Investigation of Analogue Site and Proposal for Acceptance Criteria – Native Ecosystem Outcome

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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 help select and conduct an investigation of the status of unmined analogue sites near New Hope's New Oakleigh Coal Mine. The investigation is to provide background information which will be used to help develop a set of rehabilitation acceptance criteria for a native ecosystem outcome following the eventual handover of the mine at the conclusion of mining operations. This study is part of the requirements of New Oakleigh Coal Pty Ltd.'s Environmental Authority No. M5637.

The New 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:

- In consultation with New Hope Coal select analogue sites which will provide an appropriate benchmark for native ecosystem rehabilitation at New Oakleigh Mine,
- Provide an assessment of the ecological status of the selected analogue sites,
- Determine effective and achievable comparative measures of native ecosystem productivity and health for the analogue and mine rehabilitation sites,
- On the basis of the ecological status of the analogue site, devise a set of acceptance criteria for a native ecosystem outcome which would then be applied to the rehabilitation works at New Oakleigh Mine.

FIGURE 1 Site Location

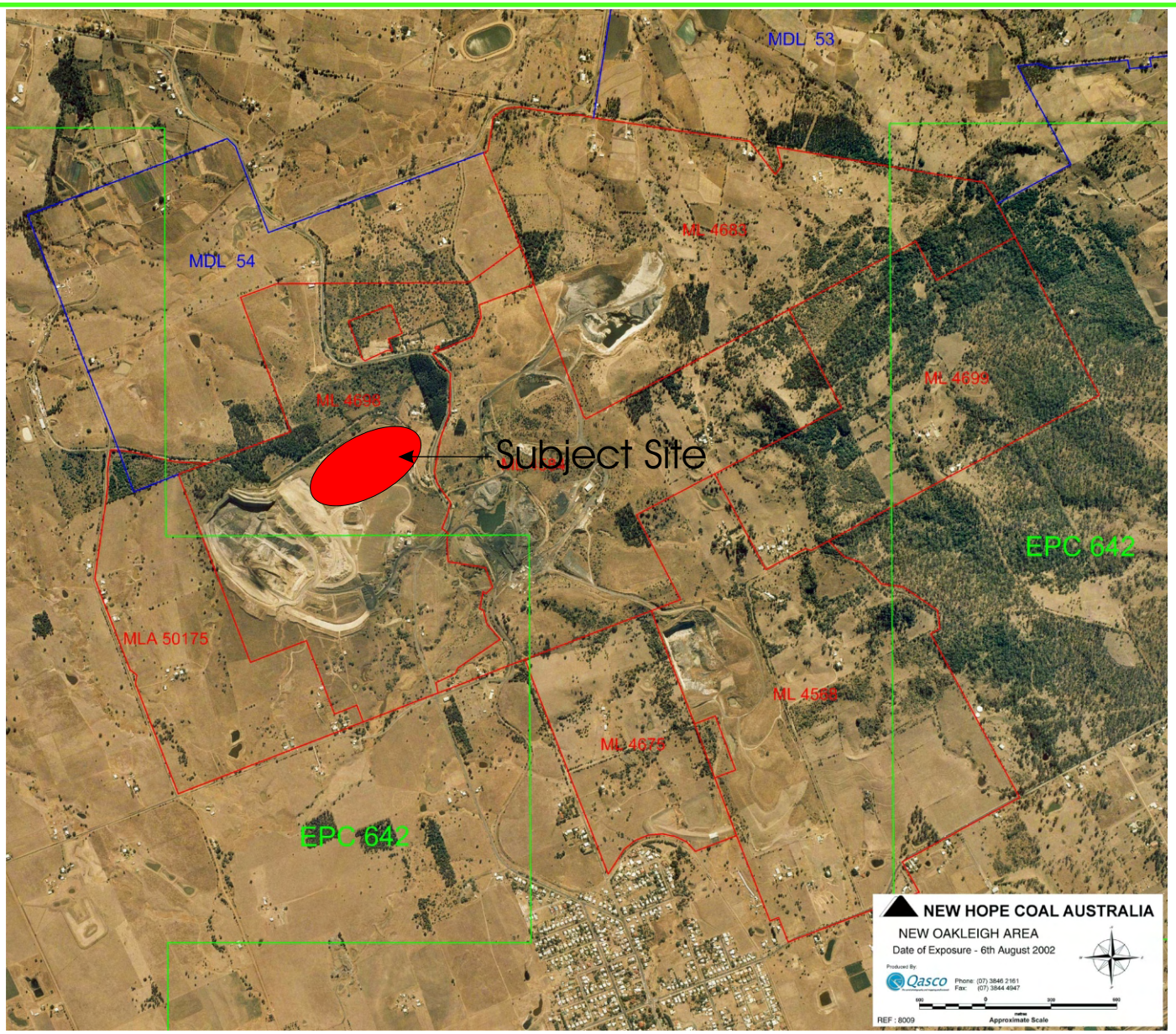

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Figure 1
Site Location

Drawing Number:

Scale: Scale Bar Attached

Date:30/8/05

Source :New Hope Coal 2002

Drawn By: JA

Checked By:KT

3.0 Methods

3.1 Literature Review

A review of relevant publications was conducted to determine best practice methods which could be applied to the vegetation sampling and selection of appropriate measures for assessing native ecosystem status and productivity. A detailed list of references is attached.

As part of this desktop study the relevant site data required for input to the Revised Universal Soil Loss Equation (RUSLE) (Renard et al. 1994) was also acquired to allow comparison of erosion rates on the sites.

3.2 Selection of Analogue Site

