

Monitoring of Rehabilitation Areas and Analogue Site

Winter 2006

**New Hope Coal-
Australia Pty Ltd**

NEW OAKLEIGH MINE



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1.0 Introduction

BTEQ have been commissioned by New Hope Coal Australia to conduct monitoring of the status of current and historic mine rehabilitation and nearby unmined analogue sites at and near New Hope's Oakleigh Colliery. The monitoring is conducted twice annually in Spring/Summer and again in Autumn/Winter. The monitoring event summarised in this report is the second monitoring conducted since the rehabilitation acceptance criteria for this site were put in place. The acceptance criteria are listed in **Appendix 1**.

The Oakleigh operation is located near Rosewood, Qld and is approximately 20 kilometres Southwest of Ipswich. The location of the mine is depicted in **Figure 1**.

2.0 Aims

The aims of the investigation were to:

- Provide a “snapshot” of the current status of the historic mine rehabilitation works at Oakleigh,
- Provide an assessment of the state of pasture growth and productivity at the “Analogue” site Lot 566 on CH31740,
- Compare progress of the rehabilitation areas in terms of meeting the agreed acceptance criteria.

FIGURE 1 Site Location

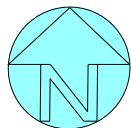
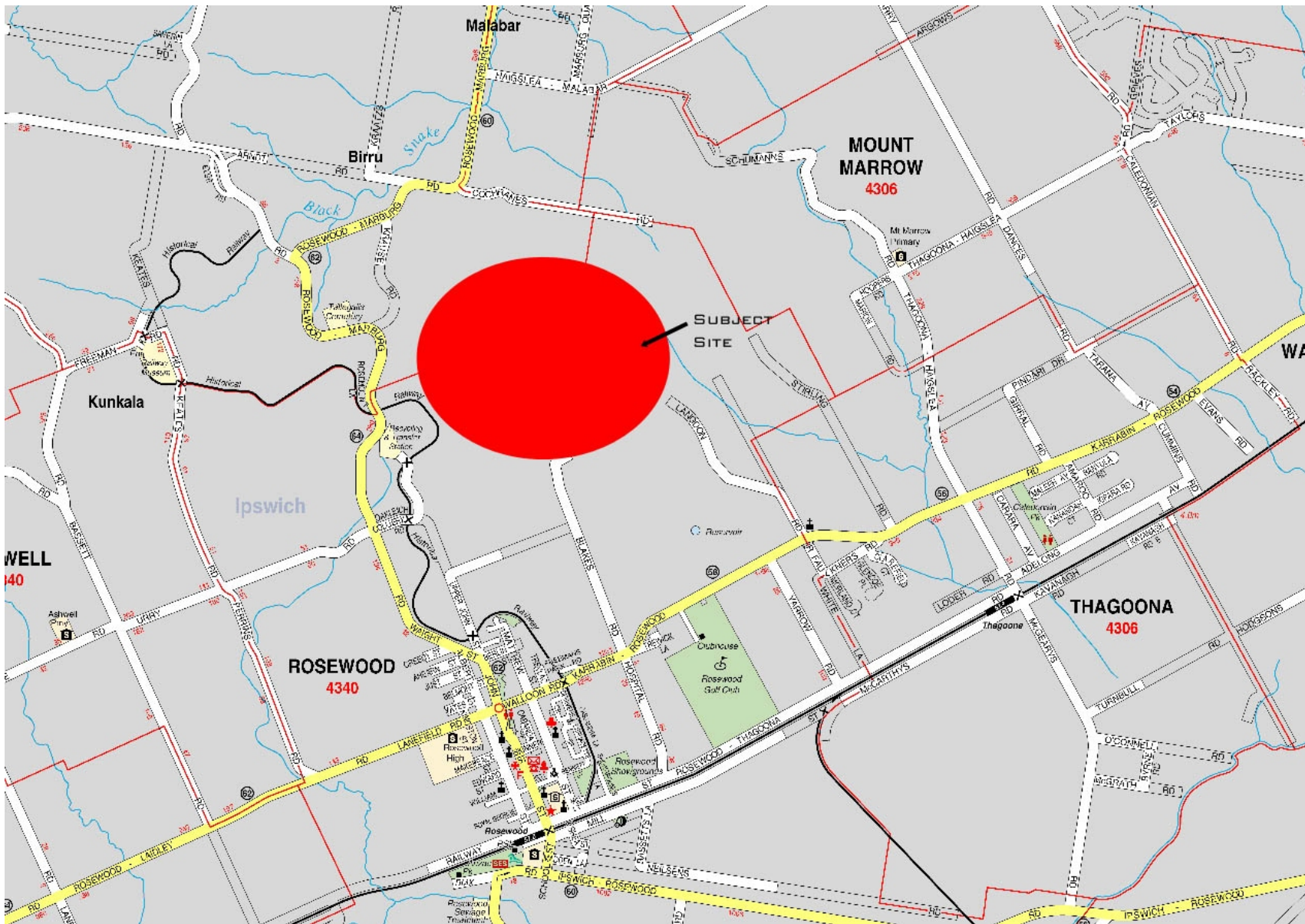


