

Appendix 7

FLORA AND FAUNA MONITORING REPORTS

Rocglen Mine Annual Fauna Monitoring

Spring 2009 and 2010

1.0 Preamble

The establishment of control plots to record the predicted impact of the Rocglen mine on the local fauna has been problematic. This is mainly due the limited area available for the purpose within the original Belmont site. This has been exacerbated by the mine expansion which further reduced the remnant woodland available for this monitoring purpose even though it now includes the property of Yarrawonga to the north. This problem has been overcome by the setting up of two woodland control plots in the adjoining Vickery state forest immediately to the west.

Initially, three control monitoring plots were established in the only remnant Ironbark, Callitris and Pilliga Grey Gum woodland in the north east corner of the Rocglen mine, north of Yarrawonga Road. The southern end of this remnant has been subjected to repeated logging of the Ironbark for local fencing until recently, as evidence by the abundance of stumps of various vintages in control plot IB1. The Rocglen Mine has been destocked since the establishment of the mine, over 5 years ago. These plots were sampled on the 21st and 22nd September 2009. Due to the mine expansion, however, these had to be reduced to two plots, W1 and W2.

A further two woodland plots (SF1 and SF2) were established in the Vickery SF which has not been subjected any recent grazing pressures. All four control plots were sampled on the 4th and 5th November 2010.

The initial sampling attempt was interrupted by heavy spring rain in the late spring 2009, and the nocturnal sampling had to be abandoned. The early November 2010 sample was taken in mild seasonal conditions with overnight temperatures above 10°C and daytime temperatures below 30°C, but windy. On the sampling days the winds were gusting up to 50 km/hr predominantly south-east at 10 to 20 km/hr veering north overnight with increasing clouds.

The monitoring plots in Vickery SF were undertaken under SF License No.....

2.0 Methods

The following methods were used to sample the various fauna groups.

2.1 Birds and Mammals

Each plot was traversed on foot along its length ten times at approximately 10 metre intervals. Signs of mammal and bird occupation and use by the various fauna species were noted.

Species that occurred within sight and hearing distance of the plots were also noted.

Spotlight transects were conducted along access tracks on the mining lease and the adjoining State Forest for the nocturnal species and bats were sampled using ultrasonic bat recording equipment.

Anabat II ultrasonic bat call recorders were placed in the various habitats, but due to the mobility of these species and close proximity of various plots, not all plots were sampled independently for these wholly aerially based samples. The calls were analysed using zero-crossing analysis to identify the microbat species.

2.2 Reptiles and amphibians

Signs of reptiles and amphibians on each plot were determined in the manner as described for birds. On each transect the ground and vegetation were closely examined, any timber or other debris on the ground was lifted (where possible) and standing dead timber checked to locate any reptiles or frogs.

In addition to the nocturnal census, the various dams and other suitable habitat on the mining lease were visited during daylight hours to record the species present. Gilgai depressions containing pools of water occur in the north end of the remnant woodland area just beyond W2.

3.0 Results

The following fauna species were recorded during these monitoring samples:

3.1 Birds

The birds recorded in the 2009 and 2010 annual monitoring samples are listed below against the list of species recorded from the fauna survey for the EIS.

Common Name	Scientific Name	IB1 2009	W1 2009	W1 2010	W1 2009	W2 2010	SF1 2010	SF2 2010	Lease	Status
1. Australian Wood Duck	<i>Chenonetta jubata</i>								-	P
2. Pacific Black Duck	<i>Anas superciliosa</i>								-	P
3. Grey Teal	<i>Anas gracilis</i>									P
4. Little Pied Cormorant	<i>Phalacrocorax melanoleucos</i>									P
5. Pied Cormorant	<i>Phalacrocorax varius</i>									P

The ultrasonic bat call analyses from these spring samples have identified almost a full complement of the 13 bats likely to occur in this region (as recorded in the EIS surveys), including the listed Yellow-bellied Sheathtail Bat, *Saccolaimus flaviventris*. The exception that was not recorded was the other listed vulnerable Little Pied Bat, *Chalinolobus picatus* that has also not been picked up by any of the other more extensive pre-start surveys since the EIS surveys. It is a species that apparently prefers dry woodland near a source of water and the main part of its range is further west. The above average rainfall in the last 18 months may have seen it retreat to the drier parts of its range.

There may be a third species of Mastiff-bat, Beccari's Mastiff-bat, *Mormopterus beccarii*, but due to the poor quality of the few recorded call from these samples and a lack of reference call, only a tentative identification has been assigned to it.

3.3 Amphibians

The following frog species that have been recorded in the Rocglen Mine were recorded in the Belmont site during the EIS surveys.

Common Name	Scientific Name	Spring 2009	Spring 2010
1. Gunther's (Broad-palmed) Frog	<i>Litoria latopalmata</i>	-	-
2. Peron's Tree-frog	<i>Litoria peronii</i>	-	-
3. Green Tree-frog	<i>Litoria caerulea</i>	-	-
4. Spotted Marsh Frog	<i>Limnodynastes tasmaniensis</i>	-	-
5. Wrinkled Toadlet	<i>Uperoleia rugosa</i>	-	-
6. Rough Frog	<i>Cyclorana verrucosus</i>		
7. Plains Toadlet+	<i>Crinia parinsignifera</i>	-	
8. Desert (Red) Tree Frog+	<i>Litoria rubella</i>	-	
9. Bleating Tree Frog+	<i>Litoria dentata</i>	-	

+ Species not recorded during the initial survey

The breaking of the long drought in 2009 saw an increase in the number of frog species recorded in the Rocglen mine. Three species that are quite common in the region but have not been recorded in the Rocglen mine were present in the spring of 2009 after the drought broke; they were the Plains Toadlet, *Crinia parinsignifera* (Now referred to as the Eastern Sign-bearing Froglet), the Desert or Red Tree Frog, *Litoria rubella* and the Bleating Tree Frog, *Litoria dentata*.