The areas surrounding the New Oakleigh site have been largely cleared for agricultural purposed over the last 100 years. Only small isolated areas of remnant vegetation exist within the general vicinity. Remnant native vegetation in the vicinity of the New Oakleigh generally takes one of three forms. These are:

1. Acacia harpophylla (Brigalow) dominated open forest with vine scrub elements,
2. Closed Vine Scrub +/- Araucaria cunninghamii (Hoop Pine) emergents (known locally as Rosewood Scrub) and;
3. Open Eucalypt forest. This is generally dominated by Eucalyptus tereticornis (Forest Red Gum) and is usually restricted to lower lying floodplain areas.

Given the New Oakleigh mine's position within the regional landscape the third form of remnant vegetation (Open Eucalypt forest) was considered to have been unlikely to have a significant occurrence on the site. Selection of the analogue site was therefore limited to the first two forms of remnant vegetation present in the area Acacia harpophylla (Brigalow) dominated open forest and Closed Vine Scrub. Of these two only the former Acacia harpophylla (Brigalow) dominated open forest is represented in remnants close to the mine site. It seems highly likely that this vegetation type would have formed a significant proportion of the native vegetation originally present on the mine site. It was therefore decided that it would be appropriate to focus on this vegetation community as an analogue for rehabilitation efforts.

Two Brigalow dominated open forest remnants exist close to the New Oakleigh site. The Kunkala remnant, Lot 9 RP35934 and Lot 1 RP 35867 boarded by Keats Road and the historic railway line, and the Cabanda remnant, Lot 1 RP35744 and Lot 2 RP159172 north of the historic railway line, are in the immediate area of the rehabilitation site.

These remnants were investigated by Greening Australia (Greening Australia, 2001) who made the following observations;

"…The dominant canopy layer of the Cabanda remnant is composed of Acacia harpophylla (brigalow)… "This remnant contains a diversity of dry vine scrub species including Pouteria cotinifolia (small leaved coondoo) Owenia venosa (rose apple), Streblus brunonianus (whalebone tree), Flindersia australis, F. collina, Citrus australis (round lime) and Carissa ovata

(current bush) which were found in significant numbers as emerging canopy, midstory and understory layers ….”