Figure 1
Site Location

Drawing Number:

Scale: 1:10000 Approx

Date: 30/8/06

Source : UBD 2002

Drawn By: JA

Checked By: KT

3.0 Methods

3.1 Field Assessment

One area of rehabilitation was sampled at the Oakleigh mine site and an analogue site chosen previously in consultation with the EPA was also assessed. The location of these sites is depicted in **Figure 2**.

A series of 20m x 20m plots were placed at random in the rehabilitation areas. Ten (10) plots were placed in the analogue site Lot 566 on CH31740 and five (5) in the areas of historic rehabilitation at Oakleigh.

At each 20m x 20m plot the following measurements and information were recorded:

- **Plot location** – AMG eastings and northings measured with hand held GPS
- **Site orientation** – measured in degrees with hand held compass and verified with GPS (Datum used was WGS 84)
- **Slope** – measured in degrees with hand held clinometer
- **Photo** – a reference photo was taken of each plot from the intersection of the tapes used to measure the plot boundaries (**see Plates 1 – 4 for examples**)
- **Foliage Projective Cover (FPC)** – understorey FPC was measured at 0.5 metre intervals along a transect within the plot and vegetation was classified as either Live, Dead or, if no vegetation was present, Bare. The 40 FPC records taken at each site were then converted to a percentage figure to allow easy analysis and comparison with other sites. Only understorey FPC was recorded at each transect as the rehabilitation areas are largely devoid of shrubs and trees (**see Plates 1 - 4**).
- **Species list** – all flora species encountered were recorded. Most species were able to be identified in the field however any species not able to be identified on site were collected for later identification. A cumulative species list for the sites is included as **Appendix 2**.
- **Standing Dry Matter** – Standing Dry Matter was calculated using a comparative photo reference standard method (Cambell and Hacker, 2002)

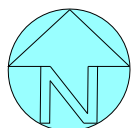


Figure 2

Rehabilitation Site Locations

Drawing Number:
Scale: As Above
Date:30/08/06
Source: New Hope Coal
Drawn By:JA
Checked By:KT



