brachychiton populneus Kurrajong	1





Grid: GDA94 Zone 55 768515 6417983	**Location:** Lower rocky slope of valley to the west of the mine site	Site: *C3*

Site Description

The native vegetation (rough barked apple and black cypress) has been selectively killed in the past and the area is been used until recently for grazing of improved pasture. The slope is greater than 15% and soil is shallow and rocky.

2010

2008

2007

2011

Ground layer characteristics at C3

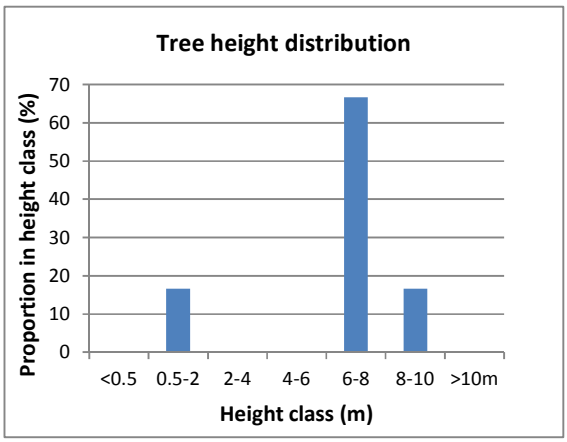
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	55	32	6	9	405	0.7
2010	42	35	11	11	268	0.7

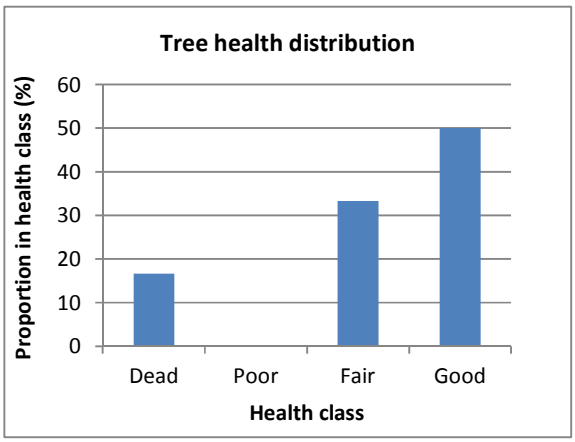
Species %	2011
Aristida vagans Three awned speargrass	63
Eragrostis brownii Brown's lovegrass	14
Lomandra longifolia tall mat grass	8
Sida sp.	6
Chloris truncata windmill grass	6
Plantago lanceolata lamb's tongue	2
Cassinia arcuata sifton bush	1
Chrysocephalum apiculatum yellow buttons	0

Tree and shrub layer characteristics at C3

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	267	0	140	407	6.8	3.2

Tree layer composition %	2011
Angophora floribunda rough-barked apple	66
Callitris endlicheri black cypress pine	18
Cassinia arcuata sifton bush	16





Grid: GDA94 Zone 55 768543 6417887	**Location:** Lower steep slope of the valley to the west of the mine site	Site: *C4*

Site Description

The area has been partially cleared of native vegetation in the past and is now used for grazing of improved pasture. Site is situated below grove of black cypress.

2010

2008

2007

2011

Ground layer characteristics at C4

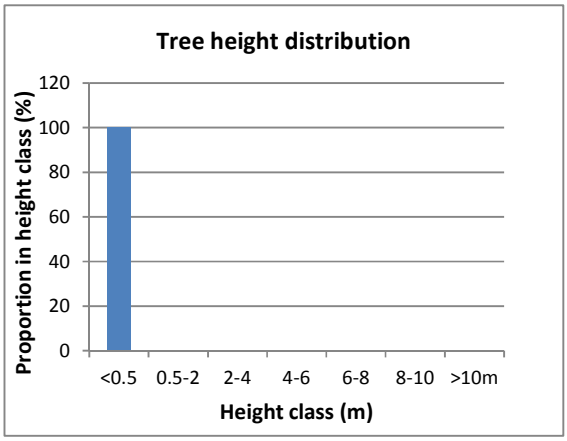
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	81	9	11	0	490	0.0
2010	84	8	8	0	255	0.0

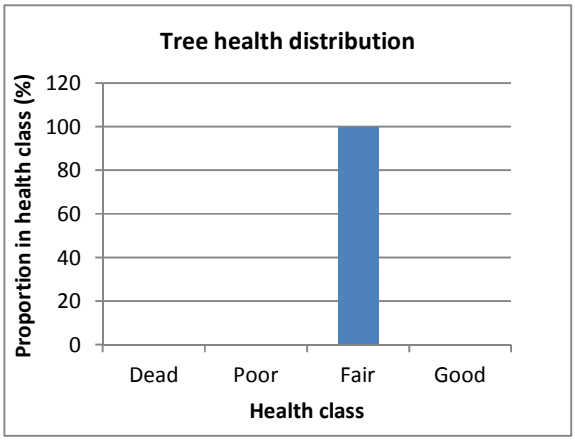
Species %	2011
Eragrostis brownii Brown's lovegrass	62
Sporobolus creber slender rat's tail grass	23
Aristida ramosa purple wiregrass	8
Taraxacum officinale dandelion	5
Cheilanthes seiberi rock fern	1
Geranium solanderi native geranium	1
Carthamus lanatus saffron thistle	0

Tree and shrub layer characteristics at C4

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	67	0	0	67	0.5	3.0

Tree layer composition %	2011
Angophora floribunda rough-barked apple	100





Grid: GDA94 Zone 55 768562 6417754	**Location:** Lower slope of the valley to the west of the mine site	Site: *C5*

Site Description

The area has been cleared of native rough barked apple vegetation in the past and has until recently been used for grazing of improved pasture.

2010

2008

2007

2011

Ground layer characteristics at C5

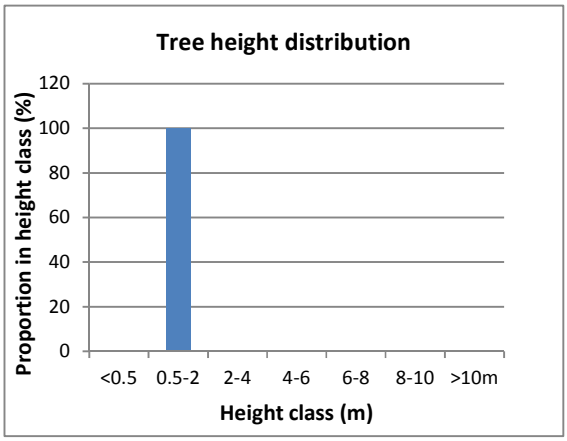
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	72	28	0	0	615	0.0
2010	86	13	0	0	364	0.0