“..The Kunkala remnant is smaller and more highly degraded with the northwest corner towards boarded by the historic railway line and Keates Road extensively covered with lantana and other environmental weeds…”

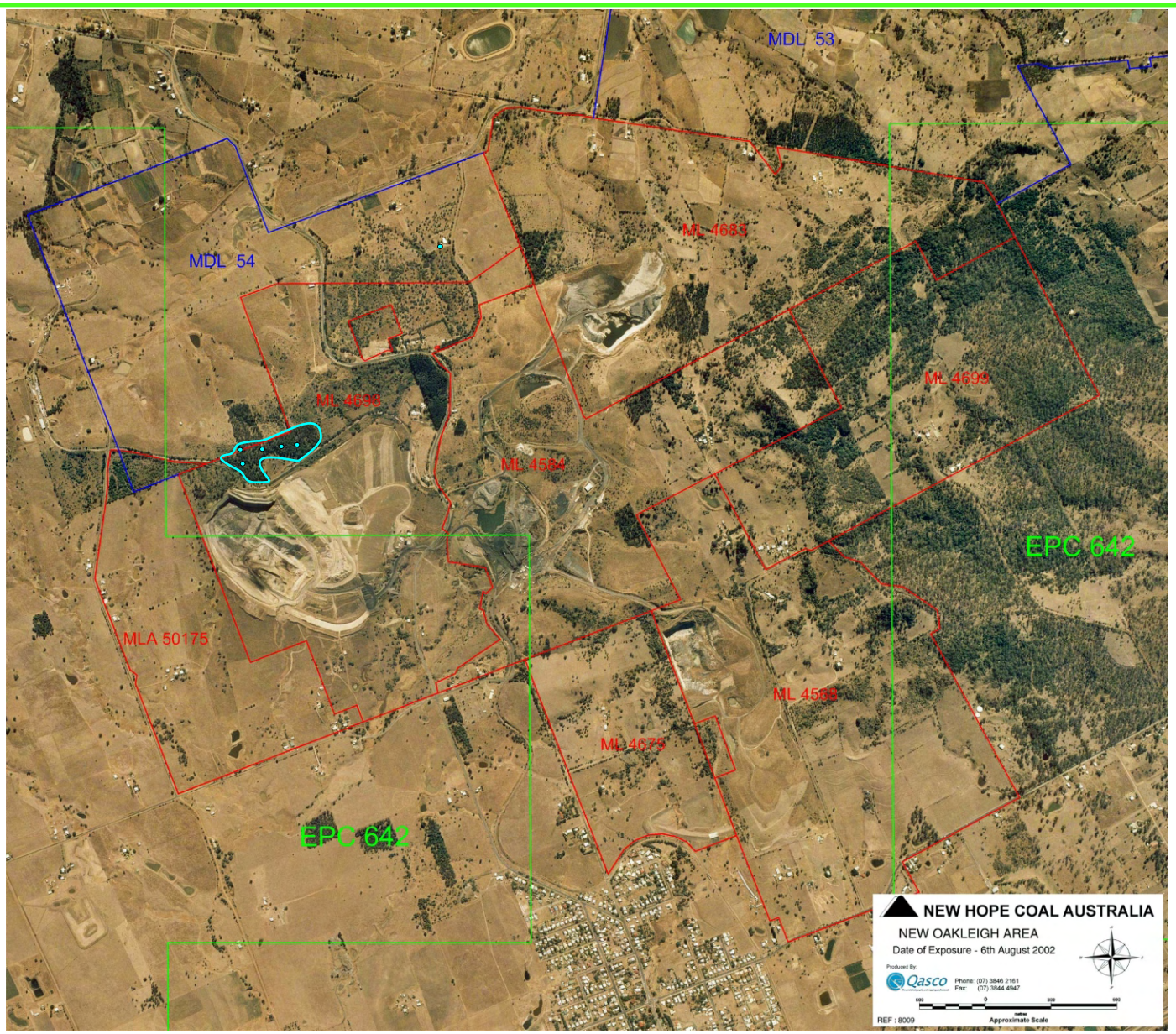
On the basis of the degraded state of the Kunkala remnant it was decided that the Cabanda remnant was the most appropriate site to be use as an analogue for the revegetation outcomes at New Oakleigh.

3.3 Field Assessment

After an initial orientation inspection of the site, a series of 20m x 20m plots were placed at random in the analogue site. Five (5) plots were placed in the analogue site Lot 1 on RP35744 and Lot 2 on RP159172. The location of these sites is depicted in Figure 2.

