SECTION 3

EXISTING ENVIRONMENT, SAFEGUARDS AND POTENTIAL EFFECTS

3.1 INTRODUCTION

This section:

- presents an overview of the existing environment within and surrounding both the Canyon extension and the existing Whitehaven Coal Mine and along the approved coal haulage route to the Whitehaven CHPP;
- identifies the design and operational safeguards which are currently in place and will be continued, and/or would be implemented in association with the Canyon extension; and
- assesses the likely environmental effects should the proposed extension be approved.

3.2 METEOROLOGY

3.2.1 Source of Data

The following summaries of meteorological information for the Whitehaven area have been derived primarily from long-term data collected by the Bureau of Meteorology from Station No. 055023 (Gunnedah Composite) and Station No. 055024 (Gunnedah Soil Conservation Research Station) and short-term data collected from the Whitehaven Coal Mine's meteorological station. The comments on the climate have also been sourced, in part, from the Soil Conservation Service of NSW, Gunnedah Technical Manual.

Data collected from Station No. 055023 comprised:

- temperature;
- rainfall;
- relative humidity;
- fog and frost frequency; and
- wind (9.00 am and 3.00 pm).

Pan evaporation data was sourced from the Soil Conservation Research Station at Gunnedah, the nearest available source of that information.

With the exception of wind data from Station No. 055023, all meteorological data is presented in **Table 3.1**.

3.2.2 Climatic Characteristics

Gunnedah Shire is situated between the tropical and temperate climatic zones, between the belts of the sub-tropical highs and the zone of mid-latitude westerlies. In summer, synoptic highs dominate the climate. Low pressure systems pass at regular intervals bringing milder temperatures and winds from the southerly quadrant. The climate is also influenced by the substantial mountain ranges located to the east, and to a lesser extent, the south of the region.

3.2.3 Temperature

The data summarized in **Table 3.1** show the area to be characterized by mild to hot summers and cool winters. December, January and February are the warmest months with mean daily maximum temperatures approximating 33°C. July is the coldest month with a mean daily minimum of 3°C. Autumn and spring are generally mild with occasional erratic temperature fluctuations. Mean diurnal temperature variation is relatively constant throughout the year at about 15°C.

Table 3.1
Monthly Meteorological Data*

Month	Parameter									
	Temperature		Rainfall			Relative Humidity		Frost	Fog	Evaporation
	Mean Daily Max (°C)	Mean Daily Min (°C)	Mean (mm)	Median (mm)	Mean Rain-days	Mean 9.00 am (%)	Mean 3.00 pm (%)			Mean (mm)
January	33.6	18.3	72.3	49	6.5	61.5	42.4	0	0.2	254.2
February	32.7	18.0	65.6	44	6.0	66.1	42.8	0	0	207.2
March	30.6	15.6	48.7	34	4.6	66.0	44.9	0	0	207.7
April	26.2	11.1	38.2	34	4.3	68.2	46.2	0	0.1	141.0
May	21.3	7.2	44.2	20	5.3	74.6	52.1	1	0.3	93.0
June	17.5	4.3	43.0	38	6.2	79.9	55.9	3.8	0.4	63.0
July	16.8	3.0	42.6	32	6.2	79.9	55.9	3.8	0.4	65.1
August	18.7	4.1	42.0	38	6.2	72.5	47.5	5	0.1	93.0
September	22.6	6.8	39.4	34	5.8	65.8	43.8	1.2	0.3	129.0
October	26.4	10.6	56.0	52	6.9	61.2	4.7	0	0.1	176.7
November	29.8	13.8	60.0	50	6.7	57.4	38.5	0	0	213.0
December	32.8	16.5	66.7	58	6.9	57.5	38.4	0	0.1	263.5
Annual	25.8	10.8	618.7	562	71.6	67.4	45.7			1898.0
Years of Record	74	74	120	118	118	26 – 32	26 – 32	32	32	26 - 29

* All data other than evaporation sourced from Station 55023 (Gunnedah Composite). Evaporation data from Station 55024 (Gunnedah Soil Conservation Research Station)

3.2.4 Rainfall

Rainfall in the Gunnedah area results from the passage of one of three major synoptic systems across the area, or from localised convective thunderstorms:

- the regular passage of cold fronts across NSW, whenever these fronts extend north into the area; or
- the passage of moist upper atmosphere low cells into the area from Queensland; or
- the passage of inland tropical cyclones or low pressure systems which have been located over the Pacific Ocean.

Of these, the latter two principally occur in the warmer months when convectional storms are also most frequent. These produce the majority of the area's total rainfall and are often of high intensity.

Mean and median monthly rainfall are presented in **Table 3.1**, with the difference between the median and mean rainfalls due to the influence of very high or very low rainfall events which are not expected with sufficient frequency to affect the median, but which have a significant effect on the mean. Consequently the median value is considered to be a better estimate of monthly rainfall expectancy. **Table 3.1** shows highest rainfalls occur in the period between November and February, December having the highest median rainfall of 58 mm. May and July are the driest months with median rainfalls of 29 mm and 32 mm respectively. However, winter rainfalls are more reliable.

On average, Gunnedah experiences 72 rain days per year.

3.2.5 Wind

The combined seasonal 9.00 am and 3.00 pm wind speed and direction data recorded at Station No. 055023 indicate that calm conditions in Gunnedah average approximately 12 per cent, 13 per cent, 15 per cent and 10 per cent of morning (9.00 am) winds and 8 per cent, 9 per cent, 12 per cent and 8 per cent of afternoon (3.00 pm) winds in each of summer, autumn, winter and spring. An analysis of wind data from Station No. 055023 and Whitehaven Coal Mine previously undertaken by Richard Heggie Associates Pty Ltd showed a good correlation between both sites.

3.2.6 Relative Humidity

The relative humidity in the Gunnedah area is typical of a warm temperate climate. Mean 9.00 am relative humidities range from approximately 55 per cent in late spring and early summer to nearly 80 per cent in early winter. Mean 3.00 pm relative humidities range from between 35 and 40 per cent in late spring and early summer to 50 to 55 per cent in late autumn and early winter.

3.2.7 Evaporation

Mean monthly evaporation is greatest from November to March and corresponds to the months of highest temperatures and lowest relative humidities. During each of these months evaporation exceeds 200 mm. Mean monthly evaporation is least during June and July at 63 mm and 65 mm respectively. Average evaporation exceeds rainfall in all months and exceeds median annual rainfall by a factor of nearly four.

3.2.8 Temperature Inversions

Temperature inversions are often expressed as fogs and/or frosts and invariably occur during calm, clear, cool nights. After sunrise, the inversions normally increase in height before being broken down by solar heating of the land surface.

Table 3.1 shows that frosts generally occur in the Gunnedah area between May and September. Fogs may occur at any time of year but are a rare phenomenon. Based on these records alone, it may be concluded that temperature inversions could occur on up to 20 per cent of days each year. However, in a detailed review of the meteorology of the Gunnedah area, Garradd (1997) noted that "surface inversions might be expected on 50 per cent or more nights throughout the year".

An assessment of inversion occurrence at the Whitehaven Coal Mine during 2001 showed a similar result to that identified in Garradd, with weak to strong inversions occurring on in excess of 40 per cent of nights in summer, autumn, winter and spring. Night-time inversions generally prevail from about 8.00 pm. During day-time, ie 7.00 am to 6.00 pm, weak to strong inversions occurred at the Whitehaven Coal Mine site on less than 1 per cent of summer, autumn and spring days and on approximately 3 per cent of winter days, but only prevailed to approximately 8.00 am before dissipating.

3.3 TOPOGRAPHY

3.3.1 Regional, and Local and Mine Site Topography

3.3.1.1 Regional Topography

The regional topography is shown on **Figure 3.1**.

The Whitehaven Coal Mine Site, ie ML1471, lies within the Namoi River Basin in an area representative of the transition from the higher broken country to the north-east and south associated with the Nandewar, Great Dividing and Liverpool Ranges and the open plains to the west in the Wee Waa and Coonamble areas.

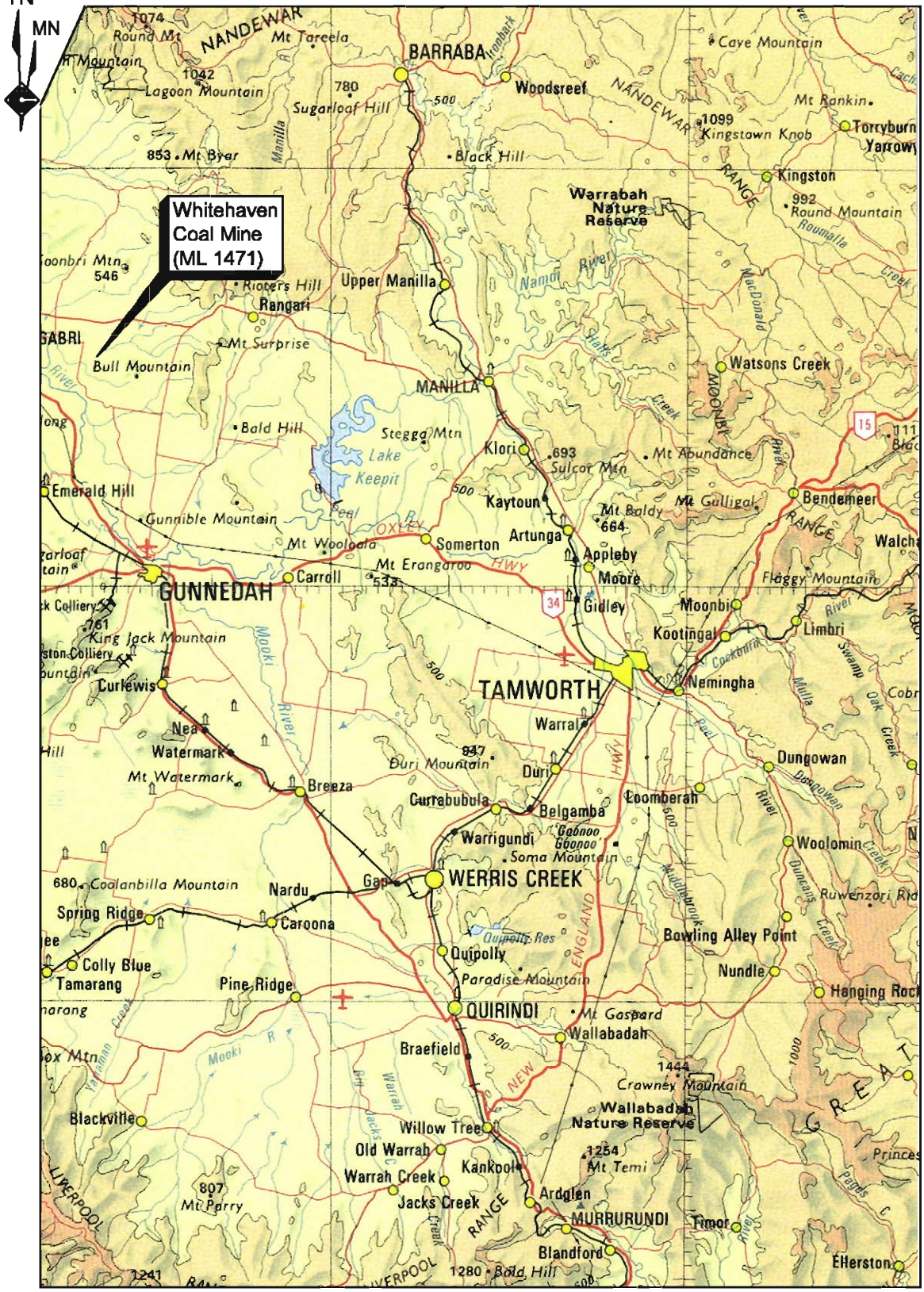
Natural slopes within the region range from less than 1° along the flood plain of the Namoi River to in excess of 25° within areas of Vickery State Forest and in excess of 45° within the Nandewar Range.

Elevations in the region range from 865 m, AHD within Kelvin State Forest (approximately 14 km east south-east of the mine, to 240 m, AHD within the Namoi River Valley (approximately 10 km west of the mine), with isolated peaks elsewhere such as Mt Binalong (18 km south-west) and Goonbri Mountain (17 km north-north-east) rising to in excess of 500 m, AHD.

Within the vicinity of the mine, the highest peak is Bull Mountain (approximately 6 km east), with an elevation of approximately 480 m, AHD.

3.3.1.2 Local Topography

The local topography in the vicinity of the mine is shown on **Figure 3.2**. The mine lies along a former north-south trending ridgeline which extended from The Red Hill to north of the "Whitehaven" residence.



Source: Readers Digest Atlas of Australia
Figure Compiled by R.W. Corkery & Co.