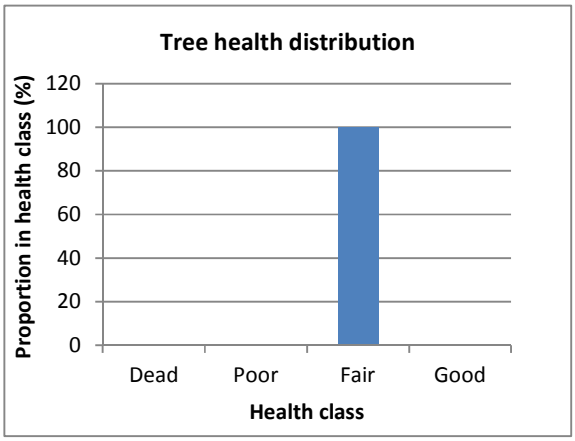
Species %	2011
Aristida ramosa purple wiregrass	41
Sporobolus creber slender rat's tail grass	16
Chloris truncata windmill grass	14
Lomandra longifolia tall mat grass	12
Eragrostis brownii Brown's lovegrass	9
Taraxacum officinale dandelion	4
Chrysocephalum apiculatum yellow buttons	4
Carthamus lanatus saffron thistle	0

Tree and shrub layer characteristics at C5

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	0	67	0	67	0.8	3.0

Tree layer composition %	2011
Acacia linearifolia narrow-leaved wattle	100





Grid: GDA94 Zone 55 768500 6416973	**Location:** Steep lower slope on valley to the west of the mine site.	Site: *C6*

Site Description
The area has been partially cleared of native black cypress vegetation in the past and has until recently been used for grazing of improved pasture.

2010

2008

2007

2011

Ground layer characteristics at C6

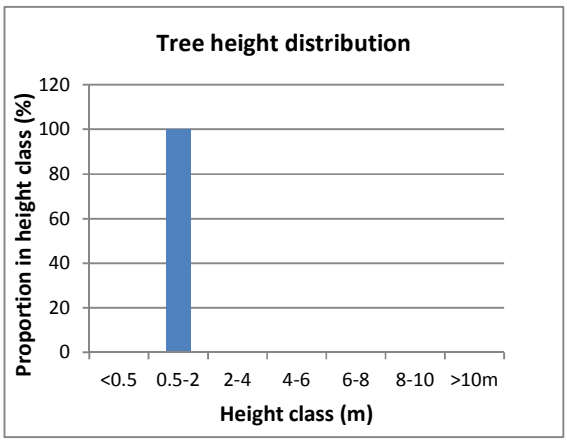
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	52	34	6	8	370	0.3
2010	71	16	10	3	241	0.8

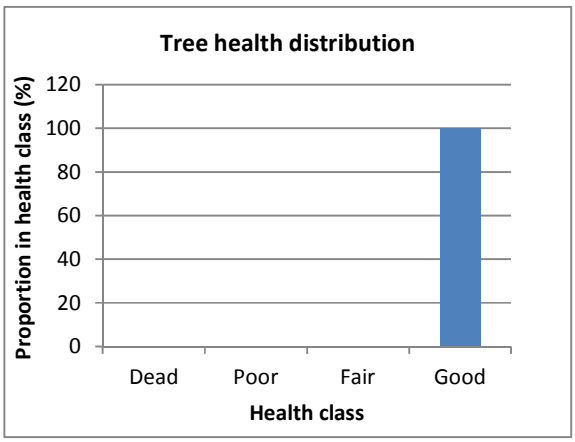
Species %	2011
Sporobolus creber slender rat's tail grass	22
Panicum queenslandicum Yadbila grass	18
Aristida vagans Three awned speargrass	16
Chloris truncata windmill grass	15
Lomandra longifolia tall mat grass	13
Carthamus lanatus saffron thistle	13
Geranium solanderi native geranium	1
Aristida holathera erect kerosene grass	1
Anagallis arvensis Pimpernel	1
Cheilanthes seiberi rock fern	0

Tree and shrub layer characteristics at C6

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	0	0	200	200	1.2	4.0

Tree layer composition %	2011
Dodonaea viscosa Hop bush	100





Grid: GDA94 Zone 55 768444 6416912	**Location**: Low rocky sloping country in the Valley to the west of the mine site	Site: *C7*

Site Description
The area has been cleared of native vegetation in the past and has been used for grazing of improved pasture.

2010

2008

2007

2011

Ground layer characteristics at C7

	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	56	41	2	2	265	0.0
2010	81	12	4	3	273	0.0

Species %	2011
Eragrostis brownii Brown's lovegrass	31
Chloris truncata windmill grass	30
Sporobolus creber slender rat's tail grass	20
Carthamus lanatus saffron thistle	8
Stellaria media common chickweed	6
Panicum decompositum native millet	4
Geranium solanderi native geranium	3
Lolium rigidum annual ryegrass	1

Tree and shrub layer characteristics at C7

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	0	0	0	0	-	-

Grid: GDA94 Zone 55 768400 6416827	**Location:** Lower hill slope in the valley to the west of the mine site	Site: *C8*

Site Description

The area has been cleared of native black cypress vegetation in the past and has until recently been used for grazing of improved pasture.

2010

2008

2007

2011

Ground layer characteristics at C8

	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	68	24	2	6	375	0.3
2010	83	10	2	5	345	0.7

Species %	2011
Geranium solanderi native geranium	46
Chrysocephalum apiculatum yellow buttons	21
Carthamus lanatus saffron thistle	13
Chloris truncata windmill grass	8
Panicum decompositum native millet	4
Lolium rigidum annual ryegrass	1
Aristida vagans Three awned speargrass	1
Cassinia arcuata sifton bush	1
Trifolium subterraneum sub clover	1
Stellaria media common chickweed	1
Anagallis arvensis Pimpernel	0

Tree and shrub layer characteristics at C8

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	0	0	0	0	-	-

Grid: GDA94 Zone 55 768365 6416914	**Location:** Low slope immediately north of Wilpinjong Creek	Site: *C9*

Site Description
The area has been cleared of native vegetation in the past and has been used for grazing of improved pasture.

2010

2008

2007

2011

Ground layer characteristics at C9

	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	46	52	0	2	580	0.0
2010	67	33	0	0	815	0.0

Species %	2011
Chloris truncata windmill grass	52
Carthamus lanatus saffron thistle	13
Anagallis arvensis Pimpernel	11
Lolium rigidum annual ryegrass	9
Onopordum acanthium Scotch thistle	8
Geranium solanderi native geranium	4
Conyza bonariensis flaxleaf fleabane	2
Trifolium subterraneum sub clover	1

Tree and shrub layer characteristics at C9

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	0	0	0	0	-	-

Grid: GDA94 Zone 55 768232 6416909	**Location:** Lower slope of a valley to the west of the mine site	Site: *C10*

Site Description
The area has been cleared of native vegetation in the past and has been used until recently for grazing of improved pasture. Soil depth is limited to 30-40 cm over rock, providing a limited rooting depth.