The aim of this was to establish a sampling pattern which would provide a representative example of the structural and floristic characteristics of the remnant vegetation within the site. Plots were measured using a 20m tapes. 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
- 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 and overstorey 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.
- 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.



Analogue Site Monitoring Location

Analogue Site Boundary

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Figure 2
Analogue Site Location

Drawing Number:

Scale: Scale Bar Attached

Date:30/8/05

Source :New Hope Coal 2002

Drawn By: JA

Checked By:KT

Plate 1 – Plot 1 New Oakleigh Native Ecosystem Analogue

Plate 2 – Plot 2 New Oakleigh Native Ecosystem Analogue

Plate 3 – Plot 3 New Oakleigh Native Ecosystem Analogue

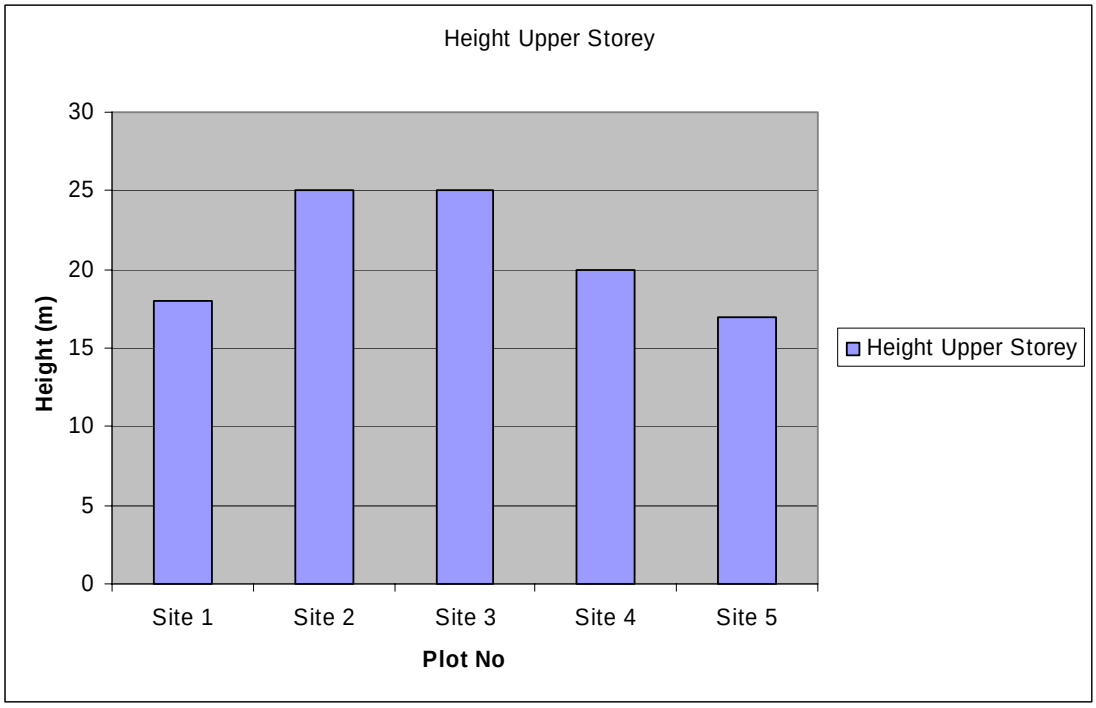
Plate 4 – Plot 4 New Oakleigh Native Ecosystem Analogue