The burrowing Rough Frog, *Cyclorana verrucosus*, had only been found between the haul road and Vickery SF as tadpoles. This highly opportunistic breeder can only be detected after heavy rain when it will emerge episodically to breed and feed before returning into its mostly sub-surface existence. It has not been seen anywhere in the region for the last few years.

3.4 Reptiles

The following reptiles marked with a dash (-) were recorded against the list of reptiles recorded during the EIS survey. Species recorded during the 2009 and 2010 samples that were not recorded

on the EIS survey are marked with a plus (+). In addition, a number of species that were observed in the Rocglen mine during the sampling periods have also been identified and marked with a dash (-) in the column marked, "Lease".

Common Name	Scientific Name	IB1	W1	W1	W2	W2	SF1	SF2	Lease&SF
		2009	2009	2010	2009	2010	2010	2010	09/10
1. Eastern Snake-necked Turtle	<i>Chelodina longicollis</i>								-
2. Blue-bellied Black Snake	<i>Pseudechis guttatus</i>								
3. Common Dwarf Skink	<i>Menetia greyii</i>			-		-			
4. Nobbi	<i>Amphibolurus nobbi</i>						-		-
5. South-eastern Morethia Skink	<i>Morethia boulengeri</i>	-	-	-	-		-		-
6. Robust Skink	<i>Ctenotus robustus</i>	-	-		-				
7. Dubious Dtella	<i>Gehyra dubia</i>								
8. Eastern Blue-tongued	<i>Tiliqua scincoides</i>								-
9. Tree Crevice-skink	<i>Egernia striolata</i>						-	-	-
10. Eastern Brown Snake	<i>Pseudonaja textilis</i>								
11. Burn's Dragon+	<i>Amphibolurus burnsi</i>					-			
12. Yellow-faced Whip Snake+	<i>Demansia psammophis</i>					-			
13. Southern Lerista+	<i>Lerista bougaainvillii</i>					-			
14. Prickly Gecko+	<i>Heteronotia binoei</i>	-							
15. Burrowing Skink+	<i>Anomalopus leuckartii</i>	-							
16. Barking Gecko+	<i>Underwoodisaurus milii</i>								-
17. Variegated Dtella+	<i>Gehyra variegata</i>							-	-
18. Bearded Dragon+	<i>Pogona barbata</i>								-
19. Lace Monitor+	<i>Varanus varius</i>								-
20. Wall Skink+	<i>Cryptoblepharus pulcher</i>							-	-

+ Species not recorded during the initial survey

After the last two samples, the number of reptiles known to occur in the Rocglen mine and the adjoining Vickery SF increased to 20 species.

Only the elapid's, the Eastern Brown Snake, *Pseudonaja textilis*, and the Blue-bellied Black Snake, *Pseudechis guttatus*, were not encountered in these samples. However, another smaller species, the Yellow-faced Whip Snake, *Demansia psammophis*, that had not been recorded in the Rocglen mine was found in W2, within the mining lease.

The only other species on this list that was not encountered during in these samples was the Dubious Dtella, *Gehyra dubia*, although another species, the Variegated Dtella, *G. variegata*, that had not been recorded on the lease before was recorded in W2.

The wet spell in the spring of 2009 resulted in much local movement of the Eastern Snake-necked Turtle, *Chelodina longicollis*, and three were found dead as road kills on the haul road leading to the mine.

4.0 Comments

The increase in the number of reptiles recorded in these samples maybe in part due to the improvement in the habitat patch quality in the woodland remnants where the woodland control plots are located within the mining lease, as well as the improved in habitat patch quality and the general ecosystem productivity since the breaking of the prolonged drought.

The biodiversity found on and around the degraded former Belmont property had been very poor and had only been enriched by the patches of woodland remnants north of Yarrawonga Road, the mature roadside corridor habitats and the proximity to Vickery SF. Since this mine commenced operation, the destocking has improved the habitat patch quality of the remnant native vegetation around it. The recent good growing seasons from the above average rainfall has seen the ground cover increase and there was abundance of grasses.

Due to Rocglen's proximity to Vickery SF much of the fauna species richness can still be expected to continue to exist on this mine site, albeit most will only have a local transient status on most of the mine area itself.

Future monitoring should include the establishment of two grassland control plots with random deployment of, say 20, roof tiles for habitat refuges, and two rehabilitation plots presumably with the deployment of fallen logs to enhancement the ground level habitat structure.

Consideration should be made to enhance the connectivity of Vickery SF and the Kelvin Range in the valley between them by joining the remnant woodland patches between them. There is now increasing evidence that most woodland birds cannot or are reluctant to move through gaps of clearing more than 50m between remnanthabitat patches (see Ford 2011, The causes of decline in birds of eucalypt woodlands: advances in our knowledge over the last 10 years. *Emu* 111, 1-9).