2010

2008

2007

2011

Ground layer characteristics at C10

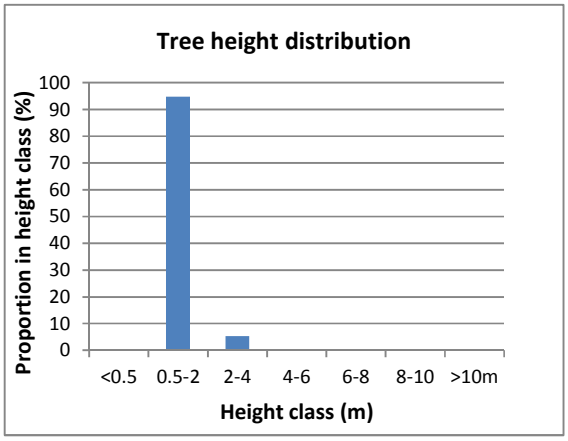
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	48	25	13	14	161	1.3
2010	46	24	11	19	132	1.5

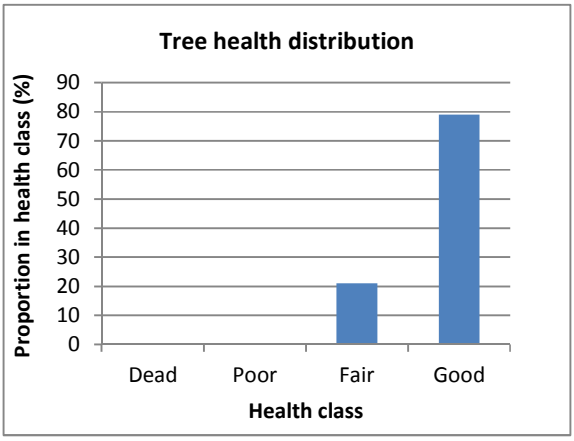
Species %	2011
Chloris truncata windmill grass	33
Sporobolus creber slender rat's tail grass	32
Austrostipa scabra slender speargrass	9
Anagallis arvensis Pimpernel	9
Chrysocephalum apiculatum yellow buttons	4
Carthamus lanatus saffron thistle	4
Geranium solanderi native geranium	4
Aristida vagans Three awned speargrass	2
Conyza bonariensis flaxleaf fleabanes	2
Onopordum acanthium Scotch thistle	1
Lolium rigidum annual ryegrass	0

Tree and shrub layer characteristics at C10

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	0	1267	0	1267	1.6	4.2

Tree layer composition %	2011
Acacia ixiophylla sticky leaved wattle	100





Grid: GDA94 Zone 55 769000 6417240	**Location:** Lower slope (>10%) to the south of the mine site	Site: *C11*

Site Description

The area has been partially cleared of native vegetation (yellow box, white box and grey gum) in the past and has been used until recently for grazing of improved pasture. A black cypress grove is located immediately upslope of this site.

2010

2008

2007

2011

Ground layer characteristics at C11

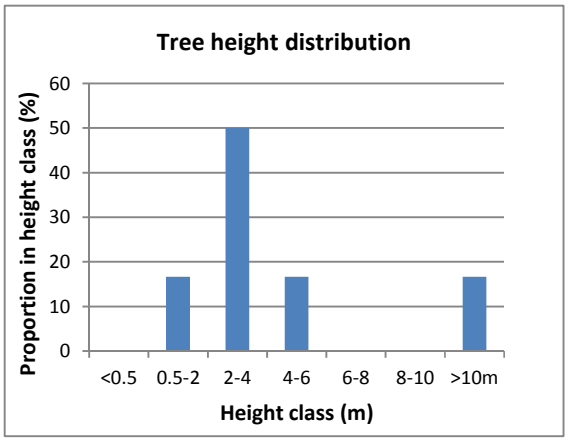
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	32	59	1	8	260	0.3
2010	53	35	2	10	195	0.5

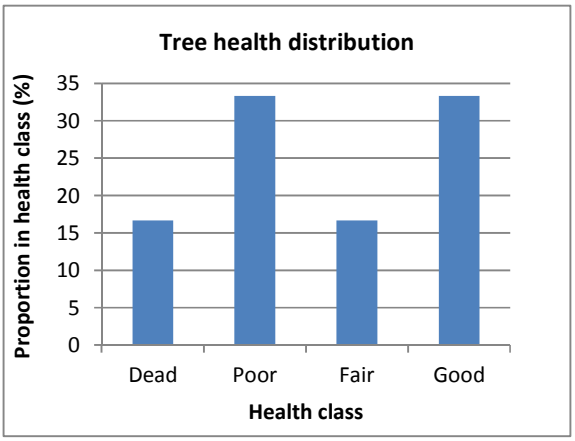
Species %	2011
Austrostipa verticillata slender bamboo grass	43
Cassinia arcuata sifton bush	28
Aristida vagans Three awned speargrass	14
Aristida ramosa purple wiregrass	5
Conyza bonariensis flaxleaf fleabane	4
Stellaria media common chickweed	3
Austrostipa scabra slender speargrass	2
Cheilanthes seiberi rock fern	0
Taraxacum officinale dandelion	0

Tree and shrub layer characteristics at C11

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	200	133	67	400	4.7	2.2

Tree layer composition %	2011
E. albens white box	50
Acacia implexa hickory wattle	33
Cassinia arcuata sifton bush	17





Grid: GDA94 Zone 55 768969 6417170	**Location:** Lower slope (10%) to the south of the mine site	Site: *C12*

Site Description
The area has been partially cleared of native vegetation (yellow box and white box) in the past and has been used until recently for grazing of improved pasture. A black cypress grove is located immediately upslope of this site.