Plate 1 – Plot 3 Oakleigh Analogue (Lot 566 on CH31740) 28/7/06



Plate 2 – Plot 9 Oakleigh Analogue (Lot 566 on CH31740) 28/7/06



Plate 3 – Plot 1 Oakleigh Mine site (Near Normanton Pit) 25/8/06

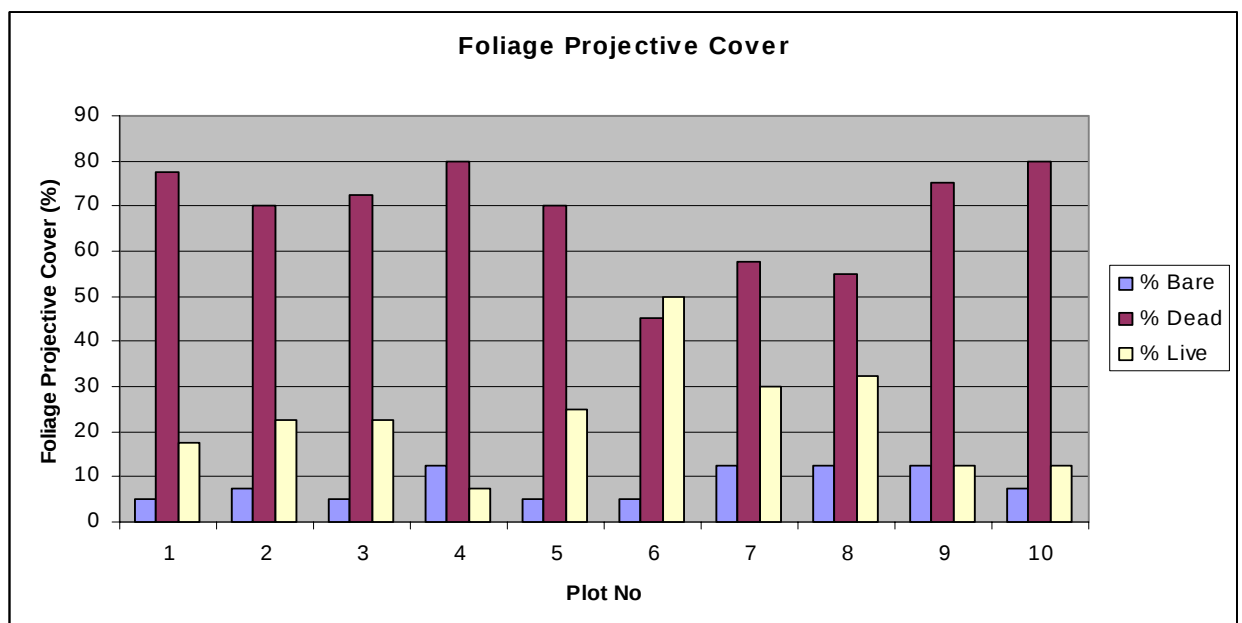
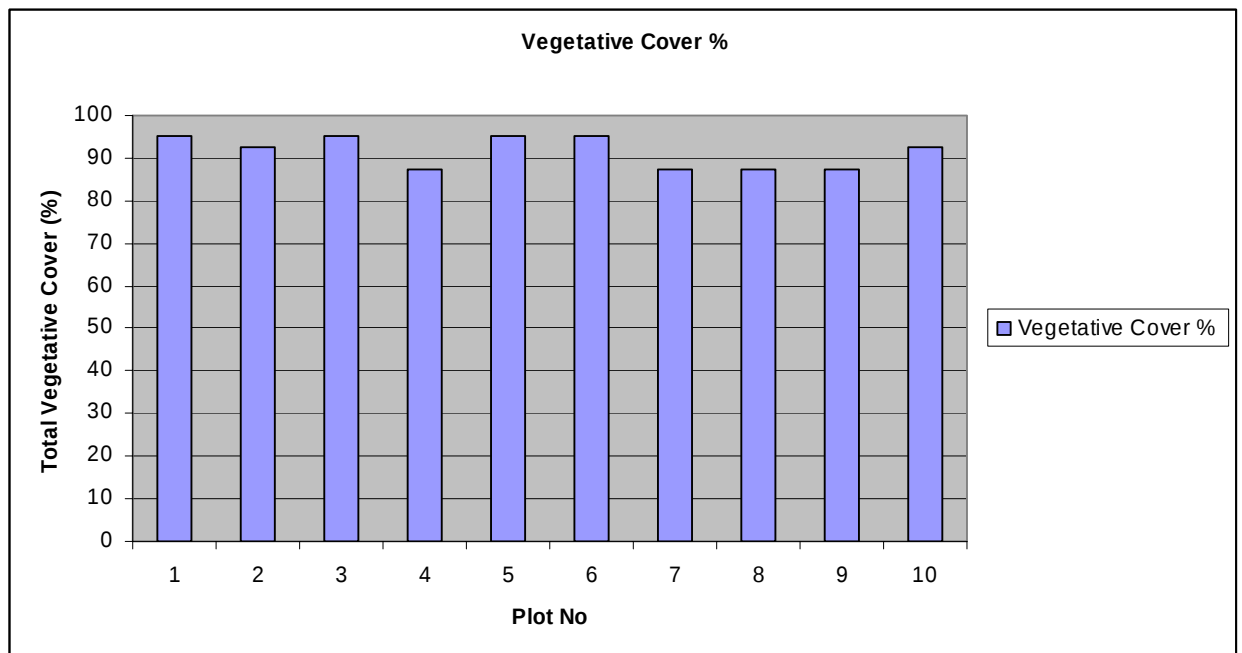