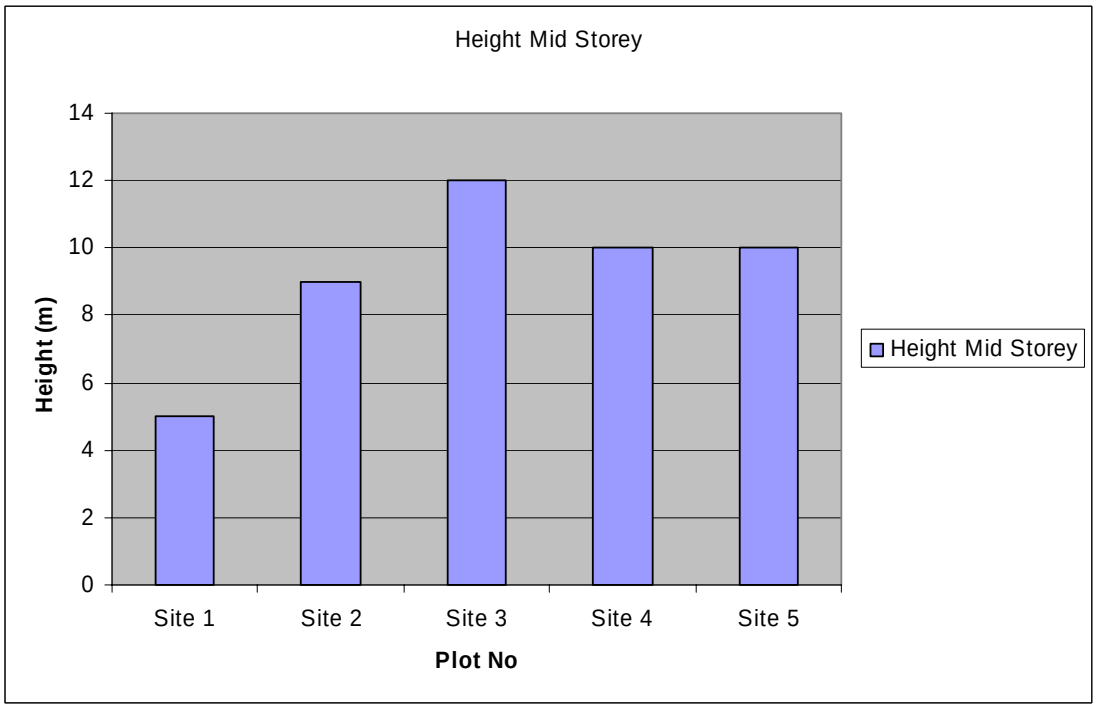
Plate 5– Plot 5 New Oakleigh Native Ecosystem Analogue