2010

2008

2007

2011

Ground layer characteristics at C12

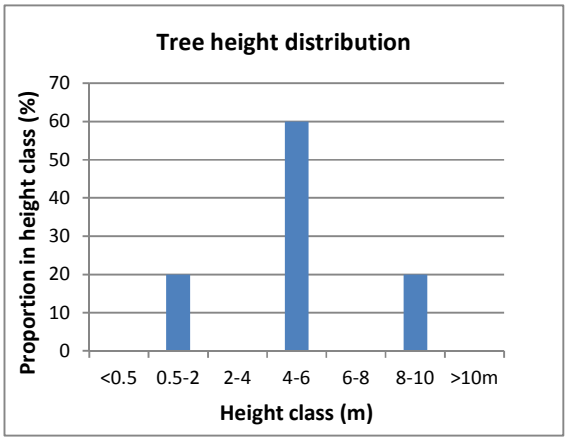
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	24	62	3	11	133	0.0
2010	43	30	10	16	59	0.2

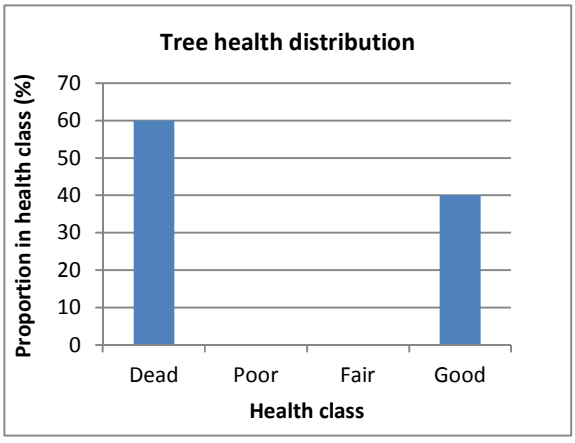
Species %	2011
Aristida vagans Three awned speargrass	45
Cassinia arcuata sifton bush	43
Austrostipa scabra slender speargrass	8
Stellaria media common chickweed	3
Panicum queenslandicum Yadbila grass	2

Tree and shrub layer characteristics at C12

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	67	267	0	334	5.3	1.6

Tree layer composition %	2011
Acacia implexa hickory wattle	60
Eucalyptus melliodora yellow box	20
Acacia linearifolia narrow-leaved wattle	20





Grid: GDA94 Zone 55 771548 6419884	**Location:** Wilpinjong Creek, bordering marsh/wetland area opposite mine site entrance.	Site: *WT1*

Site Description

Cleared area along Wilpinjong creek, with pre-clearing vegetation most likely rough barked apple and Blakely's red gum, as is present on opposite bank (shown in photograph).

2010

2009

2008

2011

Groundcover characteristics at WT1

	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	51	39	0	9	1929	0.6
2010	25	23	0	52	706	0.5

Species %	2011
Phragmites australis common reed	43
Arundinella nepalensis reed grass	22
Aristida ramosa purple wiregrass	17
Lomandra longifolia tall mat grass	12
Typha domingensis cumbungi	5

Tree and shrub layer characteristics at WT1

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	0	0	0	0	-	-

Grid: GDA94 Zone 55 6419900 771300	**Location:** Wilpinjong Creek, upstream Cumbo Creek Homestead	Site: *WT2*

Site Description
Cleared area along Wilpinjong creek, with pre-clearing vegetation most likely rough barked apple and Blakely's red gum

2010

2008

2011

Ground layer characteristics at WT2

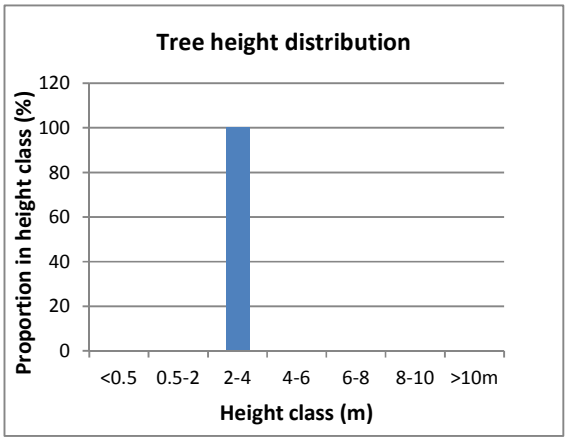
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	73	15	0	12	1600	0.0
2010	63	23	0	13	767	0.0

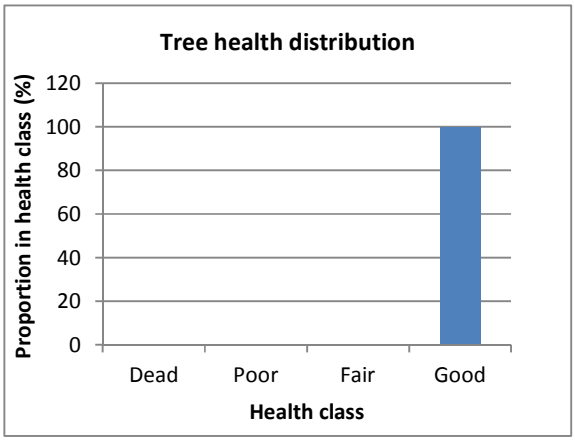
Species %	2011
Phragmites australis common reed	52
Imperata cylindrica blady grass	32
Typha domingensis cumbungi	7
Paspalum dilatatum paspalum	5
Eragrostis brownii Brown's lovegrass	3
Plantago lanceolata lamb's tongue	1

Tree and shrub layer characteristics at WT2

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	133	0	0	133	2.5	5.0

Tree layer composition %	2011
Angophora floribunda rough-barked apple	100





Grid: GDA94 Zone 55 771089 6419870	**Location:** Wilpinjong Creek at base of sandstone mesa	Site: *WT3*

Site Description

Cleared area along Wilpinjong creek, with pre-clearing vegetation most likely rough barked apple and Blakely's red gum

2010

2009

2008

2011

Ground layer characteristics at WT3

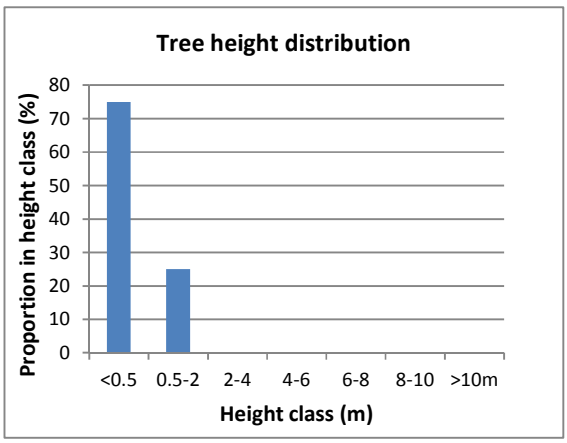
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	79	19	0	2	1371	0.0
2010	56	41	0	4	871	0.0

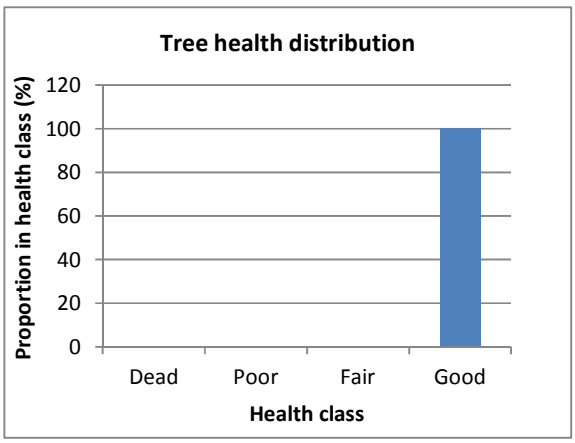
Species %	2011
Phragmites australis common reed	58
Aristida ramosa purple wiregrass	24
Imperata cylindrica blady grass blady grass	11
Typha domingensis cumbungi	6
Lomandra longifolia tall mat rush	1
Lolium rigidum annual ryegrass	0