Figure 3.1
REGIONAL TOPOGRAPHY

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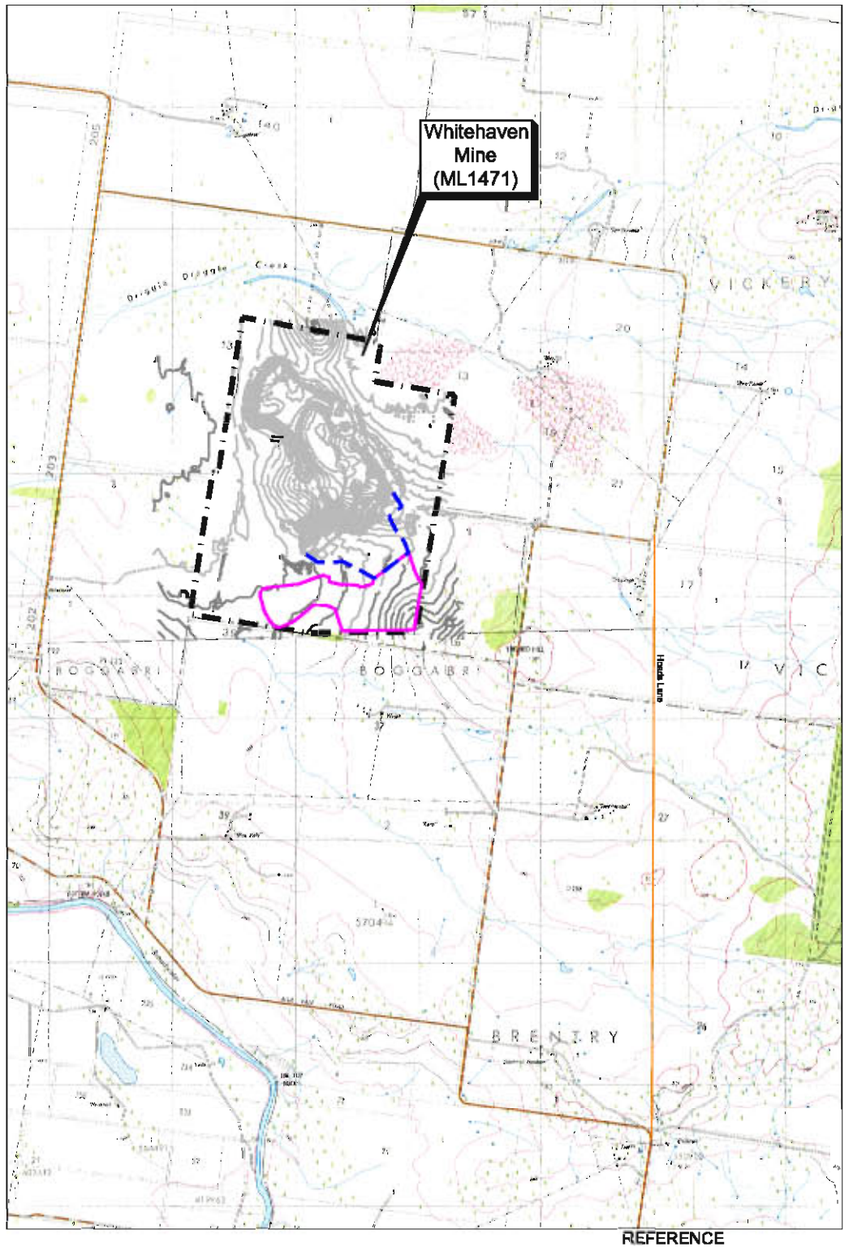
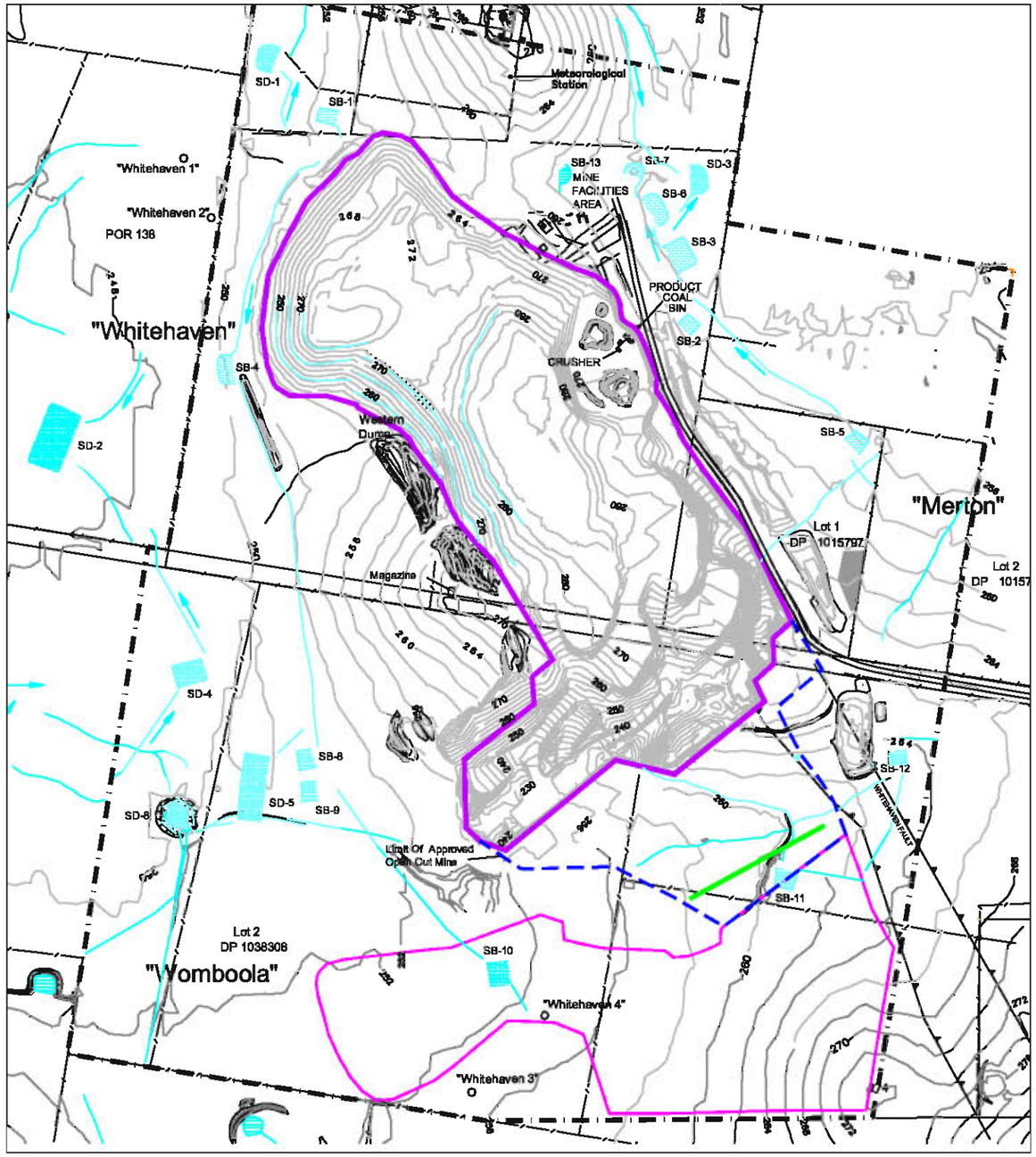




REFERENCE
- Mining Lease Boundary - ML 1471
- Limit of Mine Development (1/10/2004)
- Limit of Approved Open Cut Mining
- Proposed Canyon Extension
- Cadastral Boundary
- 270 Contour (m AHD)
- Existing Bank / Drain
- Drainage Direction
- Dam / Water Storage
- Fence
- Semi Linear Trend (Gravel)

Figure Compiled by R.W. Corkery & Co.

Figure 3.2
LOCAL AND SITE
TOPOGRAPHY

Elevations in the local area range from approximately 310 m on The Red Hill and in the vicinity of the "Silkdale" residence, to 250 m AHD within Driggle Draggle Creek, while within ML 1471, natural elevations ranged from 250 m AHD to 276 m AHD.

Natural slopes within ML 1471 range from less than 2° increasing to 6° (ie 1:10 (V:H) immediately east of the "Whitehaven" residence.

3.3.1.3 Topography

Figure 3.2 shows that the natural topography within those components of ML 1471 affected by prior and current mining activities has been modified and currently comprises:

- a ridgeline rising from approximately 276 m AHD at its northern extent to approximately 286 m AHD towards the southern "Whitehaven" boundary, that is, in areas formed to their post-mining landform. The ridge incorporates isolated knolls and exhibits slopes ranging from less than 2° to 10° around the periphery;
- an area of active mining comprising an excavation up to 36 m below the adjacent natural surface, near vertical slopes to the east, west and south, and areas partially backfilled with overburden and interburden comprising near flat terraces separated by temporary slopes of approximately 1:1.5 (V:H);
- a number of temporary topsoil, subsoil and friable overburden stockpiles awaiting application to reprofiled post-mining landform.

Within the area of the proposed Canyon extension, the natural topography remains essentially unaffected by existing mining activities, with the modifications that have occurred limited to the construction of water management structures, principally sediment basins and banks / drains.

3.3.2 Safeguards

WCM's Mining Leases, which incorporate both the existing approved Whitehaven Coal Mine and the proposed Canyon extension, require areas of mining related disturbance to be reprofiled to create a revegetated post-mining landform which is acceptable to the relevant authorities, stable and erosion free.

The reprofiled surfaces within the proposed Canyon extension as shown on **Figure 2.4** would be rehabilitated in the manner described in the existing Flora and Fauna Management Plan for the mine and summarized in Section 1.6.2.1 (ix) and (x), as amended on the basis of the outcomes of the ongoing programmes.

3.3.3 Impacts

A review of the conceptual final landform presented on **Figure 2.4** shows that, with the exception of the reprofiled final void, the landform within the "Womboola" component of the existing approved mine and the Canyon extension area would be similar to that prior to mining, with a surface which grades in a general westerly direction at between 0.4° and 4°.

The final void, though a significant change to the natural landform, is essentially a relocation of the existing approved structure and one which, by virtue of its location in the landform, would be a significant potential water storage and of benefit to any future use of the land.

3.4 DRAINAGE AND SURFACE WATER MANAGEMENT

3.4.1 Regional and Local Drainage

The regional local drainage patterns are shown on **Figure 3.2** and shows the Whitehaven Coal Mine lease area lies within the Liverpool Plains catchment of the Namoi River Basin of north-western NSW. The Namoi River Basin covers an area of approximately 43 000 km^2 and incorporates the centres of Tamworth, Gunnedah, Narrabri and Walgett. The Namoi River, one of the main tributaries of the Barwon Darling River system, flows into the Darling River immediately west of Walgett.

Major rivers upstream of the Whitehaven Coal Mine contributing to flows within the Namoi River in the Gunnedah / Boggabri area include the Manilla, Peel and Mooki Rivers. Both the Manilla and Namoi Rivers flow via Keepit Dam. The Namoi River catchment upslope of the mine approximates 23 000 km^2.

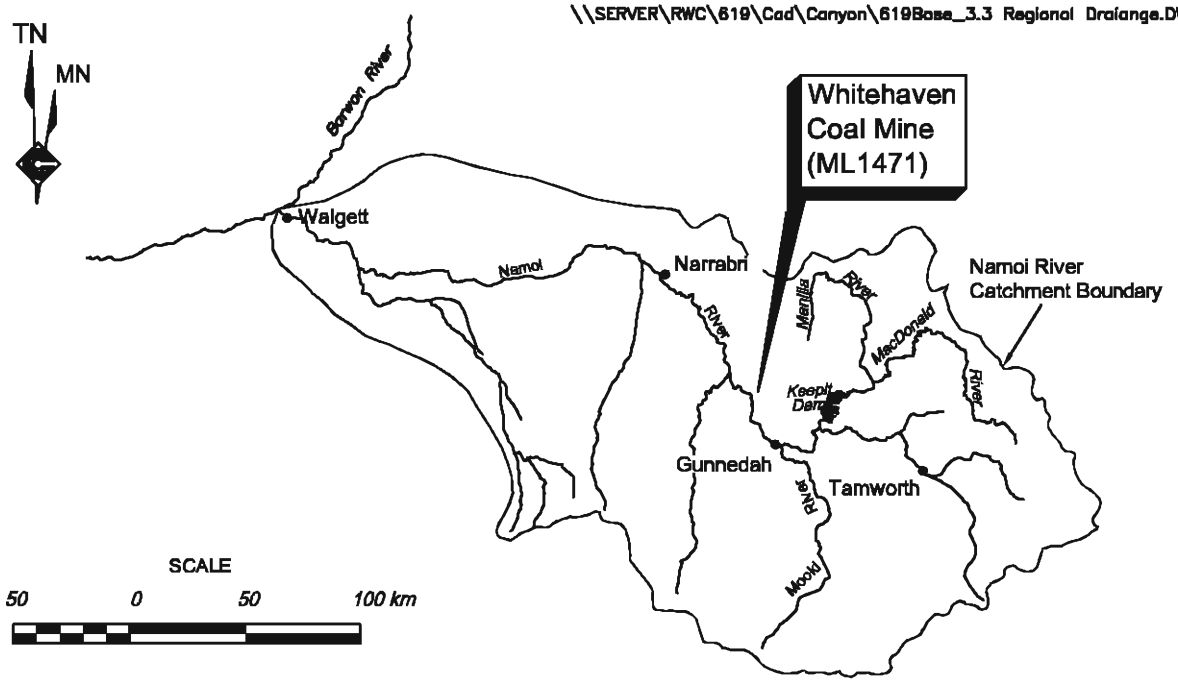
The existing approved mine and proposed Canyon extension lie within the catchment of Driggle Draggle Creek, an intermittent ill-defined watercourse which extends from the north of Kelvin State Forest to Barbers Lagoon and the Namoi River (**Figure 3.3**).

To the west of the "Whitehaven" residence, Driggle Draggle Creek is confined by levee banks. Driggle Draggle Creek has a catchment area of approximately 160 km^2 upstream of the mine. The land both east and west of the mine becomes swampy after heavy rainfall.

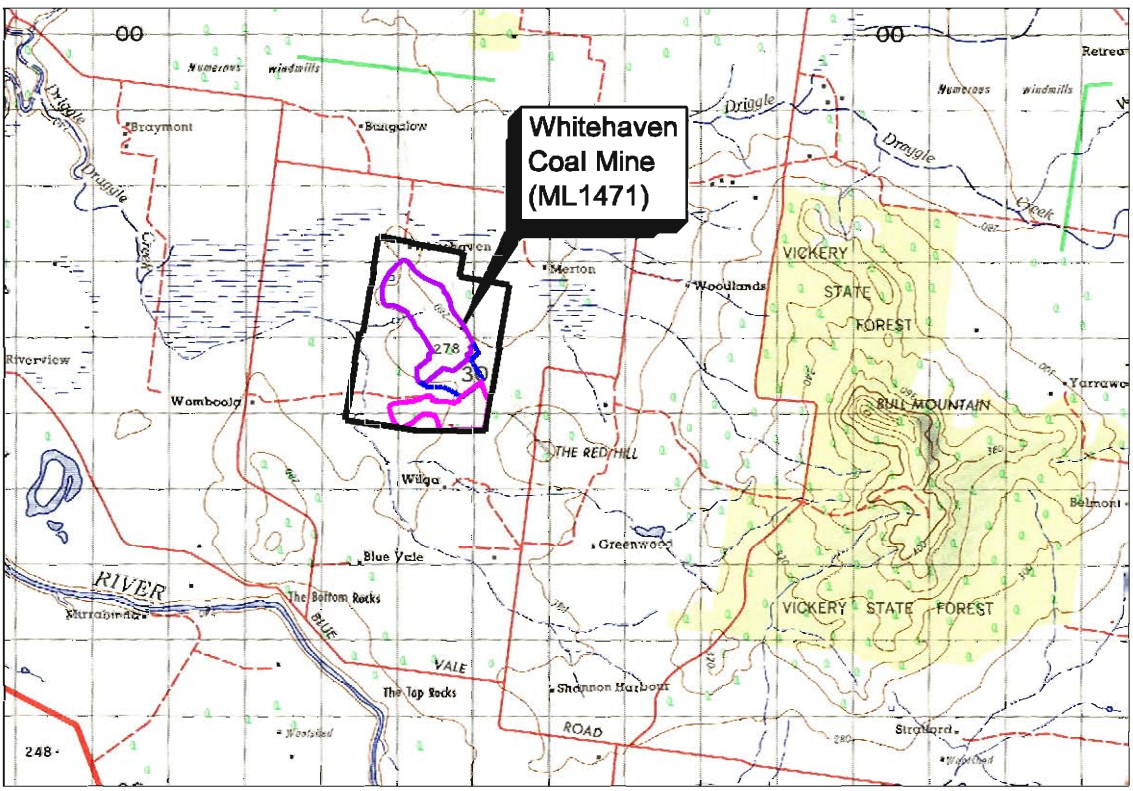
3.4.2 Mine Site Drainage

There are no permanent flows within or adjacent to ML 1471, with surface run-off being by radiating sheet flow to natural drainage depressions. The natural drainage patterns within the mine site, including components of the proposed Canyon extension, have been modified to varying degrees by mining and agricultural activities as shown on **Figure 3.2**, including:

- the installation of diversion banks to exclude run-on waters;
- catch banks to collect and direct potentially sediment-laden water generated from the existing mining operations;
- sedimentation basins for the containment of potentially sediment-laden water and the controlled release of clarified water;
- storage dams for the containment of clean water and clarified discharges from the sedimentation basins;
- contour banks and rock lines waterways on, or to direct water from the post-mining landform to the natural surface; and
- agricultural contour banks and farm dams.