It would also be prudent to continue with the monitoring of GCB in surrounding area, especially in the adjoining Vickery SF to show that this listed vulnerable species can remain relatively unaffected by this open cut coal mine – even though, from the history of the land use in this district, it is a species that does not seem have a problem with moving relatively long distances between remnant habitat patches.

Dr Leong Lim

Principal Ecologist

Countrywide Ecological Service

May 2011

FLORA MONITORING REPORT

ROCGLLEN COAL MINE –

2010

**Prepared for Whitehaven Coal Mining Pty Ltd
 PO Box 600
 GUNNEDAH NSW 2380**

BY

**Geoff Cunningham Natural Resource
Consultants Pty Ltd,
9 The Crest
KILLARA NSW 2071 [ACN 058 178 493]**

**Telephone: 02 9416 1995
Fax: 02 9416 6626
Email: geoffcun @ bigpond.net.au**

June , 2010

ROCGLEN COAL MINE, GUNNEDAH

INITIAL MONITORING REPORT – APRIL, 2010

1 BACKGROUND

Whitehaven Coal Mining Pty Ltd [WCM] recognizes the need for ongoing monitoring of undisturbed vegetation communities as well as areas being rehabilitated at the Rocglen Coal Mine site..

As a consequence, WCM has adopted the following monitoring process for each of the control and rehabilitated site monitoring quadrats that will be established at Sunnyside.

- Monitoring will be undertaken by a qualified ecologist experienced in the flora of the Gunnedah area.
- The ecologist will establish a minimum of one permanent photopoint and an associated 100m x 100m quadrat in each vegetation community to be disturbed over the life of the mine.
- Photographs will be taken in set directions from one or more set corners of the permanent quadrat at the commencement of monitoring and thereafter at annual intervals for five years and then at two year intervals until the mine monitoring program ceases.
- Each permanent quadrat will be monitored at the commencement of the monitoring program and thereafter at annual intervals for the next five years and then every two years until the mine monitoring program ceases.
- Measurements to be undertaken include include:
 - foliage cover along two 100m step point transects;
 - an assessment of the species composition of the ground flora in the quadrat using the modified Braun-Blanquet scale;
 - tree and shrub counts in the quadrat to quantify deaths or regeneration..

WCM will consult with the monitoring ecologist within four weeks of each Monitoring programme to establish the need for, and any recommendations for replantings, further plantings, maintenance works etc. required to ensure the success of the native vegetation establishment program. The recommended works will be undertaken in the timeframe recommended by the ecologist

Nine separate vegetation communities have been identified within the wider Sunnyside Coal Mine Study Area [GCNRC, 2007].

2 EXTENT OF REQUIRED MONITORING

2.1 The Vegetation Communities Present at Rocglen

NOTE * denotes an introduced species

The flora study for the proposed Rocglen [then known as Belmont] Coal Mine [GCNRC, 2007] identified six vegetation communities within the area associated with the mine site proper. Additional communities were identified along two possible haul road routes but these are not relevant to this Monitoring Report.

The relevant vegetation communities associated with the mine proper, **with the original community numbers as they appeared in the flora study**, are:

- **Community 1** - Narrow-leaf Ironbark - Pilliga Grey Box Community
- **Community 2** - Pilliga Grey Box - White Cypress Pine Community
- **Community 3** - Pilliga Grey Box - White Box - Yellow Box - White Cypress Pine Community
- **Community 6** - Brigalow Community
- **Community 7** - Regenerating White Cypress Pine
- **Community 8** - Cleared Lands - Used for Grazing and / or Cultivation

Descriptions of these communities are presented in the following sections.

2.1.1 - Community 1 - Narrow-leaf Ironbark - Pilliga Grey Box Community

The main tree species within this community are *Eucalyptus crebra* [Narrow-leaf Ironbark] and *Eucalyptus pilligaensis* [Pilliga Grey Box] and *Callitris glaucophylla* [White Cypress Pine] spaced from 1 to 10 metres apart. Other tree species occurring in this community include *Alectryon oleifolius* [Rosewood], *Geijera parviflora* [Wilga], *Callitris endlicheri* [Black Cypress Pine] and *Pittosporum phillyraeoides* [Butterbush].

Parts of this area have been used as gravel pits and are regenerating.

Shrubs are spaced from <1 to 2 metres apart or may be scattered. Species include *Myoporum montanum* [Western Boobialla], *Acacia decora* [Western Golden Wattle], *Dodonaea viscosa* subsp. *spatulata* [Broad-leaf Hopbush], *Beyeria viscosa* [Sticky Wallaby-bush], *Pimelea microcephala* [Shrubby Riceflower], *Cassinia laevis* [Cough Bush] and *Acacia dealbata* [Silver Wattle].

The main ground cover species include *Aristida jerichoensis* var. *subspinulifera* [No. 9 Wiregrass], *Cymbopogon refractus* [Barbed-wire Grass], *Dichondra repens* [Kidney Weed], *Austrostipa scabra* [Rough Speargrass], *Digitaria brownii* [Cotton Panic], *Solanum ferocissimum* [Spiny Potato-bush], *Vittadinia muelleri* [Fuzzweed] and *Opuntia* sp. [Prickly Pear].