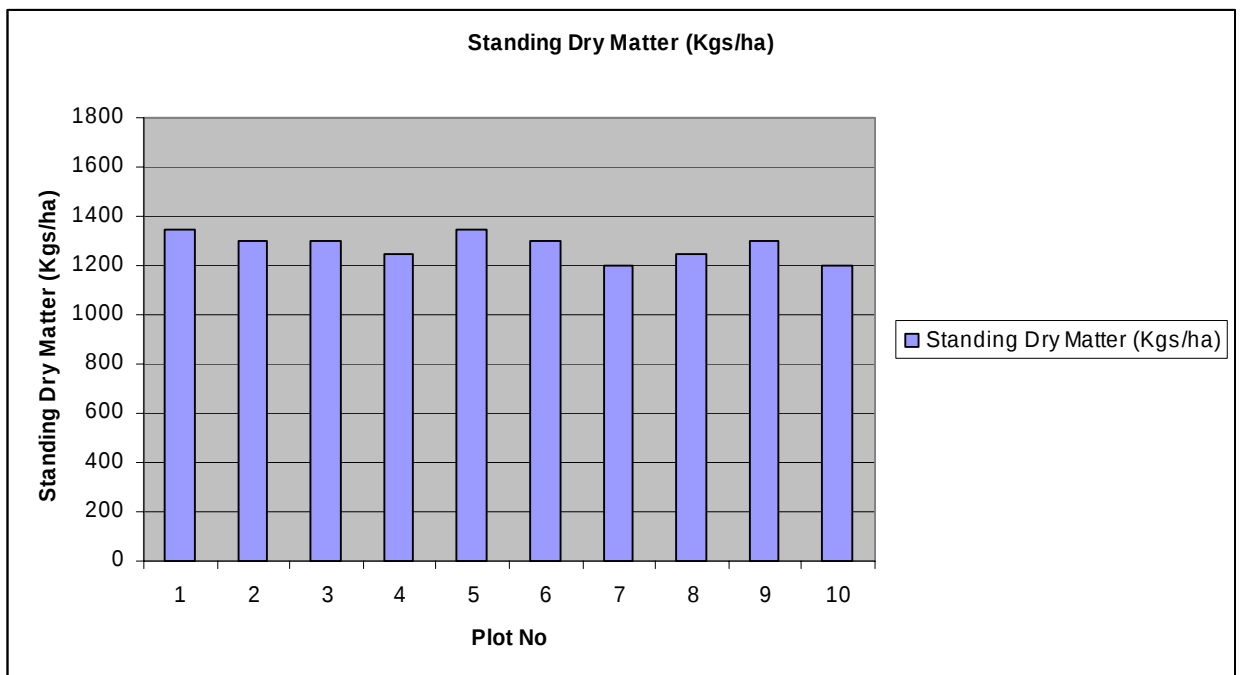
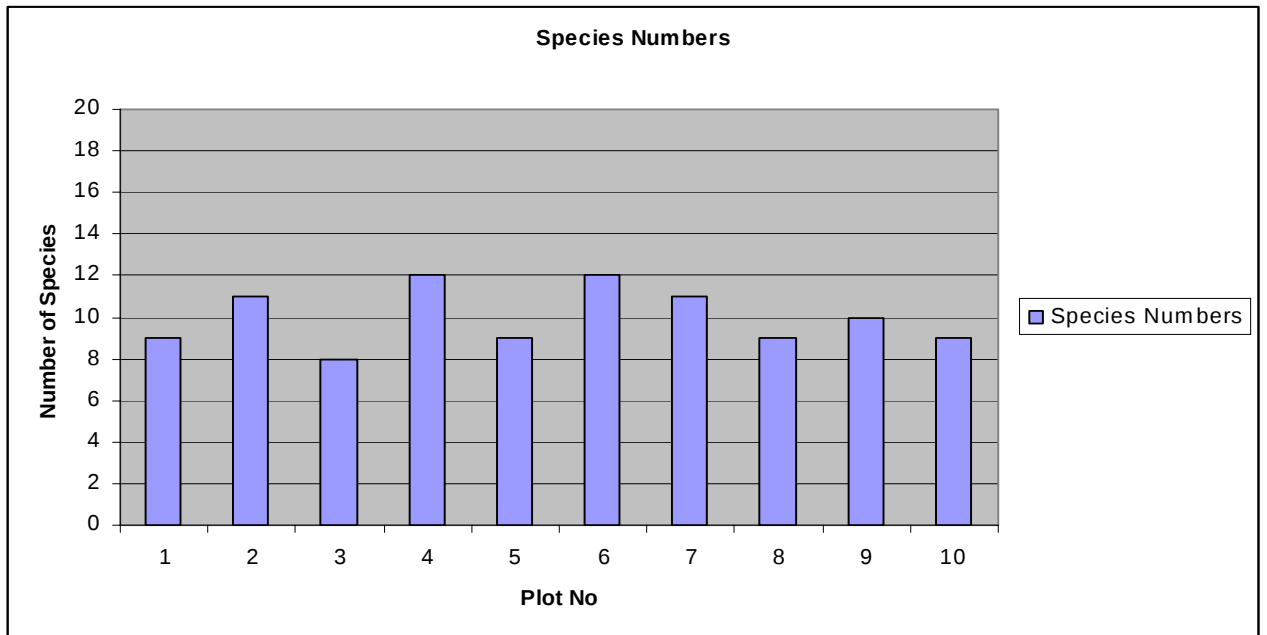
Plate 4 – Plot 4 Oakleigh Mine site (Near Normanton Pit) 25/8/06