REGIONAL DRAINAGE



LOCAL DRAINAGE

REFERENCE
- Mining Lease Boundary
- Limit of Mine Development (1/10/2004)
- Limit of Approved Open Cut Mining
- Proposed Canyon Extension

SCALE 1:100 000

1 0 1 2 3 4 5 km

Base Map Source: BOGGABRI 8936 1:100000 Topographic
Figure Compiled by R.W. Corkery & Co.

Figure 3.3
REGIONAL AND LOCAL DRAINAGE

As noted in Section 1.6.2.1(i) and shown on **Figure 3.2**, there is currently a network of 13 sediment basins (prefix SB-) and six storage dams (prefix SD-) on the mine site, with interlinking banks and drains and a combined storage of approximately 87 ML.

3.4.3 Safeguards

Given that WCM's proposed activities within the Canyon Area would be integrated and be contiguous with those at the existing Whitehaven Coal Mine, WCM's objectives and surface water management systems for the proposed Canyon extension would remain unchanged in principle from those in place at the existing approved mine as described in Section 1.7.2.2.

Figure 2.1 identifies the additional or extended surface water management structures recommended by Soil Services for installation in association with the Canyon extension in order to:

- divert clean run-on waters away from the open cut excavation and/or associated areas of disturbance; and
- collect dirty water generated within the Canyon extension.

The principle additional structures shown on **Figure 2.1** comprise:

(i) diversion banks D1, D2 and D3 – to direct clean water originating from areas east and south away from the proposed Canyon extension disturbance. The diversion banks would be pushed up from the west and south in order to maintain the grass cover within the constructed drainage channel;

(ii) a flow-through Dam FT-1. FT-1 would primarily serve as a velocity reduction structure between D2 and D3;

(iii) a Storage Dam (SD-7) to collect clean run-on water from D1 and clarified discharges from existing sediment basin SB-12;

(iv) a sediment basin (SB-14) to retain dirty water collected by catch bank CB-1;

(v) catch banks CB-1 and CB-3 to collect potentially dirty water emanating from the areas of disturbance within the Canyon extension and direct it to SB-14 and SB-9 respectively. Catch bank CB-3 would represent a modification and extension of an existing bank which links SB-10 with SB-9.

A third catch bank to be installed, CB-2, would be installed to transfer clarified water from SB-14 to Storage Dam SD-5, together with clean runoff from the area between CB-3 and CB-2.

As is currently the case at the existing Whitehaven Mine, WCM would minimize the extent of disturbance to vegetated areas, thereby maximizing the natural velocity reduction and filtration capacity provided by the dense grass cover in the open areas of the Company's landholding.

The positions of the various structures identified above is, however, conceptual, with the number of, positions, dimensions and/or storage capacities of each structure to be determined by Soil Services personnel prior to their installation in order to achieve the water management objectives identified in Section 1.7.2.1.

As with the existing Whitehaven Mine, contour banks would also be installed on the final landform as recommended by Soil Services, with rock-lined waterways or other treatments to direct the water to the reprofiled final void in a non-erosive manner.

Water management system maintenance procedures and practices which are in place at the existing Whitehaven Coal Mine would be extended to include the additional structures identified above.

3.4.4 Impacts

The extension of the existing and proven water management measures identified in Section 1.7.2.2 to incorporate the proposed Canyon extension, together with the installation of additional structures discussed in Section 3.4.3 and the continuation of the existing regular inspection and maintenance programme, would ensure WCM's continued achievement of the objectives identified in Section 1.7.2.1. Hence, there would be no adverse impacts on the water quality within, nor the use nor ecological integrity of either Driggle Draggle Creek or the Namoi River.

Similarly, the installation of the additional water management structures would have a negligible impact on the quantity of runoff to Driggle Draggle Creek from WCM's or adjacent landholdings.

3.4.5 Monitoring

The surface water monitoring programme for the existing Whitehaven Coal Mine as described in Section 1.7.2.3 would be continued for the life of the Canyon extension and until such time as a stable vegetative cover has established on all rehabilitated surfaces, with monitoring of no additional sites nor parameters considered warranted: no additional licenced discharge points would be required, with all potentially dirty water emanating from the proposed Canyon extension ultimately reporting to either the open cut void (during and following cessation of mining) or Storage Dam SD-5. SD-5 is an existing licenced discharge point under EPL 10094.

3.5 GROUNDWATER

3.5.1 Resource

Two principal aquifer systems are recognised within the vicinity of ML 1471, namely the consolidated coal measures and basement rocks and the unconsolidated colluvial / alluvial surficial sediments.

- **The consolidated coal measures and basement rocks** exhibit low intergranular porosity and permeability. Groundwater storage and flow is therefore limited, but tends to be highest within the coal seams themselves and in fracture systems (faults and joints) within the rock mass as a whole. However, these fracture systems tend to be of limited spatial extent and connectivity. These general characteristics were also confirmed by observations in the various open cuts at the Vickery Coal Mine and have been supported by observations in both the Trial and current Whitehaven Mines.

Recharge is on the higher country to the east of the "Whitehaven" property and the hydraulic gradient, ie the direction of groundwater flow, is generally to the west / south-west and the Namoi River.

- **Unconsolidated colluvial / alluvial surficial sediments**. Within these sediments which range in thickness up to 30 m, the intergranular porosity and permeability are potentially much higher than in the consolidated coal measures and basement rocks, particularly in coarser material where fractures are less important to groundwater storage and flow.

  It has previously been shown by DIPNR (then the Department of Land and Water Conservation) that those two aquifer systems are hydraulically connected and interact. The fractured rock aquifers have a higher potentiometric head than the alluvial aquifers, and thus groundwater tends to flow upward into the shallower (alluvial / colluvial) system where the two interface.

A third, localized aquifer comprising up to 25 m gravels overlying the coal seam has been identified adjacent to the northern extremity of the Canyon. This aquifer, identified by the drilling results from six anomalous holes located either side of a semi-linear trend as shown on **Figure 3.2**, variously comprises conglomerate gravel up to 25 m in thickness; rounded, coarse, dark-coloured gravel suggestive of a basic intrusive origin which has been washed in as a sediment, and a mixture of coarse rounded conglomerate and rounded and sharp dark-coloured igneous. It has been postulated that there is some kind of palaeochannel crossing the area filled with weakly cemented gravel (up to cobble size), with the dark igneous material having been picked up from some plug or vent on the Boggabri Ridge to the west.

Within the "palaeochannel", flows of up to 2.5 L/s were recorded over a V-notch weir at the time of drilling. However no testing has been undertaken to verify sustainability at this rate nor the rate of recharge. Groundwater monitoring site GW-6, the only bore which has shown any substantial change in level since the commencement of mining activities (and then only since late 2003), lies in close proximity to this "palaeochannel".

Within the area of the existing Whitehaven Coal Mine, the open cut had, until late 2003, been located in an area comprising the consolidated coal measures and basement rock fractured aquifer where bore yields are low (0.5 to 1.0 L/s), with the consequent groundwater inflows to the open cut ranging from nil to minimal. In 2001/2002 the combined surface water (ie rainfall infiltration) and groundwater inflow pumped from the open cut approximated 3 ML and in 2002/2003, even with the substantial increase in the area of enhanced infiltration, only increased to 6 ML. In 2003/2004, with the increased area of enhanced infiltration, the southward progression of the open cut towards the "palaeochannel", the occurrence of gravely overburden materials in the south-western mine blocks and an associated increase in groundwater inflows, total water extraction from the open cut approximated 30 ML.

3.5.2 Safeguards

Given the absence of any evidence of mine-related contamination of groundwater nor of any change in groundwater levels or availability to local landholders (see Section 1.7.3), no safeguards with respect to groundwater management in addition to those identified in Sections 1.7.2.2 and 1.7.3.2 are considered warranted. Despite the mine's proximity to several

production bores on the "Whitehaven" property, the only bore apparently affected by the Company's operations to-date is bore GW-6 (**Figure 1.6**) an abandoned former windmill bore on WCM's property which lies within the limits of the proposed Canyon extension.

3.5.3 Impacts

Although mining and the limited supplementary groundwater abstraction from production bores to provide dust suppression water at the mine has the potential to depressurize both the fractured rock aquifer, through seepage into the mine itself, and the alluvial aquifer by reducing upward flow into overlying unconsolidated sediments, there is no evidence to-date to suggest that this has occurred, with monitoring results from all bores (other than GW-6) showing groundwater levels to have remained essentially unchanged or to have only exhibited minor fluctuations over time.

As has been the case to date, the potential impacts on groundwater availability from non-project and related bores in the vicinity of the Canyon extension would be determined primarily by the interconnection, or lack thereof, of the fracture system.

Given that, with the single exception identified previously, there has been no adverse impacts on groundwater levels as close as 0.2 km to points of mine-related groundwater extraction or open cut mining, no impact on groundwater bores would be expected in association with the proposed Canyon extension: the nearest non-project-related bore (a derelict windmill bore) lies in excess of 1.6 km from the closest areas of planned mining activity, while the nearest non-project-related production bore lies at a distance of more than 1.9 km from the Canyon extension.

In the longer term, the increased permeability of the post mining landform and the retention of a water collecting void within the Canyon is likely to be a source of recharge to the local aquifer, in particular to that comprising the remaining localized gravels surrounding the "palaeochannel". In these circumstances, the impact of the post-mining landform would be a net increase in regional recharge.

The potential for the proposed activities within the Canyon to adversely impact on local groundwater quality would remain unchanged from that experienced to date. Given the absence of any evidence of impacts on groundwater quality to date and the proposed extension of the existing management procedures and safeguards, no adverse impacts would be expected.

Notwithstanding the above comments, WCM would extend its existing contingency plans with respect to rectification or amelioration of any mine-related groundwater quantity or quality impacts to its activities within the Canyon extension.

3.5.4 Monitoring

With the exception of Sites GW-6 and GW-12 which lie within the limits of the Canyon development, the groundwater monitoring programme for the existing Whitehaven Coal Mine as described in **Table 1.8**, would be continued. Any additional production bore installed to replace bore 90 BL 252067 (GW-12) would be incorporated into the monitoring programme, with the parameters to be monitored and the frequency of monitoring determined in consultation with DIPNR on installation.

3.6 SOILS AND LAND CAPABILITY

3.6.1 Soils

3.6.1.1 Introduction

Extensive investigations of the soils, and an assessment of land capabilities within and surrounding the existing Whitehaven Coal Mine (extending into the northern area of the proposed Canyon extension) were undertaken by Geoff Cunningham Natural Resource Consultants (GCNRC) during the preparation of the EIS accompanying DA 72-03-2004 (GCNRC, 2000(a)).

The following sub-sections summarize the results of those investigations and provide the outcomes of a review / extension of the previous work which was undertaken to specifically address the Canyon area. The extension of the previous findings to incorporate the Canyon extension was based on data from seven auger holes located just within or adjacent to the Canyon with the outcomes representing a preliminary interpretation which will be subject to confirmation based on further pit testing to be undertaken as part of the preparation of a revised Mining Operations Plan to be submitted for the Canyon extension activities.

Soil stripping and management procedures currently adopted at the existing Whitehaven Coal Mine are consistent with the recommendations by GCNRC as detailed in the approved "Soil Stripping and Management Plan – Rev 1".

3.6.1.2 Soil Mapping Units

GCNRC (2000(a)) identified three different soil mapping units (SMU) as described below and shown on **Figure 3.4.** As noted in Section 3.6.1.1, the boundaries between the SMUs within the proposed Canyon extension, as shown on **Figure 3.4** are preliminary only and will be revised on the basis of additional pitting to be undertaken.

- **Soil Mapping Unit 1 (SMU-1)**

SMU-1 occurs on the ridgetops and upper slopes of the low ridges where natural gradients range from 0 per cent to about 5 per cent. The soil surfaces vary from being hardsetting to loose, with surface crusts present in some instances and surface stone being evident.

The soils within SMU-1 are shallow (usually about 60 to 75 cm deep), although some profiles extend to depths of approximately 110 cm. Gravel occurs throughout the profile and generally increases in amount with depth, with samples from cleared and cultivated sites within "Whitehaven" and "Merton" showing very similar profiles to those within the heavily grassed natural timber stands on "Womboola".

SMU-1 soils usually vary little in texture between the surface and deepest layers although, in some instances, the layer of soil and decomposing rock above the bedrock can be of a sandy clay or light clay texture. This latter layer contains many larger stones as well as gravel.

Topsoils (A horizon) are brown to dark reddish brown coloured, sandy loam in texture and generally contain 40 to 50 per cent gravel. They are usually very poorly coherent so that their structure breaks down on disturbance, although some samples showed more structure development.

The B horizons (subsoils) are similar in texture to the topsoil and there is usually a slight increase in pH with depth. The B horizons contain more gravel (60 to 70 per cent) than the topsoil and vary in colour from yellowish red and reddish brown to various shades of brown.