2.1.2 – Community 2 - Pilliga Grey Box - White Cypress Pine Community

Trees are spaced from <2 to 15 metres apart. The main tree species are *Eucalyptus pilligaensis* [Pilliga Grey Box] and *Callitris glaucophylla* [White Cypress Pine]. Other tree species include *Eucalyptus crebra* [Narrow-leaf Ironbark], *Eucalyptus albens* [White Box], *Alectryon oleifolius* [Rosewood], *Geijera parviflora* [Wilga], *Capparis mitchellii* [Wild Orange], *Allocasuarina luehmannii* [Bull Oak] and occasional *Casuarina cristata* [Belah], *Eucalyptus populnea* subsp. *bimbil* [Bimble Box] [including seedlings] and *Eucalyptus melliodora* [Yellow Box].

Shrubs are spaced from <1 to 15 metres apart or may be widely scattered. The main species is *Maireana microphylla* [Eastern Cottonbush], *Parsonia eucalyptophylla* [Gargaloo], *Eremophila mitchellii* [Budda], *Acacia oswaldii* [Miljee], *Myoporum montanum* [Western Boobialla] and *Notelaea microcarpa* var. *microcarpa* [Native Olive].

Occasional dead plants of *Lycium ferocissimum** [African Boxthorn] were noted in roadside locations.

The main ground cover species are *Aristida ramosa* [Purple Wiregrass], *Aristida jerichoensis* var. *subspinulifera* [No. 9 Wiregrass], *Austrostipa verticillata* [Slender Bamboo Grass], *Einadia nutans* [Climbing Saltbush], *Enteropogon acicularis* [Curly Windmill Grass], *Sclerolaena birchii* [Galvanised Burr], *Sida rhombifolia** [Paddy's Lucerne] and *Austrostipa scabra* [Rough Speargrass]

2.1.3 – Community 3 - Pilliga Grey Box - White Box - Yellow Box - White Cypress Pine Community

This community is largely restricted to roadside remnants and occurrences along the main drainage line through the centre of the study area.

Trees are spaced from 2 to 30 metres apart. The main tree species are *Eucalyptus pilligaensis* [Pilliga Grey Box], *Eucalyptus albens* [White Box], *Callitris glaucophylla* [White Cypress Pine], *Eucalyptus melliodora* [Yellow Box] and *Allocasuarina luehmannii* [Bull Oak].

Other tree species include *Eucalyptus crebra* [Narrow-leaf Ironbark], *Geijera parviflora* [Wilga], *Alectryon oleifolius* [Rosewood], *Pittosporum angustifolium* [Butterbush] and *Eucalyptus melanophloia* [Silver-leaf Ironbark]. *Eucalyptus dealbata* [Tumbledown Gum] occurs within this community in some midslope areas.

Shrub cover varies from relatively dense [<1 to 10 metre spacings] to scattered. The main species is *Maireana microphylla* [Eastern Cottonbush] with some *Acacia oswaldii* [Miljee], *Acacia dealbata* [Silver Wattle] and *Dodonaea viscosa* subsp. *spatulata* [Broad-leaf Hopbush].

Ground cover species include *Aristida ramosa* [Purple Wiregrass], *Aristida jerichoensis* var. *subspinulifera* [No. 9 Wiregrass], *Austrostipa scabra* [Rough

Speargrass], *Austrostipa verticillata* [Slender Bamboo Grass], *Carthamus lanatus** [Saffron Thistle], *Chloris truncata* [Windmill Grass], *Digitaria brownii* [Cotton Panic], *Einadia nutans* [Climbing Saltbush], *Enteropogon acicularis* [Curly Windmill Grass], *Eragrostis molybdea* [Granite Lovegrass], *Sclerolaena birchii* [Galvanised Burr] and *Vittadinia* sp. [Fuzzweed].

2.1.4 – Community 6 - Brigalow Community

The Brigalow community is represented by a single isolated remnant of about 55 stems of *Acacia harpophylla* [Brigalow]. Some trees may be multi-stemmed so the number of individual trees present is undoubtedly somewhat less

The remnant is located in the centre of a cultivation paddock that regularly produces crops.

Maireana microphylla [Eastern Cottonbush] shrubs are spaced from <1 to 3m apart and some *Lycium ferocissimum** [African Boxthorn] plants are present.

The community was heavily grazed and the only recognisable ground cover species was *Austrostipa verticillata* [Slender Bamboo Grass].

2.1.5 – Community 7 - Regenerating White Cypress Pine Community

Trees are spaced from <1 to 20 metres apart. *Callitris glaucophylla* [White Cypress Pine] is really the only tree species of note within these areas. The height of the saplings varies considerably from less than 1 metre to 7- 8 metres or so.

Few shrubs occur within this community. Those recorded were *Indigofera australis* [Hill Indigo], and *Pimelea microcephala* [Shrubby Riceflower].

The main ground cover species include *Aristida ramosa* [Purple Wiregrass], *Aristida jerichoensis* var. *subspinulifera* [No. 9 Wiregrass], *Austrostipa scabra* [Rough Speargrass], *Bothriochloa macra* [Red Grass], *Carthamus lanatus** [Saffron Thistle], *Chamaesyce drummondii* [Caustic Weed], *Cheilanthes sieberi* [Rock Fern], *Enneapogon gracilis* [Slender Bottlewashers], *Eragrostis* sp. [Lovegrass], *Glycine* sp. [Glycine], *Opuntia* sp. [Prickly Pear], *Petrorhagia nanteuillii** [Proliferous Pink], *Rostellularia adscendens* [Pink Tongues], *Sida corrugata* [Corrugated Sida], *Desmodium brachypodium* [Large Tick-trefoil], *Sida cunninghamii* [Ridge Sida], *Solanum esuriale* [Quena], *Sclerolaena birchii* [Galvanised Burr], *Vittadinia* sp. [Fuzzweed] and *Wahlenbergia* sp [Bluebell].