4.0 Results

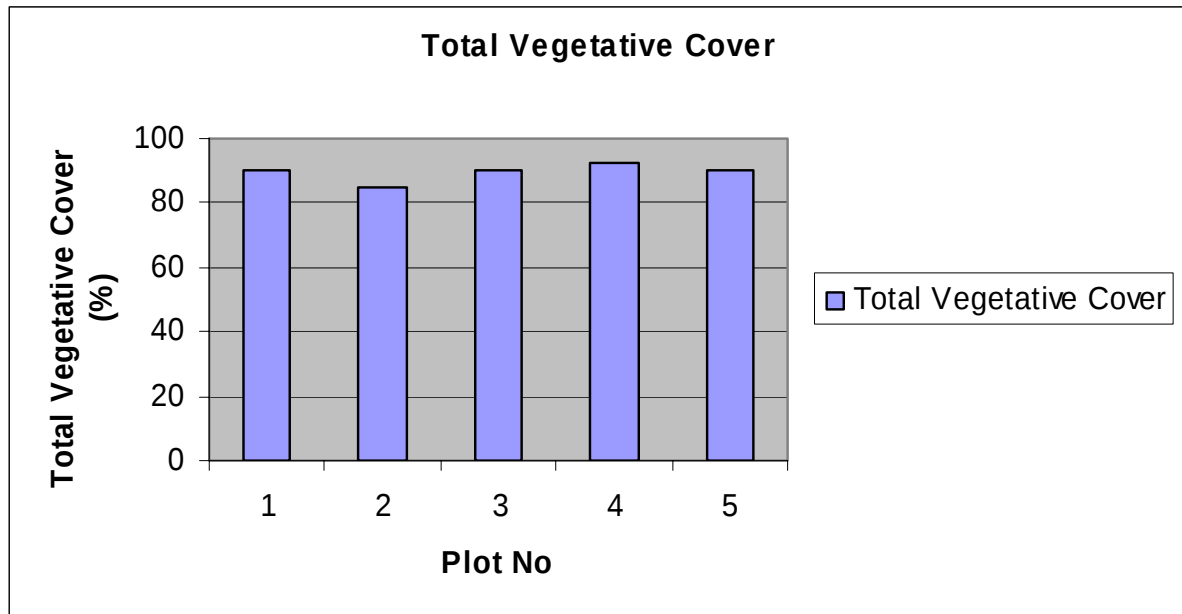
The results of the investigation are summarised in the following series of graphs. Raw data is included as **Appendix 3**.