The general physical and chemical attributes of the SMU-1 soils are as follows:

- gravel content to range from 20% to 45% within the individual soil horizons;
- sandy texture throughout the profile;
- topsoils exhibit moderately dispersion percentage values with lower horizons having moderate to high dispersion percentage values. However, based on Emerson Aggregate testing, the topsoil are, however, only slightly dispersible;
- horizon pH values to range from 5.2 to 7.3, ie within the acceptable range for agronomic / agricultural purposes of 4.0 to 8.5;
- all horizons to be non-saline.

- **Soil Mapping Unit 2 (SMU-2)**

SMU-2 occurs on the mid slopes of the low ridges in areas where slopes generally range from 2 per cent to about 5 per cent. The soil surfaces vary from being hardsetting to loose, with surface crusts present in some instances.

Soils within SMU-2 are deeper than those of SMU-1 (usually about 100 to 120 cm deep), although some profiles may extend to depths of approximately 200 cm. Gravel occurs throughout the profile and generally increases in amount with depth.

The SMU-2 soils are duplex and show a marked difference in texture between the surface and B horizons.

Topsoils (A horizon) are dark reddish grey to dark brown coloured, sandy loam, loam or sandy clay loam in texture and generally contain up to 60 per cent or more gravel. They are usually weakly to firmly coherent so that their structure breaks down relatively easily on disturbance. The boundary between the topsoil and the subsoil (B horizon) is abrupt to sharp.

The subsoil horizons are much finer in texture than the topsoil (ie more clayey) and there is usually a strong increase in pH with depth. The subsoils contain variable amounts of gravel and some stones and vary in colour from yellowish red and reddish brown to various shades of brown.

\\SERVER\RWC\619\CAD\Canyon\619Base_3.4 Soils.DWG

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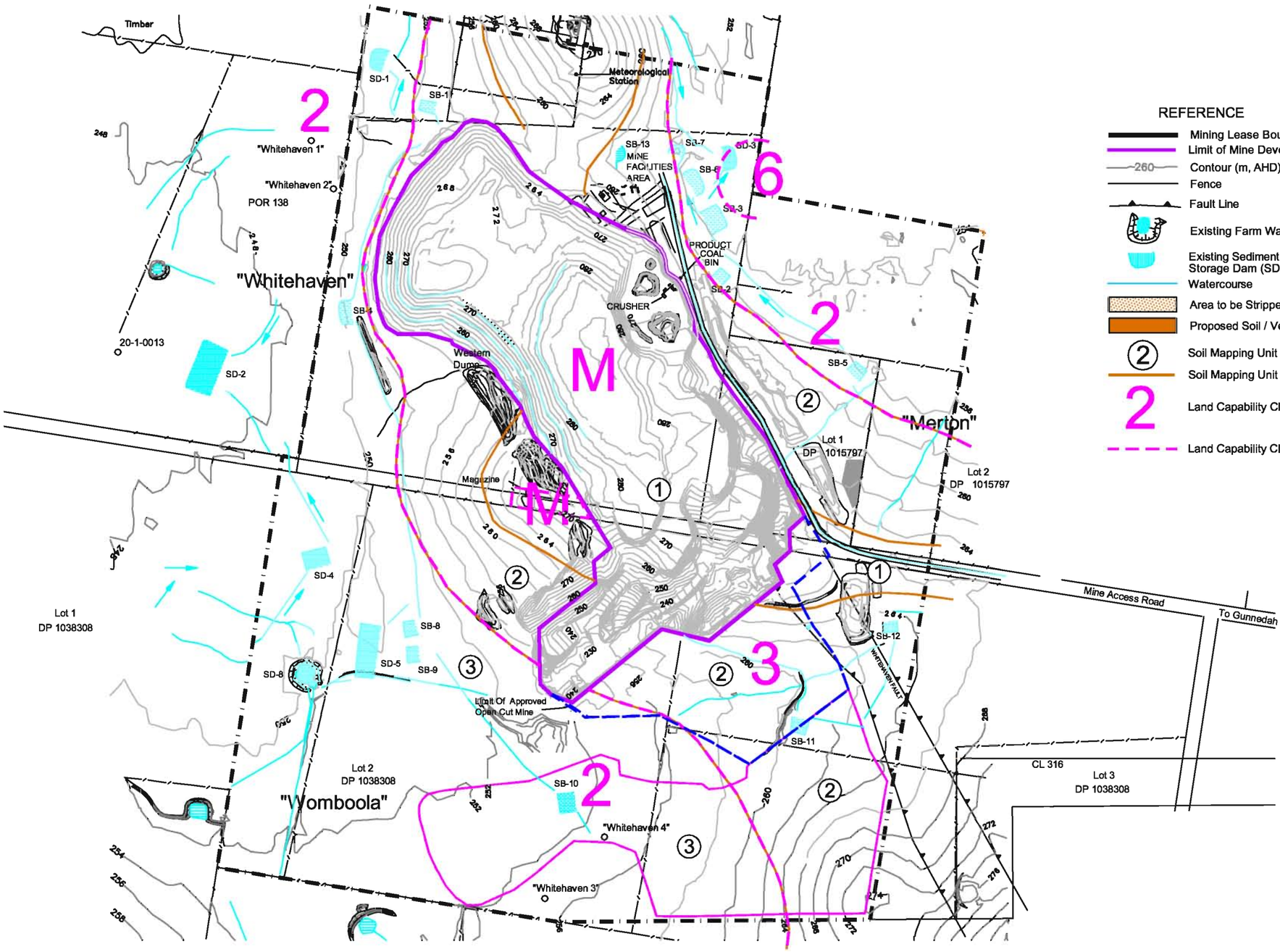


REFERENCE

- Mining Lease Boundary - ML 1471
- Limit of Mine Development (1/10/2004)
- 260 Contour (m, AHD)
- Fence
- Fault Line
- Existing Farm Water Storage
- Existing Sediment Basin (SB) / Storage Dam (SD) / Volume (Megalitres)
- Watercourse
- Area to be Stripped of Topsoil
- Proposed Soil / Vegetation Stockpiling Areas (Nominal)
- (2) Soil Mapping Unit
- Soil Mapping Unit Boundary
- 2 Land Capability Class
- Land Capability Class Boundary

SCALE 1:12 500

200 0 200 400 600 m

Figure Compiled by R.W. Corkery & Co.

Figure 3.4
SOILS AND LAND CAPABILITY

Other physical and chemical attributes of SMU-2 soils can be summarized as follows.

- Topsoils exhibit moderate dispersion percentages with dispersion percentage values for the lower horizons ranging from slight to moderate. However, based on the EAT, the topsoils are only slightly dispersible.
- Horizon pH values range from 5.6 to 7.5.
- Topsoils and some entire profiles to be non-saline, but with some deeper horizons being slightly to moderately saline.

- **Soil Mapping Unit 3 (SMU-3)**

SMU-3 occurs on the lower slopes of the low ridges and the adjacent level plains country with natural slopes ranging from 0 per cent to about 2 per cent. The soil surfaces vary from being hardsetting or firm on the lower slopes to self-mulching on the plains.

The soils within SMU-3 are deep and extend beyond depths of about 250 cm. Gravel occurs throughout the profiles on both the lower slopes and plains. However, the plains profiles contain small amounts of small gravel while the profiles on the lower slopes tend to have a higher gravel content in upper layers.

The SMU-3 soils on the lower slopes are duplex and show a marked difference in texture between the A and B horizons. GCNRC (2000) considers that, in many ways, the SMU-3 lower slopes soils are very similar to the soils of the midslopes (SMU-2), only much deeper.

The self-mulching SMU-3 soils of the level plains have a uniform clayey profile that is very different to the duplex soils of the lower slopes.

Descriptions of the SMU-3 soils on each of the lower slopes and level plains are as follows.

(i) **Soils of the Lower Slopes**

The soils of the lower slopes have duplex profiles.

The topsoils are reddish brown to dark reddish brown coloured, sandy loam in texture and generally contain up to 20 per cent or so gravel. They are strongly coherent so that their structure does not break down easily on disturbance.

The subsoils are much finer in texture than the topsoil (i.e. more clayey) and there is usually a strong increase in pH with depth. The subsoil horizons contain variable amounts of gravel and vary in colour from pinkish grey to various shades of brown.

(ii) **Soils of the Level Plains**

These soils have uniform clayey profiles that do not vary greatly in texture with depth. The soil has a medium clay texture at the surface grading into medium to heavy clay below. The topsoil colour is greyish brown to very dark greyish brown.

The boundary between the topsoil and the subsoil is clear to gradual as are the boundaries between the successive lower horizons. Colours in the subsoil horizon range from pale and light brown to brown.

The pH at the surface is approximately 6.5 and then quite abruptly changes in the subsoil to between 8.0 and 8.5. There are small amounts of gravel throughout the profile with the highest concentration closer to the surface.

The physical and chemical attributes of the SMU-3 soils to be disturbed are generally similar to those within the SMU-2 soils as described above.

3.6.1.3 Safeguards

WCM is conscious of the need to ensure all soil resources available on those areas to be disturbed in association with its mining activities are responsibly managed, are not eroded in either natural or stockpiled state, and are available for the rehabilitation of disturbed areas following final landform creation or when they are no long required for operational purposes.

In order to achieve these objectives, WCM has, with the assistance of GCNRC and Soil Services, developed procedures for the management of water, soils, ie stripping, stockpiling, replacement and reconciliation, and rehabilitation at the existing approved mine which have been proven to be effective. These procedures, which are described in the relevant approved management plans for the existing mine, would be extended to include and, as necessary, adapted for the proposed Canyon extension on the basis of the test work to be undertaken as part of the preparation of the MOP for the Canyon extension, with subsequent amendments introduced on the basis of monitoring and/or operational experience.

3.6.1.4 Impacts

The continuation and extension of existing procedures which have been proven to be successful in the management of the soil resource would ensure that the impact of WCM's planned extension of activities into the Canyon would have negligible impact on the soil resources both in the short and long-term.

3.6.2 Land Capability

3.6.2.1 Introduction

Land capability is defined as "the ability of land to accept a type and intensity of use permanently, or for specified periods under specific management, without permanent damage". It is an expression of the effect of biophysical land resources, including climate, on the ability of land to sustain use without damage under various uses. Land capability involves consideration of:

- the various land resource attributes;
- the production to be obtained from the land;

- the activities or inputs required to achieve that production;
- the risks of damage to the land resulting from those activities; and
- the inter-relations of the above.

The methods of land capability classification takes into account a range of factors including the local climate, soils, geology, geomorphology, soil erosion, topography and the effects of past land uses, but does not necessarily reflect the existing land uses. Rather, it indicates the potential of the land for such uses as crop production, pasture improvement and grazing.

The classification employed in NSW has a hierarchical sequence, ranging from Class I land, ie land with the greatest potential for agricultural or pastoral use, to Class VIII land, ie land which is entirely unsuitable for either. It is also worth noting that the classification recognises land that has been disturbed by past or current mining or quarrying activities.

A land capability assessment of the area incorporating the existing Whitehaven Coal Mine was undertaken by Geoff Cunningham Natural Resource Consultants Pty Ltd, as part of DA 72-03-2000 (GCCNRC 2000(a)). A preliminary review of GCNRC (2000(a)) was conducted by Geoff Cunningham Natural Resource Consultants in conjunction with the flora investigations undertaken during the planning for the Canyon extension and the outcomes presented on **Figure 3.4**. GCNRC has advised, however, that these outcomes may be subject to refinement on the basis of the detailed soil investigations to be undertaken as part of the MOP process (see Section 3.6.1.1). **Figure 3.4** shows that within the area of the proposed Canyon extension, the preliminary review indicates that the majority of the Canyon North area comprises Class III land, while the Canyon West area comprises Class II land.

Class III land comprises sloping land which is suitable for cropping on a rotational basis, but would require structural soil conservation such as graded banks, waterways and diversion banks, together with soil conservation practices such as conservation tillage and adequate crop rotation.

Class II land usually comprises gently sloping land suitable for a wide variety of agricultural uses but requires soil conservation practices such as strip cropping, conservation tillage and adequate crop rotation.

3.6.2.2 Safeguards

Based on the preliminary land capability assessment of the Canyon area, an estimated 28 ha Class II land would be disturbed to permit the Canyon extension to proceed, albeit that the land is currently excised from any form of agricultural activity and, in accordance with WCM's current planning, will be returned to a native vegetation community. Notwithstanding, WCM recognises the value attributed to high class lands and would return all confirmed pre-mining Class II land other than the 20 ha final void to a similar post-mining land capability classification.

Achievement of the Class II land capability on the appropriate areas of the post mining landform would be achieved primarily through the stripping and stockpiling of the soils from the Class II area (as defined by further assessment), creation of a post mining landform which is similar to that prior to mining and the subsequent replacement of the friable overburden, subsoil materials to the depths as stripped.

Given the westerly progression of mining within the Canyon West area, and the haulback system of mining, if ultimately required, the opportunity would also exist to develop an area of Class II land in the southern section of the Canyon North area similar to that lost by the creation of the final void, thereby resulting a minimal or nil net loss of the higher land capability areas on the Company's landholdings. Again, it should be noted that despite this commitment, it is WCM's intention that all areas affected by the Canyon extension be rehabilitated in a manner which encourages the re-establishment of bushland communities and the promotion of faunal habitat and corridor re-establishment.

3.6.2.3 Impacts

As noted in Section 3.5.2.2, the preliminary investigation suggests that the proposed Canyon extension could disturb an estimated 28 ha Class II land capability land and ultimately result in the reclassification of some 20 ha in the area of the final void. However, such disturbance would be ameliorated through the re-establishment of Class II land within the former Class II area and additional Class II land in areas currently defined as Class III land.

The creation of a water holding final void which would contain water of a quality which is suitable for agricultural purposes, would also offset any reduction in the actual extent of the higher class land through the provision of an extensive water resource.

3.7 FLORA

3.7.1 Introduction

A study of the flora within and surrounding the areas affected by the existing approved Whitehaven Coal Mine, including the area now incorporating the proposed Canyon extension, was undertaken by Geoff Cunningham Natural Resource Consultants Pty Ltd (GCNRC) during 1999 as part of investigations undertaken for DA 72-03-2000 and the results presented in GCNRC, 2000(b). Since that time, GCNRC has been retained as WCM's consultant botanist, developed the Flora and Fauna and Soil Stripping Management Plans, provided rehabilitation advice and undertaken the post-rehabilitation monitoring programmes.