Tree and shrub layer characteristics at WT3

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	444	0	0	444	0.5	4.0

Tree layer composition %	2011
Angophora floribunda rough-barked apple	100





Grid: GDA94 Zone 55 6419874 770913	**Location:** Wilpinjong Creek, downstream of site B10	Site: *WT4*

Site Description
Cleared area along Wilpinjong creek, with pre-clearing vegetation most likely rough barked apple and Blakely's red gum

2010

2009

2008

2011

Ground layer characteristics at WT4

	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	74	20	0	6	1250	0.4
2010	50	38	0	13	519	0.4

Species %	2011
Phragmites australis common reed	78
Aristida ramosa purple wiregrass	18
Imperata cylindrica blady grass	3
Taraxacum officinale dandelion	1
Sporobolus creber slender rat's tail grass	1

Tree and shrub layer characteristics at WT4

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	0	0	0	0	-	-

Grid: GDA94 Zone 55 770009 6420896	**Location:** Wilpinjong Creek, adjacent to Cumbo Creek Homestead	Site: *WT5*

Site Description

Cleared area along Wilpinjong creek, with pre-clearing vegetation most likely rough barked apple and Blakely's red gum

2010

2009

2008

2011

Ground layer characteristics at WT5

	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	61	37	0	2	2011	0.0
2010	12	83	0	6	1461	0.0

Species %	2011
Phragmites australis common reed	64
Imperata cylindrica blady grass	17
Typha domingensis cumbungi	9
Sedge - Cyperaceae	6
Aristida ramosa purple wiregrass	2
Sporobolus creber slender rat's tail grass	2

Tree and shrub layer characteristics at WT5

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	0	0	0	0	-	-

Grid: GDA94 Zone 55 770482 6419353	**Location:** Rehabilitation site	**Site:** *R1*

Site Description
Rehabilitated mine spoil site seeded in 2008 on low slope (<2%).

2010

2009

2011

Ground layer characteristics at R1

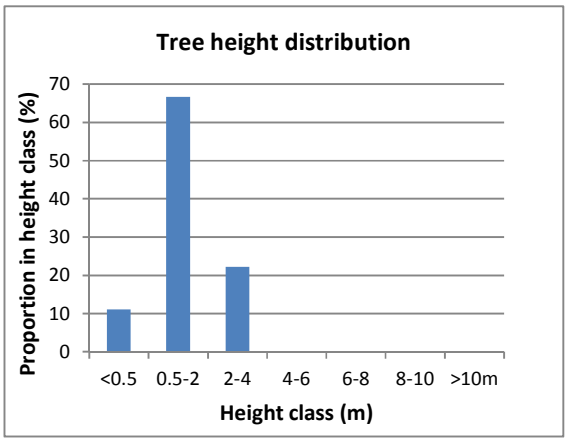
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	79	19	0	2	2110	0.0
2010	55	33	4	9	2295	0.0

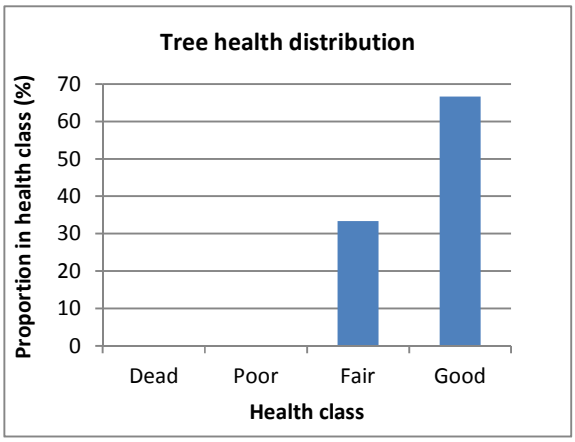
Species %	2011
Chloris gayanus rhodes grass	52
Phalaris aquatica	27
Eragrostis curvula cv Consol	17
Conyza bonariensis flaxleaf fleabane	4

Tree and shrub layer characteristics at R1

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	267	267	67	601	1.2	3.4

Tree layer composition %	2011
Other eucalypts	33
Acacia linearifolia narrow-leaved wattle	22
Acacia ixiophylla sticky leaved wattle	22
Bossiaea eriocarpa common brown pea	11
Eucalyptus crebra narrow-leafed ironbark	11





Grid: GDA94 Zone 55 770373 6419421	**Location:** Rehabilitation site	Site: *R2*

Site description

Rehabilitated mine spoil site seeded in 2008 on low slope (<2%).

2010

2009

2011

Ground layer characteristics at R2

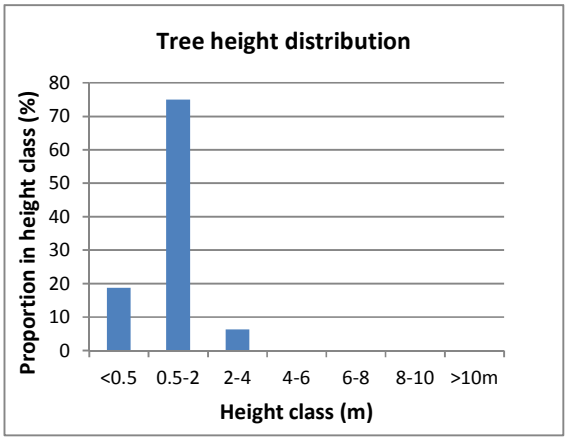
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	68	15	6	11	1610	0.0
2010	51	27	5	17	1500	0.0

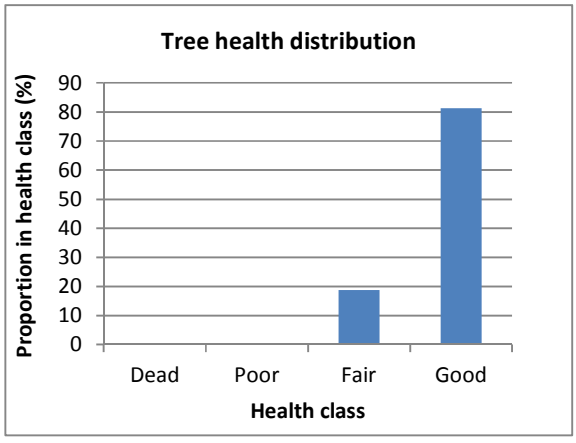
Species %	2011
Phalaris aquatica	36
Chloris gayanus rhodes grass	31
Eragrostis curvula cv Consol	18
Paspalum dilatatum paspalum	11
Lolium rigidum annual ryegrass	2
Taraxacum officinale dandelion	1

Tree and shrub layer characteristics at R2

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	933	0	200	1133	0.9	3.9

Tree layer composition %	2011
Eucalyptus crebra narrow-leafed ironbark	41
Eucalyptus melliodora yellow box	29
Bossiaea eriocarpa common brown pea	18
Other eucalypts	12





Grid: GDA94 Zone 55 770360 6419262	**Location:** Rehabilitation site	Site: *R3*

Site description
Rehabilitated mine spoil site seeded in April 2010 on low slope (3-5%).