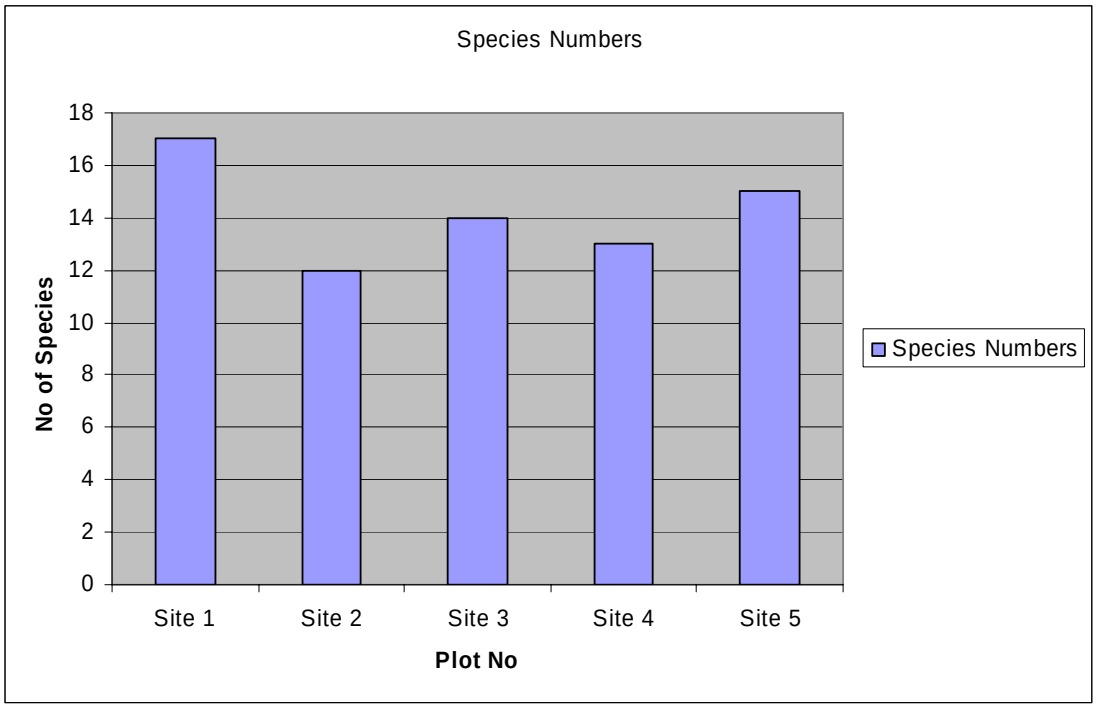
4.0 Results

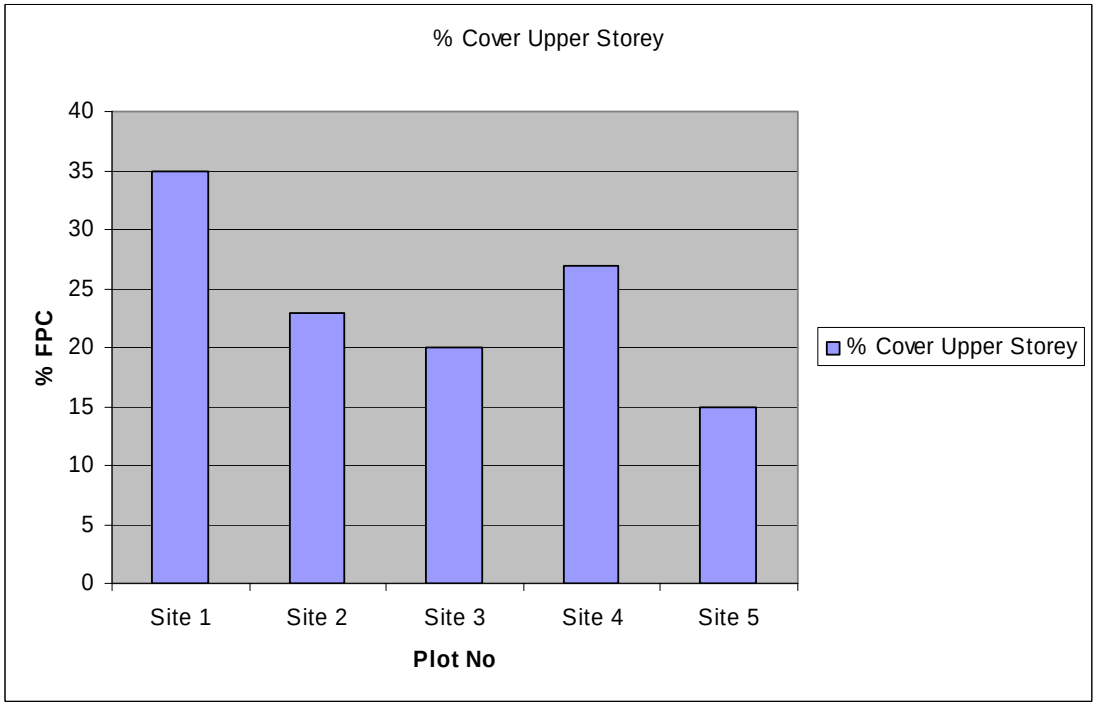
The results of the investigation are summarised in the following series of graphs.