In September 2003 and April 2004, GCNRC undertook a further detailed examination of the proposed Canyon extension and surrounding areas. The examination included stereoscopic photographic interpretation followed by field sampling at 18 sites. At each site, 20 m x 20 m quadrats were sampled and tree, shrub and ground layer species identified.

The following sub-sections present a summary of the findings of the study, proposed mitigation strategies and an assessment of the likely impact of the proposal. A full copy of the study report is presented in GCNRC (2004) which is included as **Appendix 3**.

3.7.2 Study Area Vegetation

3.7.2.1 Outline

GCNRC (2004) identified the following four vegetation communities within the study area as shown on **Figure 3.5** and described below.

- **Community 1** – Cleared – Cultivated / Uncultivated Pasture Lands
- **Community 2** – *Eucalyptus albens* [White Box] Community
- **Community 3** – *Eucalyptus crebra* [Narrow-leaf Ironbark] – *Eucalyptus melanophloia* [Silver-leaf Ironbark] – *Eucalyptus pilligaensis* [Pilliga Grey Box] – *Callitris glaucophylla* [White Cypress Pine] Community
- **Community 4** – *Eucalyptus populnea ssp. bimbil* [Bimble Box] – *Eucalyptus pilligaensis* [Pilliga Grey Box] Community.

A full list of species is presented in **Appendix 3**.

The following sub-sections identify the principal tree, shrub and ground layer species within each community as described in **Appendix 3**. An asterisk (*) represents an introduced species.

Much of the study area has, however, been highly modified from its original condition and habitat values as a consequence of previous clearing of tree and shrub cover, by invasion of introduced weed species and by past agricultural land use.

3.7.2.2 Community 1 – Cleared – Cultivated / Uncultivated Pasture Lands

"This community comprises level to undulating cleared and cultivated / uncultivated land. The area is generally treeless but some areas support scattered regeneration of *Callitris glaucophylla* [White Cypress Pine]. Shrubs of *Maireana microphylla* [Eastern Cottonbush] are present in a scattering over much of the area occupied by this community.

The main groundcover species recorded are *Aristida ramosa*. [Purple Wiregrass], *Austrostipa scabra* [Rough Speargrass], *Bothriochloa macra* [Red Grass], *Bracteantha bracteata* [Golden Everlastings], *Carthamus lanatus** [Saffron Thistle], *Chloris ventricosa* [Tall Chloris], *Hypochaeris radicata** [Flatweed], *Sclerolaena birchii* [Galvanised Burr], *Sonchus oleraceus** [Sowthistle], *Trifolium arvense** [Haresfoot Clover] and *Trifolium campestre** [Hop Clover]."

3.7.2.3 Community 2 – *Eucalyptus albens* [White Box] Community

"This community occurs over a limited area on an upper slope section of the Study Area adjacent to the former Vickery Mine site. The main tree species is *Eucalyptus albens* [White Box] although scattered *Eucalyptus populnea ssp. bimbil* [Bimble Box], *Eucalyptus crebra* [Narrow-leaf Ironbark], *Geijera parviflora* [Wilga] *and Callitris glaucophylla* [White Cypress Pine] [including regenerating seedlings / saplings]are present. Recorded shrubs include *Maireana microphylla* [Eastern Cottonbush] and *Eremophila debilis* [Amulla].

The main groundcover species recorded were *Anagallis arvensis** [Scarlet Pimpernell], *Aristida ramosa* [Purple Wiregrass], *Bothriochloa macra* [Red Grass], *Brunoniella australis* [Blue Trumpets], *Carthamus lanatus** [Saffron Thistle], *Chenopodium* sp. [Crumbweed], *Hedypnois rhagadioloides* ssp. *cretica** [Cretan Weed], *Lepidium africanum** [Peppercrss], *Scutellaria humilis* [Dwarf Skullcap] and *Wahlenbergia communis* [Tufted Bluebell]."

Community 2, though occurring within the area examined by GCNRC, lies outside the boundary of ML 1471 and the area of the proposed Canyon extension.

3.7.2.4 Community 3 – *Eucalyptus crebra* [Narrow-leaf Ironbark] – *Eucalyptus melanophloia* [Silver-leaf Ironbark] – *Eucalyptus pilligaensis* [Pilliga Grey Box] – *Callitris glaucophilla* [White Cypress Pine] Community

"The main tree species within this community are *Eucalyptus crebra* [Narrow-leaf Ironbark], *Eucalyptus melanophloia* [Silver-leaf Ironbark], *Eucalyptus pilligaensis* [Pilliga Grey Box] and *Callitris glaucophylla* [White Cypress Pine]. Other tree species include scattered *Allocasuarina luehmannii* [Bull Oak] and *Geijera parviflora* [Wilga]. Shrubs include *Acacia decora* [Western Golden Wattle], *Lycium ferocissimum** [African Boxthorn], *Eremophila debilis* [Amulla], *Maireana microphylla* [Eastern Cottonbush] and *Dodonaea viscosa* ssp. *spatulata* [Broad-leaf Hopbush].

The main groundcover species include *Anagallis arvensis** [Scarlet Pimpernell], *Aristida ramosa* [Purple Wiregrass], *Austrostipa scabra* [Rough Speargrass], *Bothriochloa macra* [Red Grass], *Bracteantha bracteata* [Golden Everlastings], *Calotis lappulacea* [Yellow Burr-daisy], *Daucus glochidiatus* [Australian Carrot], *Digitaria brownii* [Cotton Panic], *Echium plantagineum** [Paterson's Curse], *Eragrostis lacunaria* [Purple Lovegrass], *Hedypnois rhagadioloides* ssp. *cretica** [Cretan Weed], *Lepidium africanum** [Peppercress], *Medicago polymorpha** [Burr Medic], *Scutellaria humilis* [Dwarf Skullcap], *Sida corrugata* [Corrugated Sida], *Sida cunninghamii* [Hill Sida] and *Vittadinia* sp. [Fuzzweed]."

3.7.2.5 Community 4 – *Eucalyptus populnea ssp. bimbil* [Bimble Box] – *Eucalyptus pilligaensis* [Pilliga Grey Box] Community

"This community occurs on generally lower and more level sections of the Study Area. The main tree species are *Eucalyptus populnea* ssp. *bimbil* [Bimble Box] and *Eucalyptus pilligaensis* [Pilliga Grey Box]. Other tree species recorded include *Callitris glaucophylla* [White Cypress Pine], *Alectryon oleifolius* [Rosewood], *Geijera parviflora* [Wilga],

Shrubs recorded include *Eremophila debilis* [Amulla], *Maireana microphylla* [Eastern Cottonbush], *Eremophila mitchellii* [Budda], *Acacia oswaldii* [Miljee], *Senna artemisioides* ssp. [Punty Bush], *Acacia homalophylla* [Yarran] and *Lycium ferocissimum** [African Boxthorn]. The vine, *Parsonsia eucalyptophylla* [Gargaloo], is also present.

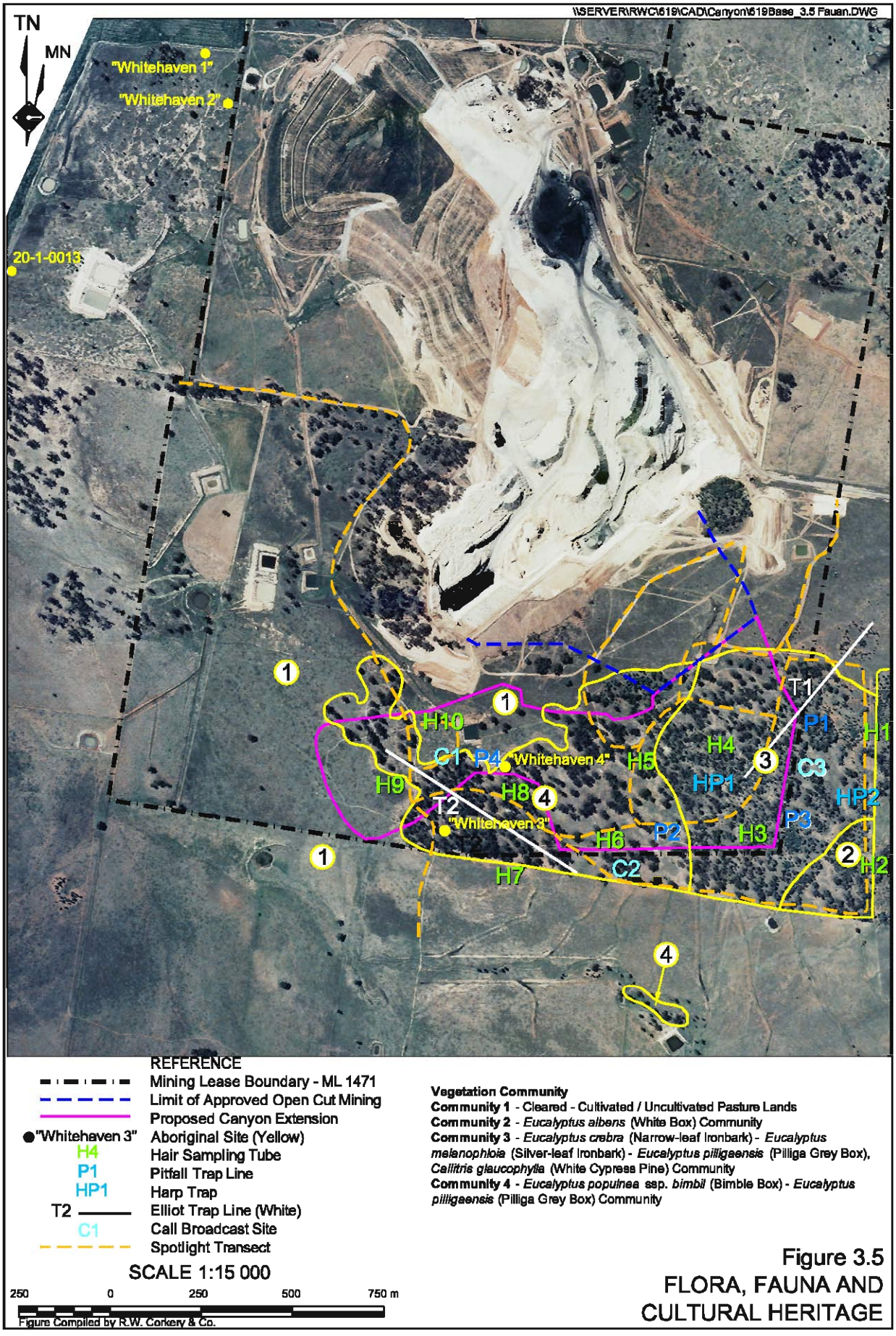


Figure 3.5
FLORA, FAUNA AND CULTURAL HERITAGE

The main groundcover species include *Aristida ramosa* [Purple Wiregrass], *Austrostipa scabra* [Rough Speargrass], *Bothriochloa macra* [Red Grass], *Bracteantha bracteata* [Golden Everlastings], *Calotis lappulacea* [Yellow Burr-daisy], *Enteropogon acicularis* [Curly Windmill Grass], *Eragrostis* sp. [Lovegrass], *Hedypnois rhagadioloides* ssp. *cretica** [Cretan Weed], *Medicago minima** [Small Woolly Burr Medic], *Medicago polymorpha** [Burr Medic], *Sclerolaena birchii* [Galvanised Burr], *Sporobolus caroli* [Fairy Grass] and *Vittadinia* sp. [Fuzzweed]."

3.7.2.6 Noxious Weeds

As noted in Section 3.7.2, GCNRC (2004) observed that the groundcover within the area surveyed has been invaded by introduced weed and pasture species, both in cropped area and areas of remnant native vegetation. Of these, African Boxthorn [*Lycium ferocissimum*]* [W3], Galvanised Burr [*Sclerolaena birchii*] [W2], Bathurst Burr [X*anthium spinosum*]* [W3], Paterson's Curse [*Echium plantagineum*]* [W3] and Prickly Pear [*Opuntia stricta*]* [W4f] were present at some sites.

All of these species are listed as being noxious for Gunnedah Shire on the NSW Department of Primary Industries [Agriculture] Website.

The noxious weed codes identified above are as follows:

- W2 - The weed must be fully and continuously suppressed and destroyed.
- W3 - The weed must be prevented from spreading and its numbers and distribution reduced.
- W4f - The weed must not be sold, propagated or knowingly distributed. Any biological control or other control program directed by the local control authority must be implemented.

3.7.2.7 Threatened Species Issues

Threatened Species Conservation Act, 1995
A review of the Vulnerable and Endangered flora species, Endangered Ecological Communities, Endangered Population and Critical Habitat listings within the DEC's "Atlas of NSW Wildlife" database for the Boggabri 1:100000 scale map sheet area identified the following.

(vi) Four records of Threatened flora species for the search area, each relating to *Hakea pulvinifera*, a species that is found only near Keepit Dam.

(vii) Nine species predicted by the BIOCLIM model as likely / possibly occurring, namely:

Bothriochloa biloba
Cadellia pentastylis
Calotis glandulosa
Dichanthium setosum
Goodenia macbarronii

Hakea pulvinifera
Philotheca ericifolia
Swainsona murrayana
Thesium australe

It is noted, however, that *B.biloba* is no longer listed on the Schedules of the Threatened Species Conservation Act, 1995.

(viii) Seven Endangered Ecological Communities as being recorded or predicted to occur, namely:

- Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregions.
- Coolibah and Black Box Woodland of the northern riverine plains in the Darling Riverine Plains and Brigalow Belt South Bioregions.
- Howell Shrublands in the Northern Tablelands and Nandewar Bioregions.
- McKies Stringybark / Blackbutt Open Forest in the Nandewar and New England Tableland Bioregions.
- Native Vegetation on Cracking Clay Soils of the Liverpool Plains.
- Semi-evergreen Vine Ticket in the Brigalow Belt South and Nandewar Bioregions
- White Box Yellow Box Blakely's Red Gum Woodland.

(ix) No Endangered Flora Populations nor any Critical Habitat.

The likelihood of occurrence of each of the species identified in (i) and (ii) above within the Canyon Extension Study Area is discussed in **Appendix 3** and summarized in **Table 3.2**.

Commonwealth Environment Protection and Biodiversity Conservation Act, 1999
A review of the Threatened Flora and Threatened Ecological Communities listings within the Environment Australia Database for a radius of 30km of the Canyon extension ("the search area") identified:

(i) Nine Threatened flora species as recorded or likely to occur within the search area, namely:

Cadellia pentastylis
Digitaria porrecta
Diuris sheaffiana
Goodenia macbarronii
Homopholis belsonii
Philotheca ericifolia
Pterostylis cobarensis
Thesium australe
Tylophora linearis.