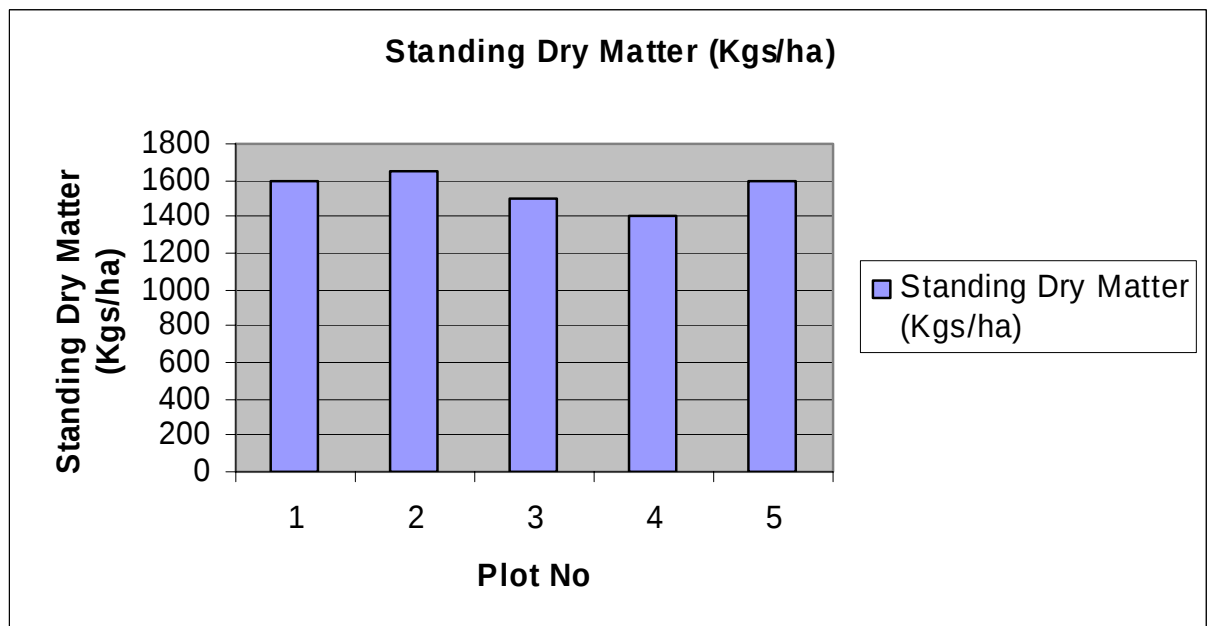
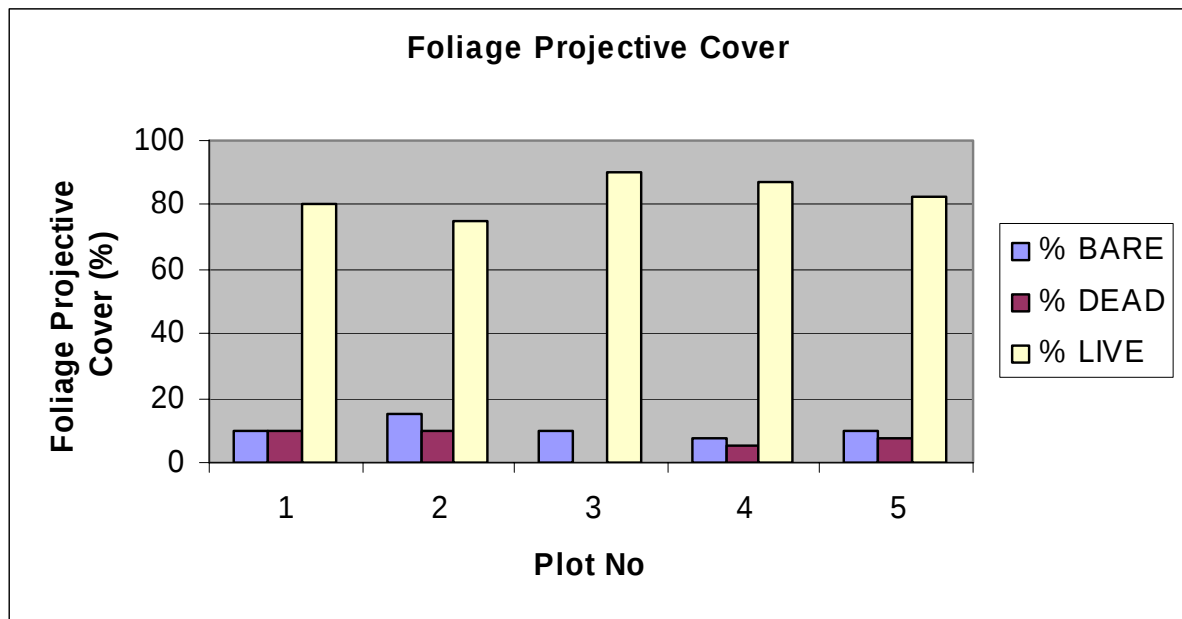
4.1 Analogue Site Results





4.2 Oakleigh Mine Site Results





5.0 Comparison of Results

The results indicate that the progress of the rehabilitation in comparison with the analogue site is within the agreed acceptance criteria.

Average total vegetative cover (FPC) was identical at the analogue site and at the mine site (89.5%) well above the 70% required in Acceptance Criteria 1.