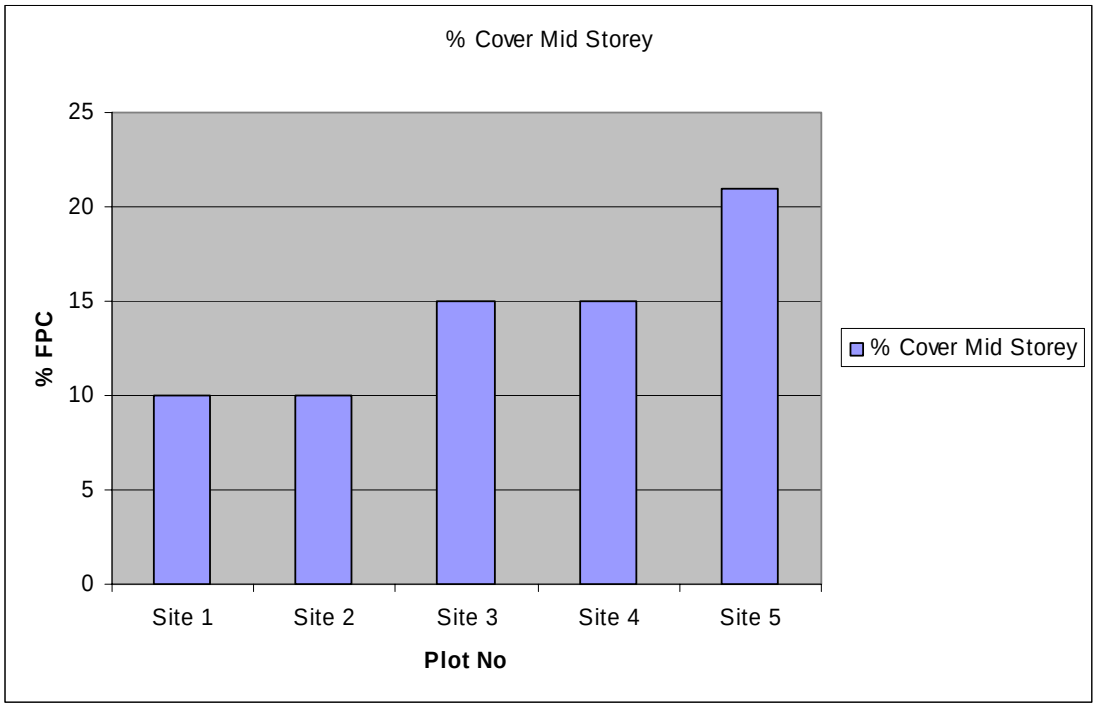
4.1 Analogue Site Results

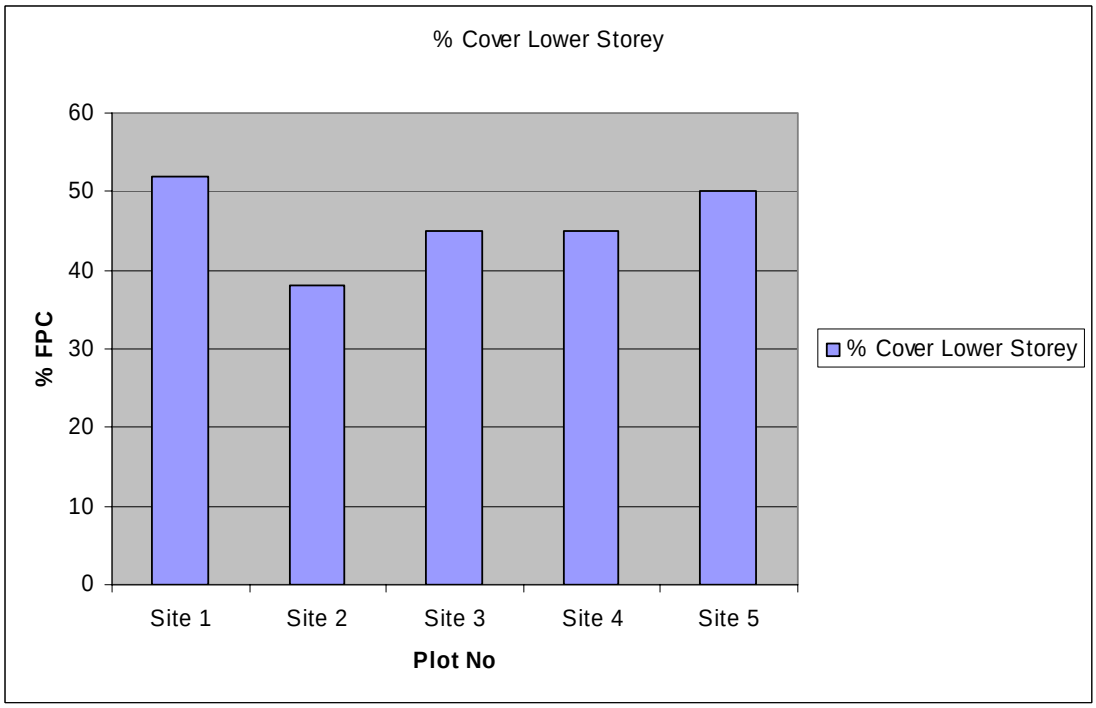





Species Numbers
18
16
14
12
10
8
6
4
2
0
No of Species
Site 1
Site 2
Site 3
Site 4
Site 5
Plot No
Species Numbers


% Cover Upper Storey
40
35
30
25
20
15
10
5
0
% FPC
Site 1
Site 2
Site 3
Site 4
Site 5
Plot No
% Cover Upper Storey


% Cover Mid Storey
25
20
15
10
5
0
% FPC
Site 1
Site 2
Site 3
Site 4
Site 5
Plot No
% Cover Mid Storey


% Cover Lower Storey
60
50
40
30
20
10
0
% FPC
Site 1
Site 2
Site 3
Site 4
Site 5
Plot No
% Cover Lower Storey

5.0 Discussion

The results indicate that the analogue sit fit with the definition of Open Forest as described in Walker and Hopkins (1990). Overstorey FPC varied between 35% and 15% whilst Mid storey was between 21% and 10%. The lower storey varied from 52% to 38%. All these values were generally lower than would normally be expected. This is principally due to the extremely dry conditions prevailing in the study are at the time. Lower storey FPC values were also reduced as a consequence of cattle grazing in the area.

Species numbers varied between 17 and 12 per plot. These numbers could be expected to rise significantly in better climatic conditions when ground cover species have a chance to recover from the impacts of the current drought.

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.

The information collected during this investigation was aimed at providing background information to allow a set of indicators (Acceptance criteria) for rehabilitation of mined areas to a native ecosystem outcome. The data collected is based on the information collection requirements of the Ecosystem Function Analysis (EFA) model (Tongway and Hindley, 2004) a commonly used method for rapid assessment of rehabilitation at disturbed sites (Randall, 2004). The EFA has been extensively tested and implemented throughout Australia, Africa, he middle East, southern Africa and Asia, and is currently employed in around 300 mine sites throughout Australia as a principal tool for the assessment of rehabilitation success (Randall, 2004).