2.1.6 – Community 8 - Cleared Lands - Used for Grazing and / or Cultivation

This community is basically treeless although some shade trees remain in most paddocks.

Species present as scattered trees within the paddocks or around boundaries include *Eucalyptus pilligaensis* [Pilliga Grey Box], *Brachychiton populneus* [Kurrajong], *Geijera parviflora* [Wilga], *Callitris glaucophylla* [White Cypress Pine], *Allocasuarina luehmannii* [Bull Oak], *Eucalyptus melliodora* [Yellow Box],

Alectryon oleifolius [Rosewood] and occasional *Eucalyptus crebra* [Narrow-leaf Ironbark].

Maireana microphylla [Eastern Cottonbush] is basically the only shrub present and its spacing varies from 5 to 30 metre through a scattered distribution to complete absence on recently cultivated land.

The main ground cover species are *Aristida ramosa* [Purple Wiregrass] *Aristida jerichoensis* var. *subspinulifera* [No. 9 Wiregrass], *Austrostipa scabra* [Rough Speargrass], *Bothriochloa macra* [Red Grass], *Carthamus lanatus** [Saffron Thistle], *Sclerolaena birchii* [Galvanised Burr], *Austrostipa verticillata* [Slender Bamboo Grass], *Centaureum tenuiflorum** [Centaury], *Chloris truncata* [Windmill Grass] and *Chondrilla juncea** [Skeleton Weed].

A complete listing of the species recorded in this community is contained in **Table 2**.

Note: In **Table 1**, data for field survey quadrats 31-38 [inclusive] have been omitted from the Table as they were located along an alternative transport route that is now not relevant to the proposal. The remaining quadrats retain their original numbers.

2.2 Vegetation Communities to be Monitored

The Monitoring program outlined in **Section 1** requires permanent photopoints and quadrats to be established and other forms of regular monitoring to be undertaken within vegetation communities that will be affected by the mine.

Of the six communities described in the flora study that was prepared prior to the mine establishment [GCNRC, 2007] only two vegetation communities will be affected. These are Communities 2 and 8. The remaining communities will not be affected. Consequently, Community 2 is the only native vegetation community that requires permanent monitoring facilities to be established at this time.

In addition to the monitoring quadrat in Community 2, a single quadrat was established within Community 8 to monitor ground cover and other vegetation changes in this open cleared area. Additional quadrats will be established on the mined area once rehabilitation is complete.

3 OVERVIEW OF MONITORING

3.1 Initial Monitoring Plots [2010]

Monitoring at Rocglen Coal Mine commenced on 20th April, 2010

Details of these monitoring [permanent quadrat] sites are contained in **Table 1**.

Table 1**Permanent Quadrat Locations**

SITE NO.	POINT DESCRIPTION	EASTING	NORTHING	COMMUNITY / LAND DESCRIPTION
I	north-west corner peg	238377E	6594961N	Community 2
2	north-west corner peg	238300E	6595324N	Community 8

4 MONITORING OUTCOMES**4.1 PERMANENT QUADRATS****4.1.1 Tree and Shrub Counts**

Tree and shrub counts on each quadrat were carried out when the permanent quadrats were established on 18th April, 2010. The data are contained in **Tables 2 and 3** along with any relevant comments about tree and shrub health.

Table 2**Tree and Shrub Count for Permanent Quadrat 1**

SPECIES	MATURE TREES / SHRUBS	SAPLINGS	SEEDLINGS	TOTAL / COMMENT
<i>Eremophila mitchellii</i> [Budda]	100	0	7	107
<i>Geijera parviflora</i> [Wilga]	6	53	0	59
<i>Hakea leucoptera</i> [Needlewood]	1	0	21 [suckers]	22
<i>Senna artemisioides</i> subsp. <i>filifolia</i> [Punty Bush]	2	0	0	2
<i>Eucalyptus pilligaensis</i> [Pilliga Grey Box]	3	0	7	10
<i>Pittosporum angustifoliaum</i> [Butterbush]	1	0	0	1
<i>Maireana microphylla</i> [Eastern Cottonbush]	72	0	0	72
<i>Acacia oswaldii</i> [Miljee]	2	0	1	3
<i>Casuarina luehmanniana</i> [Bull Oak]	2	0	3	5
<i>Alectryon oleifolius</i> [Rosewood]	2	0	3	5

Table 2 [cont]

Tree and Shrub Count for Permanent Quadrat 1

SPECIES	MATURE TREES / SHRUBS	SAPLINGS	SEEDLINGS	TOTAL / COMMENT
<i>Notelaea microcarpa</i> subsp. <i>microcarpa</i> [Native Olive]	1	0	1	2
<i>Capparis lasiantha</i> [Nepine]	2	0	0	2
<i>Lycium ferocissimum</i> * [African Boxthorn]	3	0	0	3
<i>Pimelea microcephala</i> [Shrubby Rice-flower]	0	0	1	1