(ii) One Threatened Ecological Community – the Grassy White Box Woodland – as recorded or likely to occur within or around the search area. This community, which equates to the White Box Yellow Box Blakely's Red Gum Endangered Ecological Community was identified within the area surveyed but outside ML 1471 and the area of the proposed Canyon extension.

(iii) No World Heritage Properties and no Wetlands of International Significance.

The likelihood of the occurrence of each of the species identified in (a) above within the Canyon Extension Study Area is discussed in **Appendix 3** and summarized in **Table 3.2**.

ROTAP GCNRC (2004) includes a list of 29 species recorded from the region, none of which were recorded from the Study Area.

Table 3.2
Assessment of Likelihood of Occurrence of Threatened Flora Species

Species	Listing	Likelihood of Occurrence	Habitat Sustainability	Found During Survey	Presence in Study Area
Bothriochloa biloba	TSC (now deleted)	Possible	Yes	No	No
Cadellia pentastylis	TSC, EPBC	Possible	Possible	No	No
Calotis glandulosa	TSC	Possible	Yes	No	No
Dichanthium setosum	TSC	Possible	Yes	No	No
Digitaria porrecta	EPBC	Possible	Yes	No	No
Goodeniz macbarronii	TSC, EPBC	No likely	No	No	No
Hakea pulvinifera	TSC	Not likely	No	No	No
Homopholis belsonii	EPBC	Possible	Possible	No	No
Philotheca ericifolia	TSC, EPBC	Not likely	No	No	No
Pterostylis cobarensis	EPBC	Not likely	No	No	No
Swainsona murrayana	TSC	Possible	Possible	No	No
Thesium australe	TSC, EPBC	Possible	Possible	No	No
Tylophora linearis	EPBC	Possible	Possible	No	No

Note TSC = Threatened Species Conservation Act
EPBC = Commonwealth Environment Protection and Biodiversity Conservation Act

On the basis of the investigations undertaken, GCNRC (2004) concluded:

(i) There are no records of threatened plant species contained in the 'Atlas of NSW Wildlife' database for study area.

(ii) No Threatened [TSC Act] plant species have been previously recorded from the study area and none were recorded during the field survey.

(iii) No Threatened [EPBC Act] plant species have been previously recorded from the study area and none were recorded during the field survey.

(iv) Despite predictions and records that indicated that a number of Threatened flora species might be likely to occur at the site, none of these was recorded.

(v) Some of the study area has been cleared for cultivation while the remainder has been grazed in the past.

(vi) There are no occurrences within the study area of any of the Endangered Plant Populations listed in the Schedules of the TSC Act or under the EPBC Act.

(vii) One Endangered Ecological Community only occurs within the Study Area. This community, the White Box Yellow Box Blakely's Red Gum Woodland [TSC Act] / Grassy White Box Woodlands [EPBC Act] Endangered Ecological Community, is located outside WCM's mining lease and the area of proposed disturbance. As a consequence, there will not be a significant area of known habitat affected by the proposed development.

(viii) There is no critical habitat listed for the study area or its environs.

(ix) There are no ROTAP species recorded for the study area.

3.7.3 Safeguards

WCM would implement a range of safeguards in order to minimize any potential adverse impacts on local flora. The nominated safeguards, which include those recommended in GCNRC (2004), represent an extension of those measures currently undertaken at the existing mine and would, together with the additional safeguards identified in Section 3.8.4 which pertain more closely to fauna impact minimization:

- limit the short-term impact of the proposed Canyon extension; and
- provide increased areas of native bushland beyond the life of the mine.

The proposed safeguards include:

(i) Minimize the extent of clearing undertaken consistent with operational requirements.

(ii) Undertake clearing and soil stripping in campaigns on an as-needs basis.

(iii) Employ preferential direct transferral of soil and biomass. It is noted that at the existing mine, minimal topsoil stockpiling is now undertaken.

(iv) Stockpile soil (ie topsoil, subsoil and friable overburden) in accordance with the existing approved Soil Stripping and Management Plan.

(v) Plant seedlings on the post-mining landform in mixes which emulate those prior to clearing and using locally-collected seed.

(vi) Protect seedlings from grazing by animals including stock, kangaroos, rabbits and hares.

(vii) Implement control programmes for rabbits and other feral animals.

3.7.4 Impacts

The proposed Canyon extension to the existing Whitehaven Coal Mine as identified within this SoEE would necessitate the removal of vegetation from approximately 46 ha within the footprint of the proposed open cut, comprising:

- approximately 11.3 ha Community 1 (Cleared – Cultivated / Uncultivated Pasture Lands);
- approximately 15.3 ha Community 3 (*Eucalyptus crebra* [Narrow-leaf Ironbark] – *Eucalyptus melanophloia* [Silver-leaf Ironbark] – *Eucalyptus pilligaensis* [Pilliga Grey Box] – *Callitris glaucophylla* [White Cypress Pine] Community; and
- approximately 19.4 ha Community 4 (*Eucalyptus populnea ssp. bimbil* [Bimble Box] – *Eucalyptus pilligaensis* [Pilliga Grey Box] Community.

An additional 4 ha of Community 1 would be disturbed to enable the relocation of site facilities.

No area of Community 2, the Threatened White Box Yellow Box Blakely's Red Gum Community would be affected.

In view of the outcomes of the survey, the extended implementation of existing proven procedures into the Canyon extension operations and the adoption of the other safeguards identified in Section 3.7.3, GCNRC (2004) concluded that there would be no significant impact on Threatened flora species, Endangered Ecological Communities, Endangered Flora Populations or Critical Habitat as a consequence of the proposed development. GCNRC (2004) also noted that: "in view of the lack of any significant impact on Threatened flora species, Endangered Ecological Communities, Endangered Flora Populations, a Species Impact Statement [TSC Act] or Referral [EPBC Act] will not be required."

An 8-part list which supports this conclusion is presented in GCNRC (2004) – **Appendix 3.**

3.8 FAUNA

3.8.1 Introduction

A study of the fauna within and surrounding the proposed Canyon extension was undertaken by Countrywide Ecological Service (CES) in July 2003 and Autumn 2004 and supplemented work undertaken by that consultancy in 1999 (as part of DA 72-03-2000) and observations during pre-clearing inspections undertaken since that time. CES has been retained as WCM's fauna consultant throughout the life of the mine to date and, in that role, has been involved in the development of the flora and fauna management strategies and documentation for the mine.

CES (2004) – **Appendix 4** identified three principal habitat types within and surrounding the proposed Canyon extension, namely:

1. Open Woodland;
2. Cleared Paddocks (with scattered trees); and
3. Wetlands (man-made dams).

In order to identify all protected fauna living in or utilizing the Canyon area and surrounds, the following sampling methods were employed in Habitats 1 and 2.

- Pitfall traplines and tube traps – amphibians, small mammals and reptiles.
- Call identification, broadcasts and general observations – birds.
- Elliott small mammal traps – small mammals.
- Hair tubes – small, medium, large and trap-shy mammals.
- Anabat ultrasonic recordings – microbats.
- Spotlight searches – nocturnal species and arboreal mammals.
- Call broadcasting – mammals.
- Targetted searches – reptiles.
- Signs and body, eg bone, tissue, hair remains searches – mammals.

Further details on the sampling techniques applied are provided in **Appendix 4**.

Sampling locations are presented on **Figure 3.5**.

3.8.2 Regional Fauna

A checklist of the fauna of the Boggabri 1:100000 topographic sheet prepared from the "Atlas of NSW Wildlife" database and other published and unpublished sources identified 18 species of frog (none Threatened); some 225 bird species (including two listed as Endangered and 8 listed as Vulnerable); 54 mammal species (including seven listed as Endangered – presumed extinct, 1 species listed as Endangered and 9 species listed as Vulnerable) and 47 reptile species (including 1 Vulnerable species). CES (2004) also noted that three additional Vulnerable species had been identified by the author in this and previous work undertaken in the local area.

A search of Commonwealth listed Threatened species, international agreement listed species, Threatened populations and ecological communities and key threatening processes in the Environment Australia on-line database also identified:

- one Threatened ecological community (the Grassy White Box Community – see Section 3.7.2.7;
- four Threatened bird species (two Endangered and two Vulnerable, including one species also listed under the TSC Act);
- three Threatened mammal species (two Vulnerable; one Endangered, all of which are listed under the TSC Act);

- two Threatened reptile species (both Vulnerable, including one listed in the TSC Act);
- one Threatened (Vulnerable) fish species (also listed under the TSC Act);
- five terrestrial and wetland species covered by the migratory provisions of the EPBC Act 1999; and
- five listed marine species.

There are no World Heritage properties, National Heritage places, Ramsar sites or Critical Habitats within 10 km of the proposed Canyon extension.

A listing of all Threatened species is presented in CES (2004) – **Appendix 4**.

3.8.3 Survey Results

Table 3.3 identifies the regional occurrence and numbers of amphibian, bird, mammal (excluding bat), bat and reptile species observed in or near the Canyon fauna survey area and lists those identified as Threatened under the TSC Act 1995 or EPBC Act 1999.

Table 3.3
Fauna Species Occurrence

Fauna Grouping	Regional Occurrence (Number)	Species Identified in Fauna Survey Area	Threatened Species	Status V=Vulnerable E=Endangered	Comment
Amphibians	18	5	Nil		
Birds	(at least) 225	41 (including 1 exotic species)	Grey Falcon	V	Recorded outside Survey Area but within 10 km.
			Glossy Black Cockatoo	V	Recorded once as a flyover in sight distance of the survey area.
			Grey Crowned Babbler	V	Four nests and a breeding family of up to 14 individuals located on or within sight distance of the survey area. One nest within Canyon extension; three within 50m.
Mammals	54	8 (including 3 exotic species)			
Bats		10	Yellow-bellied Sheathtail Bat	V	No roosting pulse recorded.
Reptiles	47	5	Nil		

Despite active searching and the use of recorded calls to invoke a response, no Koala nor signs of Koala were encountered during the surveys. Furthermore, other than a single transient male Koala identified at the mine as part of a pre-clearing inspection, there is no historical evidence of Koala in the local area. CES therefore concluded that although the area may constitute potential Koala habitat, it does not constitute core habitat.

3.8.4 Safeguards

In order to minimize or ameliorate any potential adverse impacts on fauna in general, and in particular, any listed Threatened species that may occur in the area of the proposed Canyon extension, WCM would adopt the following safeguards a recommended by CES. It is noted that the majority of safeguards are currently implemented at the existing mine.

(i) Where possible, tree removal, especially the mature trees, would be carried out in late spring and early autumn to avoid spring nesting birds and over-wintering bats.

(ii) Pre-clearing inspections of mature trees for nesting birds and roosting bats would be conducted when mature trees are to be removed.

(iii) Where possible, nesting and roosting hollows, and the nests used by listed threatened species, would be relocated to appropriate locations nearby.

(iv) No less than 50% in volume of felled and fallen timber and logs (notwithstanding their suitability for farm use and firewood) would be left on the ground.

(v) No fallen timber, stags, logs or vegetation debris (other than tree stumps) from any vegetation clearing for the proposed mining activity would be buried or burned.

(vi) Post-mining rehabilitation would commence as soon as practicable with the improvement of the connectivity of the wildlife corridor along Hoads Lane being the main priority.

(vii) A suitable vertebrate pest control program would be included as part of the mining operation and management plan in order to minimise the impact of species that have been listed as key threatening processes.

(viii) With the exception of a small area adjacent to the south-western lease boundary as shown on **Figure 2.4**, areas within the mining lease (outside cultivated areas) that are not directly affected by the proposed extension would remain free from grazing by domestic stock.

(ix) The local population of Grey-crowned Babblers would be monitored, at least annually, to determine the impact of the proposed extension on their behaviour.

3.8.5 Impacts

A discussion of the likely impact of the proposed Canyon extension on Threatened species is presented in **Appendix 4**, including:

- 8-point tests of significance for each of the Vulnerable species identified during the surveys or assessed as potentially occurring within the survey area due to the habitat quality and types present, ie for the Yellow-bellied Sheathtail Bat, Turquoise Parrot, Grey Falcon and Grey-crowned Babbler. With respect to the Grey-crowned Babbler in particular, CES (2004) noted that the habitat patch quality around the Whitehaven Coal Mine has improved as a consequence of WCM's land management practices including stock exclusion and the sensitive use of felled and fallen timber, and the numbers of this species have increased since 1999, despite the presence of the mining activity;
- considerations relating to EPBC Act;
- Native Vegetation Conservation; and
- the principles of Ecologically Sustainable Development.

As a consequence of these assessments, CES (2004) concluded that the proposed Canyon extension is:

(i) unlikely to significantly affect any of the listed threatened species, fauna populations or communities;

(ii) unlikely to augment or significantly contribute to any of the Commonwealth or State listed key threatening processes in the long term;

(iii) unlikely to significantly affect any Ramsar wetland or any CAMBA or JAMBA listed species;

(iv) unlikely to significantly affect any core or potential Koala habitat; and

(v) consistent with ESD principles with regards to fauna and will not adversely affect the local biodiversity.

CES (2004) is therefore of the opinion that the proposed mine extension should not be considered to constitute a controlled action and no SIS should be warranted. CES (2004) also consider that the proposal is unlikely to affect Koalas and hence no Koala Habitat Management Plan should be required.

3.9 CULTURAL HERITAGE

3.9.1 Introduction

An assessment of the Cultural Heritage of an area incorporating all of ML 1471 (including the proposed Canyon extension) was undertaken by Archaeological Surveys and Reports Pty Ltd (AS&R) as part of DA 72-03-200, with three sites (Whitehaven 1, 2 and 3) identified as discussed in Section 1.7.9.1 and shown on **Figure 3.5**. A further site, No 24-4-0013 (**Figure 3.5)** was previously identified in the MINARC (now AHIMS) database. The results of that survey are presented in AS&R (1999).

Due to the time that had elapsed since the prior survey, AS&R were commissioned to undertake a further archaeological investigation of the proposed Canyon extension with representatives of the Red Chief Local Aboriginal Land Council in order to identify any sites and relics that might be present.

The assessment included:

- an examination of the AHIMS database;
- liaison with Red Chief Local Aboriginal Land Council;
- a review of relevant studies undertaken in the local area; and
- a detailed survey to investigate the occurrence and significance of any Aboriginal Cultural material.