2011

Ground layer characteristics at R3

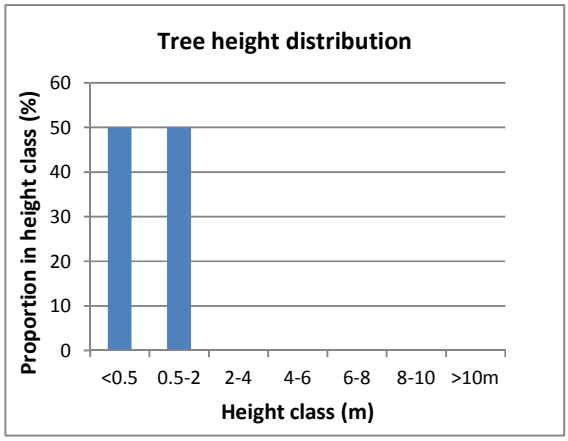
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	84	12	0	4	2110	0.0
2010	80	7	3	10	1150	0.0

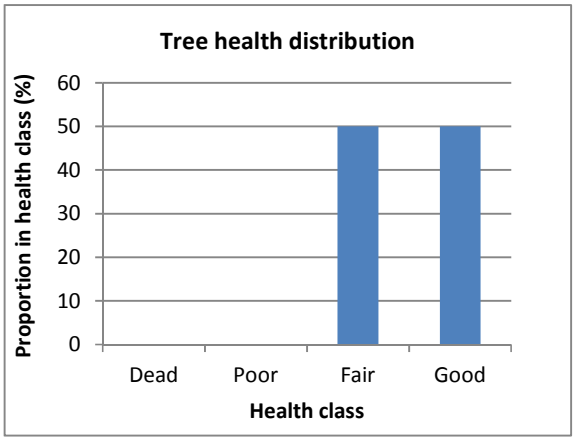
Species %	2011
Chloris gayanus rhodes grass	60
Phalaris aquatica	37
Carthamus lanatus saffron thistle	2
Eragrostis curvula cv Consol	1

Tree and shrub layer characteristics at R3

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	67	67	0	134	0.6	3.0

Tree layer composition %	2011
Acacia ixiophylla sticky leaved wattle	50
Other eucalypts	50





Grid: GDA94 Zone 55 770353 6419152	**Location:** Rehabilitation site	Site: *R4*

Site description
Rehabilitated mine spoil site seeded in April 2010 on slope of approximately 7%

2011

2010

Ground layer characteristics at R4

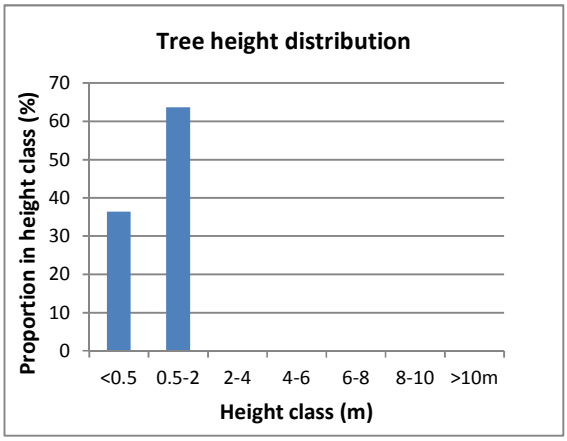
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	48	12	15	26	896	1.6
2010	50	4	17	29	247	1.4

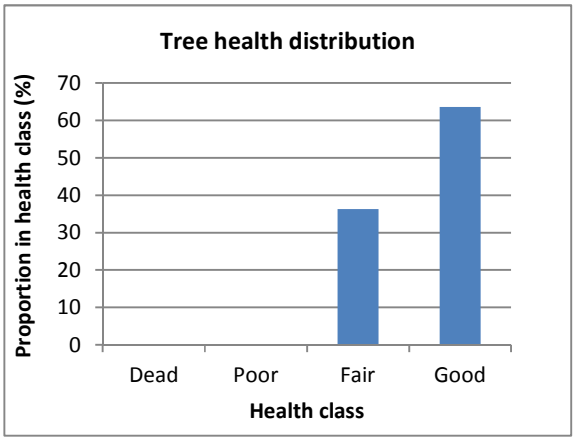
Species %	2011
Chloris gayanus rhodes grass	85
Lolium rigidum annual ryegrass	8
Conyza bonariensis flaxleaf fleabane	4
Phalaris aquatica	1
Trifolium subterraneum sub clover	1
Eragrostis curvula cv Consol	1
Chrysocephalum apiculatum yellow buttons	0

Tree and shrub layer characteristics at R4

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	667	800	0	1467	0.8	3.7

Tree layer composition %	2011
Other eucalypts	36
Acacia ixiophylla sticky leaved wattle	32
Other acacias	18
Eucalyptus crebra narrow-leafed ironbark	9
Acacia linearifolia narrow-leaved wattle	5





Grid: GDA94 Zone 55 770234 6419256	**Location:** Rehabilitation site	Site: *R5*

Site description

Rehabilitated mine spoil site seeded in April 2010 on slope of approximately 7%

2011

2010

Ground layer characteristics at R5

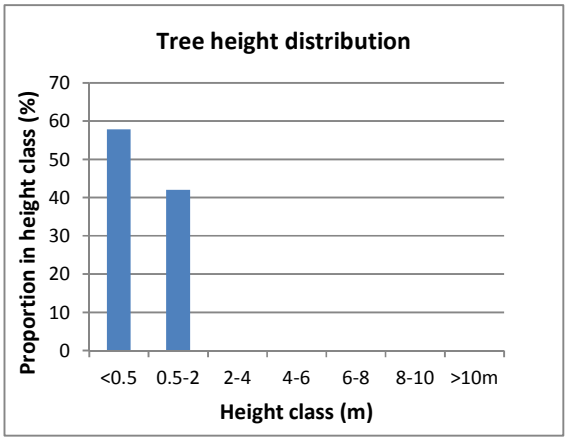
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	59	10	10	22	1110	0.9
2010	58	7	15	20	255	0.7