Species numbers were on average slightly lower on the mine rehabilitation site than at the analogue site (9.4 species per plot vs 10.3 species). This well within the +/- 20% range outlined in Acceptance Criteria 3

Standing Dry Matter was generally higher at the rehabilitation site than on the analogue site (1550 kgs/ha vs 1350 kgs/ha). This meets the requirement of Acceptance Criteria 2

Comparison of the data used as input data for the Revised Universal Soil Loss Equation (RUSLE) showed that input data for the two areas was identical (Brough et. al 2004). This is a reflection of the two sites close proximity to one another and similarity of landform, vegetative cover, soil type and land use. Erosion rates for the two sites would be shown to be similar if not identical with only variables such as Slope length and intensity of landuse having an impact on the RUSLE's results.

Only five sites in the vicinity of the Normanton pit were sampled during this sampling event. Other sites sampled previously at Oakleigh have more of a relationship with native ecosystem rehabilitation outcomes and as such were not deemed appropriate for sampling in this and future monitoring events

6.0 Discussion

Generally the results gained in this assessment suggest that the historic rehabilitation which has been undertaken at the site has produced a “grazing outcome” standard pasture which compares favourably with the current state of the analogue site.

Variation in grazing pressure is an uncontrolled variable at this stage. However despite these grazing pressures the rehabilitation areas in the Normanton pit area meet all acceptance criteria.

7.0 References

Brough.D., Lawrence.P., Fraser.G., Rayner. D.and Le Grand .J. (2004) *Improved inputs of Regional Scale Soil Erosion potential for Queensland*. Proceedings of the 13th International Soil Conservation Organisation Conference – Brisbane, July 2004.

Cambell. T. and Hacker. R. (2002) *Tactical Grazing Management for the Semi - Arid Woodlands*. NSW Agriculture, Sydney

Renard. K.G., Laflen, J.M., Foster.G.R.and McCool. D.K. (1994). *The Revised Universal Soil Loss Equation*. Soil Erosion Research Methods, 2nd edition, Soil and Water Conservation Society and St Lucie press, pp104-124, USA

Soiloss: A Program to Assist in the Selection of Management Practices to Reduce Erosion, by Colin J Rosewell. 2nd ed. Soil Conservation Service of NSW, Sydney, 1993.

Appendix 1.

Acceptance Criteria New Oakleigh Mine

Acceptance Criteria (Grazing Outcome)

The following acceptance criteria and associated monitoring practices are proposed for the New Oakleigh mine rehabilitation areas.

Acceptance Criteria 1

- ❖ FPC of Monitoring rehabilitation sites is at or above 70% understorey FPC

Monitoring

Biennial monitoring of randomly selected plots within mine rehabilitation areas proposed for the “grazing outcome” and the analogue site using methods described in section 3.

Acceptance Criteria 2

- ❖ Standing Dry Matter to be within +/- 10% of the analogue sites production rate over a period of 12 months

Monitoring

Biennial monitoring of randomly selected plots within mine rehabilitation areas proposed for the “grazing outcome” and the analogue site using methods described in Campbell and Hacker (2002).

Acceptance Criteria 3

- ❖ Grazing species diversity on the mine rehabilitation sites to be on average within +/- 20% of the analogue site.

Monitoring

Biennial monitoring of randomly selected plots within mine rehabilitation areas proposed for the “grazing outcome” and the analogue site using methods described in section 3.

Acceptance Criteria 4

- ❖ Erosion rates of the mine rehabilitation areas, as determined by the Revised Universal Soil Loss Equation (RUSLE) (Renard et. al. 1994), to be within +/- 10% of the rates of the analogue site.

Monitoring

Biennial monitoring of randomly selected plots within mine rehabilitation areas proposed for the “grazing outcome” and the analogue site using methods described in Renard et. al. 1994

Appendix 2.

Cumulative Species List

Analogue Sites

Pasture Species

Grasses

Species Name	Common Name
<i>Cynodon nlemfluensis</i>	African star grass
<i>Cynodon plectostachyus</i>	African star grass
<i>Dichanthium annulatum</i>	Angleton
<i>Panicum coloratu</i>	Bambatsi
<i>Cenchrus ciliaris</i>	Buffel
<i>Cynodon dactylon</i>	Couch, green
<i>Bothriochloa inculpta</i>	Creeping Bluegrass
<i>Pennisetum clandestinum</i>	Kikuyu
<i>Panicum coloratum</i> var. <i>mararikariense</i>	Makarikari
<i>Panicum maximum</i> var. <i>trichoglume</i>	Green Panic, Gatton Panic
<i>Paspalum plicatulum</i>	Plicatulum
<i>Setaria incrassata</i>	Purple Pigeon
<i>Dichanthium sericum</i>	Queensland bluegrass
<i>Chloris gayana</i>	Rhodes grass
<i>Setaria sphacelata</i>	Setaria
<i>Themeda australis</i>	Kangaroo Grass