The field survey methodology and effectiveness, together with results of the investigation and a significance assessment are presented in AS&R (2004) – **Appendix 5**, and are summarized below.

3.9.2 Field Survey

In order to design a field survey, a predictive model for possible archaeological site location was first developed to enable the survey to observe and record sufficient of the archaeological record present that it could be considered representative of the Survey Area.

Factors considered in the design of the field survey included:

- the likelihood, specific location and frequency of Aboriginal use of the area. This aspect is determined by the richness of resources such as water, food, stone material resources, shelter, etc and the proximity to mythological natural features, and factors such as seasonal accessibility;
- the degree to which evidence was likely to be observable. This in turn is affected by the durability of likely artefactual evidence and the extent of post-European land use; and
- the recognition that the majority of sites identified throughout Australia previously, have been stone artefacts located:
  - (i) on or adjacent to sedimentary deposits containing quartz, quartzite, jasper, silcrete, chert, chalcedony, metamorphosed greywacke, and other siliceous sedimentary rocks, or redeposited fine-grained volcanics; or
  - (ii) on river banks or adjacent to river banks where the watercourse contains river pebbles of quartz, quartzite, jasper, silcrete, chert, fine-grained volcanics, basalt, etc, and particularly, at the junctions of watercourses; or
  - (iii) on ridges and spurs overlooking water courses or on high vantage points affording uninterrupted views of swamps, waterholes, saddles, passes and any other likely access path into the observer's area; or
  - (iv) in the vicinity of outcrops of suitable raw materials for tool production, etc such as igneous rocks.

Because the Survey Area was quite small, it was determined that a full survey of the area could be undertaken. The survey was performed entirely on foot by John Appleton (AS&R) with the assistance of Messrs Les Field and Gary Griffiths (Sites Officers for the Red Chief LALC) under conditions assessed as ideal for observing any artefactual material present and observable, and included written and photographic recording of observations regarding the topography, vegetation cover and conditions.

3.9.3 Results

The survey identified a single isolated site additional to the previously identified scarred tree referred to as "Whitehaven 3". The location of the additional site, an isolated artefact referred to as "Whitehaven 4", together with all previously located or known sites within the vicinity of the Whitehaven Coal Mine, is shown on **Figure 3.5**.

No post-European features of significance occur within the proposed Canyon extension.

3.9.4 Significance and Recommendations

The Aboriginal or cultural significance of Aboriginal relics and sites can only be assessed by the Aboriginal community, and in particular, the Elders. Accordingly, it is the responsibility of the archaeologist to ensure that the Elders, or elected representatives of the Aboriginal community are advised of the survey results, and are consulted as to their knowledge and opinion of the significance of the area, and to transcribe and present those expressions in report form.

In the case of site "Whitehaven 4", both Messrs Field and Griffiths, experienced Aboriginal Sites Officers, considered the flake fragment to be insignificant and did not pose a constraint to the proposed Canyon extension. Following the investigation, both men provisionally recommended that the site could be destroyed under Consent to Destroy, providing the site was recorded on the AHIMS site register.

Correspondence was subsequently received from Red Chief LALC setting out their comments and recommendations, which confirmed the provisional recommendations of the Sites Officers, namely:

"
- To support the development application by Whitehaven Mine.
- To support the recommendations and report compiled by John Appleton (Archaeologist).
- To support an application for consent to destroy from NPWS (Department of Environment and Conservation).
- That Whitehaven have monitors on site when doing ground disturbance work.
- If during development, any other artefacts or items are unearthed, work should cease and Red Chief LALC be notified."

A copy of the correspondence is included in AS&R (2004).

The site, and the survey area as a whole, was also assessed to be of low research potential.

With respect to the recommendation identified above:

(i) a consent to destroy site "Whitehaven 4" was lodged with DEC (NPWS) and was approved on 06 December 2004 (Consent # : 2051); and

(ii) the recommendation for monitor presence during ground disturbance work within the Canyon area represents an extension of an existing procedure in place at the Whitehaven Mine which is supported by WCM.

Additionally, prior to the commencement of activities within the Canyon extension, WCM would permanently fence Site "Whitehaven 3" in order to prevent accidental visitation or damage to the site and assign the fenced area with a "no go" status. Signs to this effect would be placed on the fence and all employees would be advised of the presence of the site and their obligations with respect to its management and preservation.

3.10 LAND OWNERSHIP, RESIDENTIAL PROXIMITY AND LAND USE

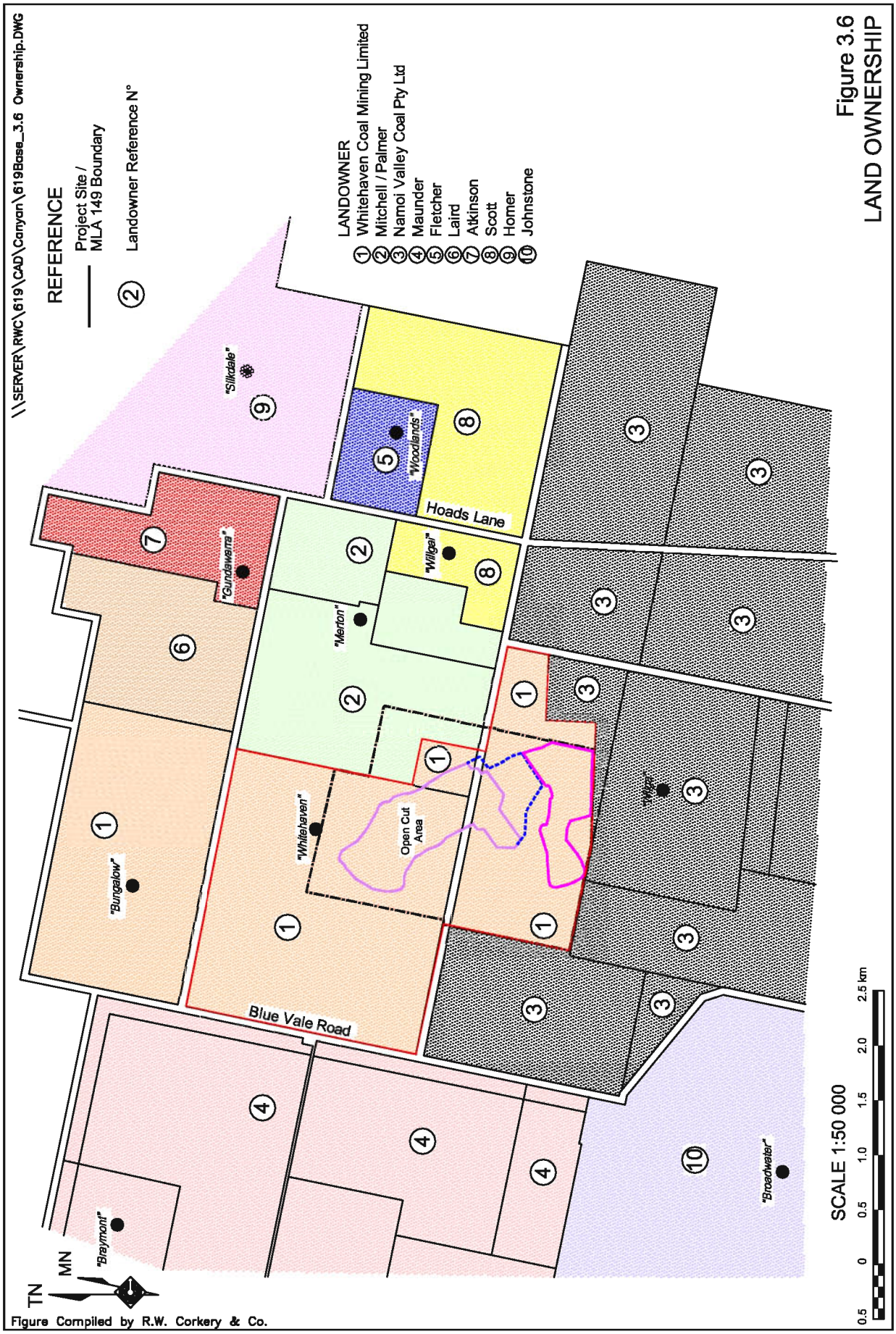
3.10.1 Description

Land ownership in the vicinity of the existing Whitehaven Coal Mine, the proposed Canyon extension and along the private mine access road to Hoads Lane is shown on **Figure 3.6**.

Figure 3.6 also identifies the residences in the vicinity of the existing mine and proposed Canyon extension while **Table 3.4** identifies the minimum distance between each residence and the nearest point of both the existing approved activities and those within the proposed Canyon extension.

Table 3.4
Residential Proximity

RESIDENCE (see Figure 3.6)	STATUS P = Project Related NP = Non-project-related	DISTANCE TO		
		Closest limit of existing approved activity (m)	Nearest current mining or processing activity (m)	Closest limit of proposed Canyon extension (m)
Whitehaven	P	300	800	2100
Merton	P	1650	1650	2000
Willgai	NP	1700	1700	1900
Gundawarra	NP	2500	2600	3100
Woodlands	NP	3100	3100	3200
Silkdale	NP	4100	4100	4400
Bungalow	P	1900	2500	3800
Braymont	NP	4000	4600	5000
Wilga	P	1100	1350	650
Blue Vale	P	2350	2350	1800
Broadwater	NP	3800	3800	3300


\\SERVER\RWC\619\CAD\Canyon\619Base_3.6 Ownership.DWG
REFERENCE
Project Site / MLA 149 Boundary
Landowner Reference N°
LANDOWNER
1 Whitehaven Coal Mining Limited
2 Mitchell / Palmer
3 Namoi Valley Coal Pty Ltd
4 Maunder
5 Fletcher
6 Laird
7 Atkinson
8 Scott
9 Homer
10 Johnstone
Figure 3.6
LAND OWNERSHIP
"Silkdale"
"Woodlands"
Hoads Lane
"Gundawarra"
"Merton"
"Willga"
"Bungalow"
"Whitehaven"
Open Cut Area
"Hillgrove"
Blue Vale Road
"Braymont"
"Broadwater"
TN
MN
SCALE 1:50 000
0.5 0 0.5 1.0 1.5 2.0 2.5 km
Figure Compiled by R.W. Corkery & Co.

A review of **Figure 3.6** and **Table 3.4** shows:

- The proposed Canyon extension to lie within and be surrounded by land owned by WCM and/or Namoi Valley Coal Pty Ltd (Coal and Allied).
- With the exception of the project-related "Wilga", "Blue Vale" residences and the "Broadwater" residence, the nearest activities within the Canyon extension to each of the residences in the vicinity of the mine will be greater than that from the closest point of existing mining activity to date.
- Although the "Broadwater" residence is approximately 500m closer to the nearest area of activity within the proposed Canyon extension, that residence at 3300 m, is topographically shielded by an elevated ridgeline of approximately 40m relief located approximately 1km to its north-east.

Land uses within the various properties comprising and surrounding ML 1471 are as follows:

- "Whitehaven" – cereal / fodder cropping in rotation with sheep production principally in areas external to ML 1471.
- "Merton" – cattle grazing.
- "Womboola" – formerly used for cattle grazing but now, with the exception of limited grazing at its south-westernmost extent, is excluded from all agricultural activities.
- "Wilga" – formerly used for cattle grazing and cropping but now essentially fallow.
- "Willgai" – rural / residential with limited cattle and fodder crop production.
- "Bungalow" – cattle grazing.
- "Gundawarra" – primarily rural / residential with newly established agro-forestry.
- "Braymont" – cattle grazing and fodder production.
- "Silkdale" – primarily rural / residential with miniature ponies.
- "Broadwater" – cattle grazing and mixed cropping.

No agricultural land in the vicinity of the mine is used for purposes which may be considered sensitive to mining or mining-related impacts.

3.10.2 Safeguards and Potential Impacts

The potential impacts of the proposed Canyon extension on landowners, residents and land users would remain unchanged from those currently associated with the existing mine and primarily relate to air quality, noise, blasting, groundwater and visibility issues, each of which is addressed elsewhere in this SoEE.

3.11 NOISE

3.11.1 Introduction

The noise climate in the vicinity of the existing Whitehaven Coal Mine is typically influenced by rural activities such as ploughing, harvesting, trucking of rural products, stock, insects, birds, wind through vegetation, etc as well as mining activities and equipment, with the extent of the mine's contribution determined primarily by the distance from the mining activities to the receiver and prevailing meteorological conditions and the time of day.

Potential noise generating activities associated with the proposed Canyon extension would not be altered from those currently undertaken at the existing mine and would include:

- vegetation removal;
- soil stripping;
- drilling and blasting;
- overburden and interburden pushing, excavation and transportation;
- on-site coal transportation and processing;
- transportation of product coal between the mine site and the Whitehaven CHPP.

The following sub-sections present the noise criteria relevant to the proposed Canyon extension; the design and operational safeguards and management procedures to be employed to meet the criteria; the predicted noise levels under a range of operational scenarios and an assessment of the likely impacts of the proposal.

The approach to predicting future noise levels and assessing their impacts has been drawn from the results of a comprehensive noise assessment conducted by Richard Heggie Associates Pty Ltd (RHA), specialist consultants, whose report is presented in **Appendix 6** and referred to hereafter as RHA (2004(a))**.**

The responsibility for the control of noise emissions in New South Wales is vested in local government and the Department of Environment and Conservation (DEC). The DEC (as the former Environment Protection Authority or EPA) released an Industrial Noise Policy (INP) in December 1999 that provides a framework and process for deriving noise criteria for development consents and licences that would enable the EPA to regulate premises that are scheduled under the *Protection of the Environment Operations Act 1997* (POEO Act). The existing Whitehaven Mine, including the area of the proposed Canyon extension, is a scheduled premises and is licenced under that Act (Environment Protection Licence No. 10094).

The specific policy objectives are to:

- establish noise criteria that would protect the community from excessive intrusive noise and preserve amenity for specific land uses;
- use the criteria as the basis for deriving project-specific noise levels;
- promote uniform methods to estimate and measure noise impacts, including a procedure for evaluating meteorological effects;

- outline a range of mitigation measures that could be used to minimise noise impacts;
- provide a formal process to guide the determination of feasible and reasonable noise limits for consents or licences that reconcile noise impacts with the economic, social and environmental considerations of industrial development; and
- carry out functions relating to the prevention, minimisation and control of noise from premises scheduled under the POEO Act.