Table 2

Tree and Shrub Count for Permanent Quadrat 2

SPECIES	MATURE TREES / SHRUBS	SAPLINGS	SEEDLINGS	TOTAL / COMMENT
<i>Eremophila mitchellii</i> [Budda]	11	0	0	11
<i>Eucalyptus pilligaensis</i> [Pilliga Grey Box]	0	0	1	1
<i>Lycium ferocissimum</i> * [African Boxthorn]	1	0	0	1
<i>Maireana microphylla</i> [Eastern Cottonbush]	7	0	0	7

4.1.2 Step-point Transect [Vegetative Cover] Data

Two 100-point step-point transects were undertaken on each permanent Quadrat to obtain a measure of plant cover and the species composition of the ground cover. The observations recorded for each Quadrat are shown in **Tables 3 and 4**.

It should be noted that in these Tables the **perennial** component of the vegetation cover includes only definitely perennial species while the **annual** cover class includes both annual and biennial species.

4.1.2.1. **Quadrat 1**

Table 3

Step-point Data for the groundcover on Permanent Quadrat 1

SPECIES	% COVER TRANSECT 1	% COVER TRANSECT 2	MEAN % COVER
<i>Aristida ramosa</i> [Purple Wiregrass]	2.0%	0%	1.0%
<i>Austrodanthonia</i> sp. [Wallaby Grass]	18.0%	3.0%	10.5%
<i>Austrostipa scabra</i> [Rough Speargrass]	4.0%	4.0%	4.0%
<i>Austrostipa verticillata</i> [Slender Bamboo Grass]	0%	1.0%	0.5%
<i>Bothriochloa macra</i> [Red Grass]	3.0%	1.0%	2.0%
<i>Chloris truncata</i> [Windmill Grass]	0%	1.0%	0.5%
<i>Enteropogon acicularis</i> [Curly Windmill Grass]	51.0%	61.0%	56.0%
<i>Eragrostis alveiformis</i> [Granite Lovegrass]	2.0%	5.0%	3.5%
<i>Eragrostis lacunaria</i> [Purple Lovegrass]	1.0%	1.0%	1.0%
<i>Paspalidium constrictum</i> [Box Grass]	2.0%	6.0%	4.0%
Perennial Grass	2.0%	1.0%	1.5%
<i>Portulaca oleracea</i> [Munyeroo]	0%	1.0%	0.5%
<i>Sclerolaena birchii</i> [Galvanised Burr]	2.0%	2.0%	2.0%
<i>Sclerolaena muricata</i> [Black Roly-poly]	1.0%	0%	0.5%
<i>Sporobolus caroli</i> [Fairy Grass]	4.0%	0%	2.0%
<i>Vittadinia</i> sp. [Fuzzweed]	1.0%	0%	0.5%
<i>Wahlenbergia communis</i> [Tufted Bluebell]	0%	1.0%	0.5%
BARE	1.0%	8.0%	4.5%
LITTER	6.0%	4.0%	5.0%
TOTAL COVER	99.0%	92.0%	95.5%
TOTAL LIVING VEGETATION	93.0%	88.0%	90.5%
TOTAL ANNUAL COVER	0%	1.0%	0.5%
TOTAL PERENNIAL VEGETATION COVER	93.0%	87.0%	90.0%

Additional Species Observed Within the Quadrat but not Recorded in Step Points

*Alternanthera pungens** [Khaki Weed]
*Carthamus lanatus** [Saffron Thistle]
Chamaesyce drummondii [Caustic Weed]
Convolvulus erubescens [Australian Bindweed]
Dichanthium sericeum [Queensland Bluegrass]
Evolvulus alsinoides [Blue Bindweed]
Oxalis sp.* [Wood Sorrel]
Sida cunninghamii [Hill Sida]