The EFA model has three interrelated parts, these are:

- Landscape function analysis
- Vegetation and structural composition; and
- Habitat complexity

Currently only information relating to landscape function (slope, soil stability etc) and vegetation floristics and structure are being collected. As native ecosystem rehabilitation is currently in its very early stages at New Oakleigh habitat complexity data such amount of leaf litter, fallen logs, area of rocks etc has not been collected at this stage as these values obviously take some time to develop. Full details of the EFA model can be found in (Tongway and Hindley, 2003 & Tongway and Hindley, 2004).

With these factors in mind a range of acceptance criteria are proposed in section 6.0.

6.0 Proposed Acceptance Criteria (Native Ecosystem Outcome)

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

Acceptance Criteria 1

- FPC (canopy cover) of Monitoring rehabilitation sites averages within +/- 10% of the analogue site FPC

Monitoring

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

Acceptance Criteria 2

- FPC (midstorey cover) of Monitoring rehabilitation sites averages within +/- 10% of the analogue site FPC

Monitoring

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

Acceptance Criteria 3

- 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 "native ecosystem 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 "native ecosystem" and the analogue site using methods described in Renard et. al. 1994

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.

Hannan. J.C. (1995), *Mine Rehabilitation : A handbook for the Coal Mining Industry*. NSW Coal Association, Elisabeth St Sydney

Randall, J (2004) *Ecosystem Function Analysis – A tool for monitoring mine –site rehabilitation success.* MESA Journal, October 2004.

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

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Tongway, D.J. and Hindley, N.L. (2003) *Indicators of rehabilitation success, Stage 2. Verification of indicators, Final Report.* CSIRO Sustainable Ecosystems, Canberra

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