Legumes

Species Name	Common Name
<i>Desmanthus virgatus</i>	Desmanthus
<i>Lablab purpureus</i>	Lablab

Leucaena leucocephala	Leucaena
Medicago sativa	Lucerne
Medicago truncatula	Barrel Medic
Medicago polymorpha	Common Burr Medic
Medicago scutellata	Snail Medic
Macroptilium atropurpureum	Siratro
Vicia villosa	Woolly pod vetch

Other Species

Species Name	Common Name
Sida cunninghamii	Paddys Lucerne
Desmodium varians	
Desmodium brachypodium	Slender Treefoil
Cirsium vulgare	Scotch Thistle
Sedgesbeckia orientalis	Sedgesbeckia
Lantana camara	Lantana
Lantana montevidensis	Lantana

Rehabilitation Sites

Pasture Species

Grasses

Species Name	Common Name
<i>Dichanthium annulatum</i>	Angleton
<i>Panicum coloratu</i>	Bambatsi
<i>Cenchrus ciliaris</i>	Buffel
<i>Cynodon dactylon</i>	Couch, green
<i>Bothriochloa insculpta</i>	Creeping Bluegrass
<i>Pennisetum clandestinum</i>	Kikuyu
<i>Panicum maximum</i> var. <i>trichoglume</i>	Green Panic, Gatton Panic
<i>Paspalum plicatulum</i>	Plicatulum
<i>Setaria incrassata</i>	Purple Pigeon
<i>Dichanthium sericum</i>	Queensland bluegrass
<i>Chloris gayana</i>	Rhodes grass
<i>Setaria sphacelata</i>	Setaria
<i>Themeda australis</i>	Kangaroo Grass

Legumes

Species Name	Common Name
<i>Desmanthus virgatus</i>	Desmanthus
<i>Medicago truncatula</i>	Barrel Medic
<i>Medicago polymorpha</i>	Common Burr Medic
<i>Medicago scutellata</i>	Snail Medic
<i>Vicia villosa</i>	Woolly pod vetch

Other Species

Species Name	Common Name
<i>Sida cunninghamii</i>	Paddys Lucerne
<i>Desmodium variens</i>	
<i>Eucalyptus crebra</i>	Narrow leaf – Iron Bark
<i>Corymbia tessellaris</i>	Morton Bay Ash
<i>Crisium vulgare</i>	Scotch Thistle
<i>Sidgesbeckia orientalis</i>	Sidgesbeckia
<i>Trema aspera</i>	Poison Peach
<i>Lantana camara</i>	Lantana
<i>Lantana montevidensis</i>	Lantana

Appendix 3.

Raw Data

Oakleigh Analogue Sites	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	Plot 10
Eastings	45 65 34	45 64 63	45 63 87	45 64 39	45 66 20	45 65 74	45 65 34 694 54	45 64 51 694 54	45 65 02	45 65 21
Northings	694 51 35	694 51 18	694 50 82	694 49 55	694 52 26	694 53 61	65	56	694 52 96	694 49 27
Live	7	9	9	3	10	20	12	13	5	5
Dead	31	28	29	32	28	18	23	22	30	32
Bare	2	3	2	5	2	2	5	5	5	3
% Bare	5	7.5	5	12.5	5	5	12.5	12.5	12.5	7.5
% Dead	77.5	70	72.5	80	70	45	57.5	55	75	80
% Live	17.5	22.5	22.5	7.5	25	50	30	32.5	12.5	12.5
Vegetative Cover %	95	92.5	95	87.5	95	95	87.5	87.5	87.5	92.5
Species Numbers	9	11	8	12	9	12	11	9	10	9
Standing Dry Matter (Kgs/ha)	1350	1300	1300	1250	1350	1300	1200	1250	1300	1200

Normanton Pit

Oakleigh Rehabilitation Site	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5
Eastings	45 99 45	46 00 00	46 00 34	45 99 60	45 98 47
Northings	694 41 17	694 40 60	694 41 59	694 45 14	694 47 11
% Bare	10	15	10	7.5	10
% Dead	10	10	0	5	7.5
% Live	80	75	90	87.5	82.5
Total Vegetative Cover %	90	85	90	92.5	90
Species Numbers	8	12	11	8	8
Standing Dry Matter (Kgs/Ha)	1600	1650	1500	1400	1600