4.1.2.2 Quadrat 2

Table 4

Step-point Data for the groundcover on **Permanent Quadrat 2**

SPECIES	% COVER TRANSECT 1	% COVER TRANSECT 2	MEAN % COVER
<i>Alternanthera</i> sp. [Joyweed]	0%	4.0%	2.0%
<i>Aristida ramosa</i> [Purple Wiregrass]	1.0%	1.0%	1.0%
<i>Austrodanthonia</i> sp. [Wallaby Grass]	0%	1.0%	0.5%
<i>Austrostipa scabra</i> . [Speargrass]	0%	6.0%	3.0%
<i>Bothriochloa macra</i> [Red Grass]	19.0%	3.0%	11.0%
<i>Chloris truncata</i> [Windmill Grass]	7.0%	8.0%	7.5%
<i>Cymbopogon refractus</i> [Barbed-wire Grass]	4.0%	0%	2.0%
<i>Cynodon dactylon</i> * [Couch Grass]	1.0%	8.0%	4.5%
<i>Dactyloctenium radulans</i> [Button Grass]	3.0%	4.0%	3.5%
<i>Dichanthium sericium</i> [Queensland Bluegrass]	1.0%	0%	0.5%
<i>Dichondra repens</i> [Kidney Weed]	1.0%	0%	0.5%
<i>Enteropogon acicularis</i> [Curly Windmill Grass]	1.0%	17.0%	9.0%
<i>Eragrostis alveiformis</i> [Granite Lovegrass]	13.0%	6.0%	9.5%
<i>Eragrostis cilianensis</i> * [Stinking Lovegrass]	5.0%	0%	2.5%
<i>Eragrostis microcarpa</i> [Dainty Lovegrass]	14.0%	13.0%	13.5%
<i>Eriochloa pseudoacrotricha</i> [Cupgrass]	12.0%	2.0%	7.0%
<i>Oxalis</i> sp. [Wood Sorrel]	1.0%	0%	0.5%
<i>Paspalidium constrictum</i> . [Box Grass]	4.0%	1.0%	2.5%
<i>Sclerolaena birchii</i> [Galvanised Burr]	3.0%	7.0%	5.0%
<i>Sida</i> sp. [Sida]	1.0%	0%	0.5%
<i>Sida rhombifolia</i> * [Paddy's Lucerne]	5.0%	7.0%	6.0%
<i>Sporobolus caroli</i> [Fairy Grass]	1.0%	4.0%	2.5%
<i>Sporobolus elongatus</i> [Western Rat'stail Grass]	0%	1.0%	0.5%
<i>Tragus australianus</i> [Small-burr Grass]	1.0%	0%	0.5%
<i>Urochloa</i> sp.	1.0%	1.0%	1.0%
LITTER	1.0%	4.0%	2.5%
BARE	0%	2.0%	1.0%
TOTAL COVER	100.0%	98.0%	99.0%
TOTAL LIVING COVER	99.0%	94.0%	96.5%
PERENNIAL LIVING COVER	89.0.0%	89.0%	89.0%
ANNUAL LIVING COVER	10.0%	5.0%	7.5%

Additional Species Observed Within the Quadrat but not Recorded in Step Points

Austrostipa verticillata [Slender Bamboo Grass]

Chloris ventricosa [Tall Chloris]

Portulaca oleracea [Munyeroo]

Sclerolaena muricata [Black Roly-poly]

Sida sp.

4.1.3 Species Abundance Data

The Rocglen Monitoring procedure adopted by WCM requires that the species recorded on each of the permanent quadrats will be given a modified Braun-Blanquet [Poore, 1995] cover abundance scale rating at each monitoring event. This scale is summarised in **Table 5**.

The species recorded on the different quadrats in the step-pointing transects are not the only species present. There are other species that were present in low numbers [i.e. < 0.5% cover] that were recorded as being present on the different quadrats.

These species were recorded during the step-point transects as plants not actually 'hit' but nevertheless present.

Tables 6 and **7** provide this data based on the Step-point transects and these additional observations on each of the Permanent Quadrats.

Table 5

Modified Braun-Blanquet Cover Abundance Scale [Poore, 1955]

Aerial Vegetative Cover	Cover Class
95 -100°/a	6
75 - 95°/a	5
50 - 75%	4
25 - 50%	3
5 - 25%	2
1-5%	1
< 1%	+
Rare	r

Table 6Species Lists and modified Braun-Blanquet Scores for **Permanent Quadrat 1**

SPECIES	modified BRAUN-BLANQUET SCORE
<i>Alternanthera pungens</i> * [Khaki Weed]	r
<i>Aristida ramosa</i> [Purple Wiregrass]	1
<i>Austrodanthonia</i> sp. [Wallaby Grass]	2
<i>Austrostipa scabra</i> [Rough Speargrass]	1
<i>Austrostipa verticillata</i> [Slender Bamboo Grass]	+
<i>Bothriochloa macra</i> [Red Grass]	1
<i>Carthamus lanatus</i> * [Saffron Thistle]	r
<i>Chamaesyce drummondii</i> [Caustic Weed]	r
<i>Chloris truncata</i> [Windmill Grass]	+
<i>Convolvulus erubescens</i> [Australian Bindweed]	r
<i>Dichanthium sericeum</i> [Queensland Bluegrass]	r
<i>Enteropogon acicularis</i> [Curly Windmill Grass]	4
<i>Eragrostis alveiformis</i> [Granite Lovegrass]	1
<i>Eragrostis lacunaria</i> [Purple Lovegrass]	1
<i>Evolvulus alsinoides</i> [Blue Bindweed]	r
<i>Oxalis</i> sp.* [Wood Sorrel]	r
<i>Paspalidium constrictum</i> [Box Grass]	1
Perennial Grass	1
<i>Portulaca oleracea</i> [Munyeroo]	+
<i>Sclerolaena birchii</i> [Galvanised Burr]	1
<i>Sclerolaena muricata</i> [Black Roly-poly]	+
<i>Sida cunninghamii</i> [Hill Sida]	r
<i>Sporobolus caroli</i> [Fairy Grass]	1
<i>Vittadinia</i> sp. [Fuzzweed]	+
<i>Wahlenbergia communis</i> [Tufted Bluebell]	+

Table 7Species Lists and modified Braun-Blanquet Scores for **Permanent Quadrat 2**