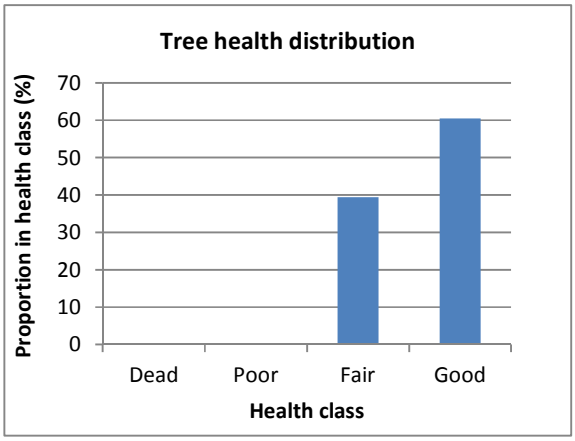
Species %	2011
Chloris gayanus rhodes grass	64
Phalaris aquatica	17
Eragrostis curvula cv Consol	5
Conyza bonariensis flaxleaf fleabane	4
Medicago sativa lucerne	4
Carthamus lanatus saffron thistle	3
Plantago lanceolata lamb's tongue	2

Tree and shrub layer characteristics at R5

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	533	1867	200	2600	0.6	3.7

Tree layer composition %	2011
Acacia ixiophylla sticky leaved wattle	56
Other eucalypts	21
Acacia linearifolia narrow-leaved wattle	15
Templetonia stenophylla leafy templetonia	8





Grid: GDA94 Zone 55 769562 6419517	**Location:** Rehabilitation site	Site: *R6*

Site description
Rehabilitated mine spoil site seeded in December 2010 on slope of <1%

2011

Ground layer characteristics at R6

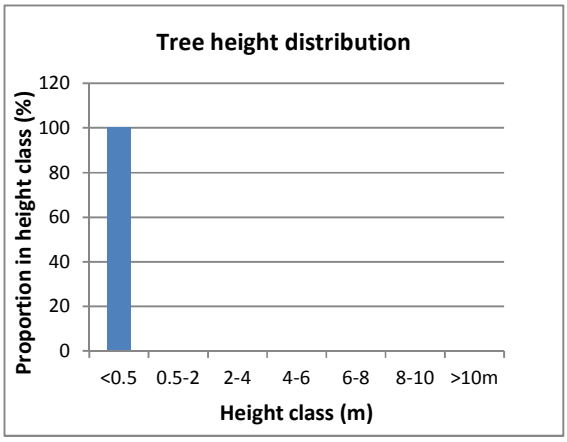
	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	40	0	11	50	526	0.0

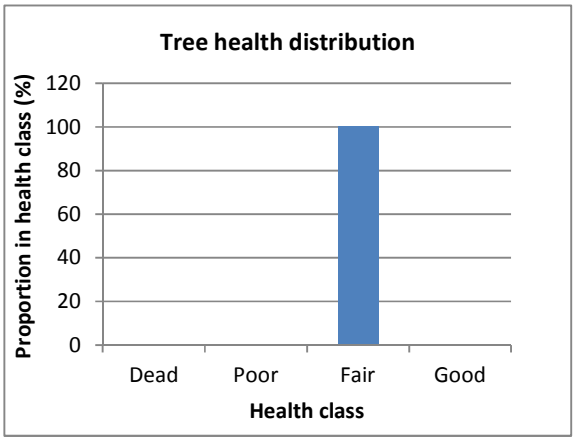
Species %	2011
Phalaris aquatica	40
Eragrostis curvula cv Consol	32
Plantago lanceolata lamb's tongue	13
Chloris gayanus rhodes grass	10
Lolium perenne perennial ryegrass	6

Tree and shrub layer characteristics at R6

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	67	0	0	67	0.1	3.0

Tree layer composition %	2011
Other eucalypts	100





Grid: GDA94 Zone 55 769666 6419383	**Location:** Rehabilitation site	Site: *R7*

Site description
Rehabilitated mine spoil site seeded in February 2011. Transect across a slope of approximately 5%

2011

Ground layer characteristics at R7

	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	67	1	7	25	950	0.0

Species %	2011
Phalaris aquatica	38
Festuca arundinacea Fescue	35
Plantago lanceolata lamb's tongue	18
Lolium perenne perennial ryegrass	7
Trifolium repens white clover	1

Tree and shrub layer characteristics at R7

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	0	0	0	0	-	-

Grid: GDA94 Zone 55 772605 6417759	**Location:** Rehabilitation site	Site: *RG1*

Site description
Former farm paddock still being grazed. Slope of approximately 4%

2011

Ground layer characteristics at RG1

	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	80	13	0	7	220	0.0

Species %	2011
Aristida ramosa purple wiregrass	28
Sporobolus creber slender rat's tail grass	27
Plantago lanceolata lamb's tongue	15
Lolium rigidum annual ryegrass	11
Trifolium subterraneum sub clover	6
Taraxacum officinale dandelion	5
Aristida vagans Three awned speargrass	4
Carthamus lanatus saffron thistle	3
Paspalum dilatatum paspalum	1
Arctotheca calendula capeweed	1

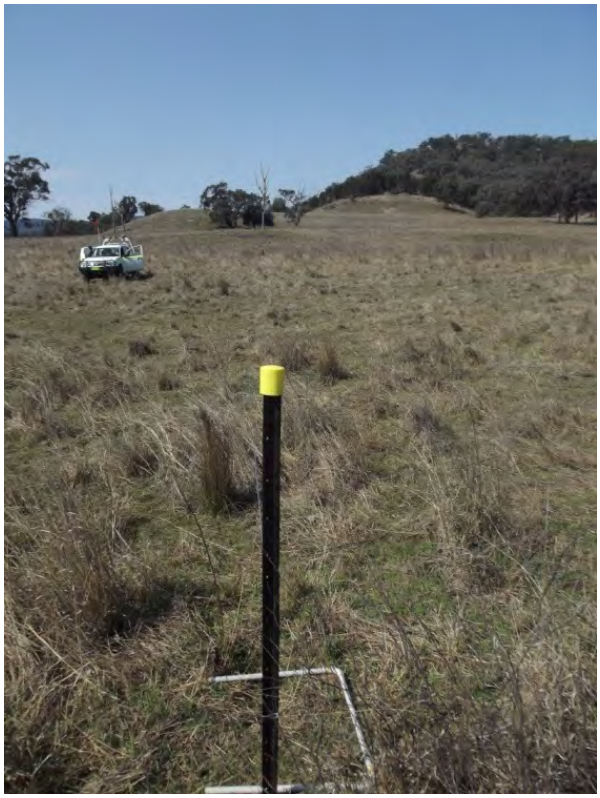
Tree and shrub layer characteristics at RG1

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	0	0	0	0	-	-

Grid: GDA94 Zone 55 771636 6417184	**Location:** Rehabilitation site	Site: *RG2*

Site description
Former farm paddock still being grazed. Slope of approximately 3%

2011



Ground layer characteristics at RG2

	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	71	29	0	0	220	0.0

Species %	2011
Sporobolus creber slender rat's tail grass	44
Lolium rigidum annual ryegrass	16
Vulpia bromoides squirrel tail fescue	12
Aristida vagans Three awned speargrass	8
Eragrostis brownii Brown's lovegrass	5
Trifolium subterraneum sub clover	4
Stellaria media common chickweed	4
Plantago lanceolata lamb's tongue	3
Conyza bonariensis flaxleaf fleabanes	2
Carthamus lanatus saffron thistle	2

Tree and shrub layer characteristics at RG2

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	0	0	0	0	-	-

Grid: GDA94 Zone 55 772397 6418241	**Location:** Rehabilitation site	Site: *RG3*

Site description

Former farm paddock on Cumbo creek currently being grazed. Slope of <1%.

2011

Ground layer characteristics at RG3

	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	79	19	0	2	465	0.0

Species %	2011
Aristida ramosa purple wiregrass	34
Sporobolus creber slender rat's tail grass	31
Aristida vagans Three awned speargrass	12
Carthamus lanatus saffron thistle	8
Plantago lanceolata lamb's tongue	7
Lolium rigidum annual ryegrass	3
Conyza bonariensis flaxleaf fleabanes	2
Trifolium subterraneum sub clover	2
Stellaria media common chickweed	1

Tree and shrub layer characteristics at RG3

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	0	0	0	0	-	-

Grid: GDA94 Zone 55 773967 6420340	**Location:** Rehabilitation site	Site: *RG4*

Site description

Former farm paddock still being grazed. Slope of approximately 2%

2011

Ground layer characteristics at RG4

	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	66	32	1	1	310	0.0

Species %	2011
Aristida vagans Three awned speargrass	57
Conyza bonariensis flaxleaf fleabanes	15
Onopordum acanthium Scotch thistle	8
Sporobolus creber slender rat's tail grass	7
Vulpia bromoides squirrel tail fescue	7
Lolium rigidum annual ryegrass	6

Tree and shrub layer characteristics at RG4

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	0	0	0	0	-	-

Grid: GDA94 Zone 55 773306 6420316	**Location:** Rehabilitation site	Site: *RG5*

Site description
Former farm paddock still being grazed. Slope of approximately 2%.

2011

Ground layer characteristics at RG5

	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	49	49	0	3	440	0.0

Species %	2011
Phalaris aquatica	29
Verbena bonariensis purple top	20
Onopordum acanthium Scotch thistle	15
Sporobolus creber slender rat's tail grass	14
Plantago lanceolata lamb's tongue	9
Aristida vagans Three awned speargrass	6
Lolium rigidum annual ryegrass	3
Vulpia bromoides squirrel tail fescue	4
Conyza bonariensis flaxleaf fleabanes	0

Tree and shrub layer characteristics at RG5

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	0	0	0	0	-	-

Grid: GDA94 Zone 55 768630 6421583	**Location:** Rehabilitation site	Site: *RG6*

Site description
Former farm paddock still being grazed. Slope of approximately 1%.

2011

Ground layer characteristics at RG6

	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	55	38	0	7	190	0.0

Species %	2011
Phalaris aquatica	32
Vulpia bromoides squirrel tail fescue	21
Verbena bonariensis purple top	13
Conyza bonariensis flaxleaf fleabanes	12
Lolium perenne perennial ryegrass	11
Trifolium subterraneum sub clover	7
Serradella	2
Onopordum acanthium Scotch thistle	1
Aristida vagans Three awned speargrass	1
Taraxacum officinale dandelion	1

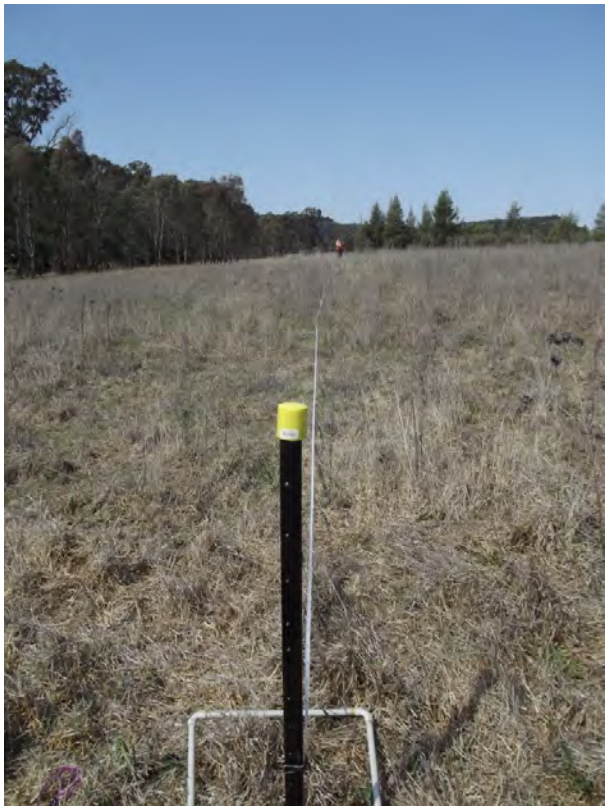
Tree and shrub layer characteristics at RG6

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	0	0	0	0	-	-

Grid: GDA94 Zone 55 769014 6421358	**Location:** Rehabilitation site	Site: *RG7*

Site description
Former farm paddock no longer grazed. Slope of approximately 3%.

2011



Ground layer characteristics at RG7

	Cover (%)				Yield	Erosion
	Standing	Litter	Rock	Bare	(kg/ha)	(0-5)
2011	51	47	0	2	630	0.0

Species %	2011
Phalaris aquatica	47
Sporobolus creber slender rat's tail grass	14
Conyza bonariensis flaxleaf fleabanes	14
Plantago lanceolata lamb's tongue	7
Taraxacum officinale dandelion	6
Lolium perenne perennial ryegrass	5
Vulpia bromoides squirrel tail fescue	3
Stellaria media common chickweed	1
Verbena bonariensis purple top	1
Anagallis arvensis Pimpernel	0
Aristida vagans Three awned speargrass	0

Tree and shrub layer characteristics at RG7

	Density (stems/ha)				Height	Health
	Myrtaceae	Acacia	Others	Total	(m)	(0-5)
2011	0	0	0	0	-	-