SPECIES	modified BRAUN-BLANQUET SCORE
<i>Alternanthera</i> sp. [Joyweed]	1
<i>Aristida ramosa</i> [Purple Wiregrass]	1
<i>Austrodanthonia</i> sp. [Wallaby Grass]	+
<i>Austrostipa scabra</i> . [Speargrass]	1
<i>Austrostipa verticillata</i> [Slender Bamboo Grass]	r
<i>Bothriochloa macra</i> [Red Grass]	2
<i>Chloris truncata</i> [Windmill Grass]	2
<i>Chloris ventricosa</i> [Tall Chloris]	r
<i>Cymbopogon refractus</i> [Barbed-wire Grass]	1
<i>Cynodon dactylon</i> * [Couch Grass]	1
<i>Dactyloctenium radulans</i> [Button Grass]	1
<i>Dichanthium sericium</i> [Queensland Bluegrass]	+
<i>Dichondra repens</i> [Kidney Weed]	+
<i>Enteropogon acicularis</i> [Curly Windmill Grass]	2
<i>Eragrostis alveiformis</i> [Granite Lovegrass]	2
<i>Eragrostis cilianensis</i> * [Stinking Lovegrass]	1
<i>Eragrostis microcarpa</i> [Dainty Lovegrass]	2
<i>Eriochloa pseudoacrotricha</i> [Cupgrass]	2
<i>Oxalis</i> sp. [Wood Sorrel]	+
<i>Paspalidium constrictum</i> . [Box Grass]	1
<i>Portulaca oleracea</i> [Munyeroo]	r
<i>Sclerolaena birchii</i> [Galvanised Burr]	2
<i>Sclerolaena muricata</i> [Black Roly-poly]	r
<i>Sida rhombifolia</i> * [Paddy's Lucerne]	2
<i>Sida</i> sp.	r
<i>Sida</i> sp. [Sida]	+
<i>Sporobolus caroli</i> [Fairy Grass]	1
<i>Sporobolus elongatus</i> [Western Rat'stail Grass]	+
<i>Tragus australianus</i> [Small-burr Grass]	+
<i>Urochloa</i> sp.	1

4.2 PHOTOPOINTS

Photopoints were established at each of the two permanent monitoring plots in April, 2010. The aim is to visually record changes in the overall ground cover and numbers of trees and shrubs during the life of the monitoring program.

Views from the two photopoints are contained in **Appendix 1**.

5 COMMENTS ON MONITORING

5.1 Rainfall Since January 2009

Table 8 shows the rainfall records for Whitehaven since April, 2009 [monitoring commenced April, 2010]

Table 8 – Rocglen Rainfall

MONTH	2009	2010
January	*	53.4mm
February	*	51.4mm
March	*	15.6mm
April	29.6mm	23.6mm
May	23.8mm	*
June	30.2mm	*
July	0.2mm	*
August	1.6mm	*
September	36.8mm	*
October	2.4mm	*
November	17.8mm	*
December	107.6mm	*

5.2 Development of Vegetation Cover

5.2.1 Changes on Monitoring Quadrat 1

Table 9 shows the initial levels of vegetation cover within Quadrat 1 at the time of establishment in April 2010.

Any changes in vegetative cover that occur within the quadrat in the coming year will be reported in the 2011 Monitoring Report.

Table 9

Note – ND indicates no data

Cover Classification	Percentage Cover at Observation		Change [in absolute terms]
	April, 2010		
Total Living Vegetation Cover	90.5%	ND	ND
Total Annual Cover	0.5%	ND	ND
Total Perennial Cover	90.0%	ND	ND
Litter Cover	5.0%	ND	ND
Bare Surface	4.5%	ND	ND

5.2.2 Changes on Monitoring Quadrat 2

Table 10 shows the initial levels of vegetation cover within Quadrat 2 at the time of establishment in April 2010.

Any changes in vegetative cover that occur within the quadrat in the coming year will be reported in the 2011 Monitoring Report.

Table 10

Cover Classification	Percentage Cover at Observation		Change [in absolute terms]
	April, 2010		
Total Living Vegetation Cover	96.5%	ND	ND
Total Annual Cover	7.5%	ND	ND
Total Perennial Cover	89.0%	ND	ND
Litter Cover	2.5%	ND	ND
Bare Surface	1.0%	ND	ND

5.3 Noxious Weed Control

Two noxious weeds were recorded during the monitoring. These are *Lycium ferocissimum** [African Boxthorn] and *Scleolaena birchii* [Galvanised Burr].

These weeds require control and regular monitoring to ensure that they are eradicated from the monitoring quadrats.

6 ACTIONS REQUIRED

The monitoring quadrats should both be fenced to exclude grazing domestic livestock so that adequate monitoring records can be obtained.

Signs should be erected on both quadrats indicating that they are 'NO GO' zones and all mine employees and contractors should be made aware of the presence and purpose of the quadrats.

Control of noxious weeds, and other weed species that may appear, should be undertaken.

7 REFERENCES

GCNRC [2007] – Flora Assessment. Belmont Coal Project near 'Belmont' Property via Gunnedah.. Specialist Consultant Studies Compendium. Part.2. In Environmental Assessment prepared by RW Corkery and Co Pty Limited, Orange for Whitehaven Coal Mining Pty Ltd, Gunnedah

Poore, M.E.D. [1955] - The Use of Phytosociological Methods in Ecological Investigations. J. Ecol.43: 226-269

Goff Cunningham B.Sc.Agr.[Hons]; FAIAST
Principal Ecologist,
Geoff Cunningham Natural Resource Consultants Pty Ltd
30th June, 2010

APPENDIX 1 –Photographs from Photopoints



Roclen Monitoring Quadrat 1 – April 2010 – Photo from southeast corner looking snorthwest



Sunnyside Monitoring Quadrat 2 – April 2010 – Photo from southeast corner looking northwest