The DEC also relies upon its policy entitled "Environmental Criteria for Road Traffic Noise" and relevant sections of the Environmental Noise Control Manual to assess the acceptability of projects.

3.11.2 Noise Emission Criteria

3.11.2.1 Intrusiveness and Amenity Criteria

The INP identifies two separate noise criteria to meet environmental noise objectives, one to account for intrusive noise and the other to protect the amenity of a particular land use.

For the proposed Canyon extension to the Whitehaven Coal Mine, the intrusiveness criterion requires that the equivalent continuous noise level (L_{Aeq}) should not be more than five decibels (dB(A)) above the background level. In accordance with previous assessments for the existing Whitehaven Coal Mine, the minimum allowable Assessment Background Level (ABL) as per the INP of 30 dB(A) has been adopted for the proposed Canyon extension, giving a resultant project specific noise goal at each residential receiver being 35 dB(A) $L_{Aeq\ (15\ minute)}$ for day, evening and night-time periods.

Table 3.5 presents the amenity criteria for residences in a predominantly rural environment such as exists around the existing Whitehaven Coal Mine and the proposed Canyon extension.

Table 3.5
Amenity Criteria for Noise Assessment (dB(A))

Type of Receiver	Time of Day	Recommended Limit (L_{Aeq})	
		Acceptable	Maximum
Residence in rural environment	Day-time	50	55
	Evening	45	50
	Night-time	40	45

In most cases where the INP project specific assessment criteria are not achieved, it does not automatically follow that all people would find the noise unacceptable and, in subjective terms, exceedance can generally be described as:

- negligible – where the exceedance is <1 dB(A) (not discernible);
- marginal – where the exceedance is 1 dB(A) to 2 dB(A) (not noticeable by most people);

- moderate – where the exceedance is 3 dB(A) to 5 dB(A) (not noticeable by some people but may be noticeable by others); and
- appreciable – where the exceedance is >5 dB(A) (noticeable by most people).

3.11.2.2 Sleep Disturbance Criteria

Sleep disturbance criteria need also to be considered. To avoid sleep disturbance, the DEC recommends that the L_{A1} of the noise source under consideration should not exceed the background noise level by 15 dB(A) during night-time periods, ie 10.00 pm to 7.00 am. The project specific sleep disturbance noise goal at all residential receivers in the vicinity of the proposed Canyon extension is therefore 45 dB(A) $L_{A\ (1\ minute)}$.

3.11.2.3 Road Traffic Noise Criteria

Road traffic noise is assessed in accordance with the EPA's 1999 document entitled "Environmental Criteria for Road Traffic Noise" (ECRTN), whereby differing noise criteria are set down for defining noise impacts from different road classifications. For the roads used for the haulage of coal from the existing Whitehaven Coal Mine, ie collector roads, the relevant criteria are:

- the $L_{Aeq\ (1\ hour)}$ day-time noise level should not exceed 60 dB(A); and
- the $L_{Aeq\ (1\ hour)}$ night-time noise level should not exceed 55 dB(A).

However, in both cases, where the criteria are already exceeded or where the existing noise levels are within 2 dB(A) of the criteria, traffic arising from the development should not lead to an increase in the existing noise levels by more than 2 dB(A).

Given that the coal from the proposed Canyon extension would utilize the same road network, the same criteria apply.

3.11.3 Noise Mitigation Measures

WCM currently employs a range of noise management and propagation path controls at the existing approved mine and in association with its coal transportation activity which have been shown to be effective in the minimization of noise emissions (see Section 1.7.4.2). As appropriate, each of these measures would be continued for the operations within the Canyon area.

In addition to existing measures, the following controls and/or features of the proposed Canyon extension would further reduce any potential for adverse impacts on the local noise climate.

- Construction of a minimum 5 m high acoustic barrier along the eastern margin of the relocated ROM pad and coal processing area.

- Positioning the relocated coal bin to the south of the ROM pad / coal processing area, thereby affording additional (topographic) shielding to residences from the south clockwise through to the north-east. Relocation of the coal bin would also reduce the distance product coal transportation vehicles are required to travel on unsealed roads.
- Limiting the elevation at which overburden / interburden disposal is undertaken. A review of **Figure 2.3** shows that for the majority of Canyon mining activities, overburden and interburden transportation and emplacement activities would be undertaken at or below the adjacent natural landform.
- The progression of mining activities away from the nearest potentially affected non-project related residences.

3.11.4 Assessment of Impacts

3.11.4.1 Introduction

In order to determine the acoustical impact of the proposed Canyon extension activities, a computer model was developed by RHA incorporating the significant proposed noise sources and the intervening terrain to the nearby potentially affected residential receivers. The "Whitehaven" Computer Model was prepared using "ENM", a commercial software system developed in conjunction with the NSW Environment Protection Authority, and recognized by the Australian and New Zealand Environment and Conservation Council and all State environmental authorities throughout Australia as representing one of the most appropriate predictive methodologies currently available.

For the purpose of predicting the noise emission levels during the proposed operations, the following three operational scenarios were assessed.

Scenario 1 – representing mining operations from mid 2006 to early 2007;

Scenario 2 – representing mining operations from early 2007 to late 2007; and

Scenario 3 – representing mining operations from late 2007 to late 2008.

Figures 2.3 (a), (b) and **(c)** represent the mine development status corresponding to each of Scenarios 1, 2 and 3. The three scenarios are considered generally conservative with mobile equipment located in elevated positions where appropriate.

The mine noise model included all existing and proposed items of plant and equipment operating concurrently in order to simulate the maximum energy equivalent (L_{Aeq}) noise emission.

Meteorological conditions, principally wind speed and direction and temperature inversions, can potentially increase noise levels in the vicinity of a noise source. For example, wind has the potential to increase noise at a receiver when it is light and stable and flows from the direction of the noise source. Conversely, as the wind strength increases, the noise produced by the wind itself obscures the noise from most sources.

The EPA's INP requires that wind effects be considered when wind is a prevailing feature of the area under consideration, ie when the wind blows from the source to the receiver at speeds up to 3 m/s for more than 30 per cent of the time in any season.

An analysis of wind data from the Whitehaven meteorological station has shown prevailing winds at the Whitehaven Coal Mine site to be as follows.

- Summer – day-time (nil), evening (nil), night-time (nil).
- Autumn – day-time (nil), evening (nil), night-time (nil).
- Winter – day-time (nil), evening (ENE ± 45°), night-time (ENE ± 45°).
- Spring – day-time (nil), evening (nil), night-time (ENE ± 45°).

Temperature inversions, when they occur, have the ability to increase noise levels by focusing sound waves. Temperature inversions occur predominantly at night.

RHA (2004(a)) have determined that temperature inversions are a feature of the Whitehaven area, ie occur for more than 30% of total night-times during winter. Previous analyses undertaken by RHA have also shown temperature inversions to occur for more than 30% of total night times during Spring, Summer and Autumn.

Drainage flow, ie low level winds associated with the flow of cold air from higher to lower ground during the presence of a temperature inversion, can also enhance noise levels where the direction of the drainage flow is from the noise source towards the receiver. Of the residential properties surrounding the proposed Canyon extension, RHA (2004(a)) have determined that the "Broadwater", "Gundawarra", "Merton", "Wilgai" and "Braymont" residences all lie below the elevation of the perimeter of the proposed Canyon excavation and, with the exception of the topographically shielded "Broadwater" residence, could be subject to some drainage flow noise enhancement. The magnitude of the drainage flow would, however, be tempered by equipment and noise source positioning during night-time periods and conflicting drainage flow patterns caused by more dominant local topographic features.

Details of the mine noise modelling weather conditions are presented in **Appendix 6**.

3.11.4.2 Operational Noise Levels

Predicted operational noise levels for each of the proposed Canyon extension scenarios described in Section 3.10.4.1 are presented in **Table 3.6**.

Table 3.6
Predicted Operational Noise Levels – Scenarios 1, 2 and 3

Scenario	Weather Condition	Braymont	Gundawarra	Merton	Wilgai	Woodlands	Broadwater
Scenario 1 – Day	Calm	18	27	32	31	27	17
Scenario 1 – Evening	Calm	18	26	32	31	27	17
Scenario 1 – Evening	NE Wind 3m/s	25	22	27	27	23	33
Scenario 1 – Night	Temperature Inversion	22	25	26	25	23	17
Scenario 1 – Night	NE Wind 3m/s	13	13	17	17	11	22
Scenario 2 - Day	Calm	20	25	31	31	26	19
Scenario 2 – Evening	Calm	20	25	31	31	25	19
Scenario 2 – Evening	NE Wind 3m/s	25	20	26	27	21	36
Scenario 2 – Night	Temperature Inversion	30	32	37	32	29	34
Scenario 2 – Night	NE Wind 3m/s	26	21	25	22	19	37
Scenario 3 – Day	Calm	19	24	29	30	25	19
Scenario 3 – Evening	Calm	17	23	29	29	22	18
Scenario 3 – Evening	NE Wind 3m/s	20	19	24	26	18	37
Scenario 3 – Night	Temperature Inversion	17	31	34	29	25	32
Scenario 3 - Night	NE Wind 3m/s	16	15	19	18	14	34
Source: RHA (2004(a))							

A review of **Table 3.6** shows that:

- Predicted noise levels for Scenario 1 satisfy the noise design goals at all locations under calm and prevailing conditions for all operating periods.
- Predicted noise levels for Scenario 2 meet the noise design goals at all residential receiver locations during all operating periods except at the "Broadwater" residence which will meet marginal compliance (<2 dB(A) above the goal) for the night-time period. This minor exceedance (of 2 dB(A)) during the night-time period under a prevailing 3 m/s ENE and wind is unlikely to be noticeable by most people.
- Predicted noise levels for Scenario 3 meet the noise design goals at all residential receiver locations for all operating periods, except at the "Broadwater" residence which will meet marginal compliance (<2 dB(A) above the goal) for the evening period. This exceedance (of 1 dB(A)) during the evening under a prevailing 3 m/s ENE wind would not be discernible.

3.11.4.3 Traffic Noise

An assessment of the noise impact at residences adjacent to the southernmost section of Hoads Lane, Blue Vale Road and the Kamilaroi Highway from the haulage of coal was undertaken by Wilkinson Murray Pty Ltd as part of the Belmont Coal Mine development proposal in November 2002. The assessment, undertaken under the EPA's Environmental Criteria for Road Traffic Noise, was based on the haulage of 1.95 Mtpa of coal, that is, the combined maximum production from the proposed Belmont Coal Mine and the then approved maximum production from the Whitehaven Coal Mine.

The assessment concluded that with a coal transportation rate of 1.95 Mtpa, at the closest residences to each of Hoads Lane (650m), Blue Vale Road (70m) and the Kamilaroi Highway (90m), $L_{Aeq(1hour)}$ traffic noise levels from all sources would be 48 dB(A), 57 dB(A) and 59 dB(A) and satisfy the 60 dB(A) criterion. A despatch level of 1.25 Mtpa from the Whitehaven Mine as proposed would, in the absence of the Belmont development, result in a lesser noise level. Wilkinson Murray also noted that as each residence potentially affected by noise from trucks moving on the Siding Access Road to the Whitehaven CHPP is located substantially closer to the Kamilaroi Highway, the noise impact from the haulage activities on that road would be significant.

Given that the proposed Canyon extension application would not result in any increase in the number of coal truck movements and does not seek any amendment to the existing approved coal haulage hours, the above assessment and conclusions remain valid.

3.11.5 Monitoring

Notwithstanding the increased distance between the proposed activities within the Canyon extension and the nearest potentially affected residences, WCM considers it appropriate that the existing bi-annual attended noise monitoring programme be extended for the duration of activities within the Canyon, with an additional monitoring site established at the "Broadwater" residence, ie subject to landowner agreement. Additional monitoring programmes would also be undertaken for example, in the event of noise issues being raised by any local resident.

3.12 BLASTING

Blasting activities within the proposed Canyon extension would continue to employ the design an operation safeguards identified in Section 1.7.5.2 which have, particularly since 2001 and the development of a detailed understanding of the local geology and the appropriate site-specific blasting procedures, been shown to be effective in the containment of blast emissions within the criteria specified in **Table 1.9**.

Based on the results to-date, the increased distance to the closest non-project-related residences and a continuation of the proven safeguards, no adverse impacts on residents, landowners or land users would be predicted.

3.13 AIR QUALITY

3.13.1 Introduction

The air quality in the vicinity of the Whitehaven Coal Mine is influenced by a range of non-mining and mining-related activities. Non-mining related activities influencing local air quality include:

- dust from agricultural activities such as ploughing, harvesting, stock and vehicle movements on the local unsealed road network and farm access roads;
- seed, pollen and smoke from farm and domestic activities; and
- exhaust fumes from vehicles travelling on the local road network.

Existing mining-related activities which influence, or potentially influence local air quality, include:

- soil, overburden and interburden removal, transportation and stockpiling / replacement;
- drilling and blasting, including emission of blasting fumes;
- ROM coal extraction and transportation;
- coal processing;
- general movement of plant and equipment and product coal trucks on unsealed roads;
- wind erosion of topsoil, overburden and ROM coal stockpiles; and
- exhausts from mobile and fixed plant and equipment and from coal product and employee vehicles.

In the EIS accompanying DA 72-03-2000 predictions of potential increase in deposited dust and TSP at the nearest potentially-affected non-project-related residences were undertaken using:

- a conservative dust emissions inventory for various operational phases of what is the now existing approved Whitehaven Coal Mine;
- extrapolation of the outcomes of modelling studies undertaken by specialist air quality assessments at a number of mines and quarries; and
- the results of extensive deposited dust monitoring programmes undertaken at the former adjacent Vickery Coal Mine.

Notwithstanding the acceptance of this methodology by appropriate authorities at the time, the verification of the predicted outcomes through monitoring (as described in Section 1.7.6) and the absence of complaints regarding air quality impacts, WCM commissioned Richard Heggie Associates Pty Ltd (RHA) to undertake an emissions assessment for the proposed Canyon extension.

The following sub-sections describe the existing air quality environment and the current air quality assessment criteria, and provide a summary assessment of the potential impact of the proposed activities with respect to dust deposition, PM_{10} and $PM_{2.5}$. The letter report prepared by RHA is presented in **Appendix 7** and referred to hereafter as RHA (2004(b)).

3.13.2 Existing Air Quality

Table 3.7 presents the assessed background air quality which was subsequently used for the assessment of air quality impacts. Consistent with other studies undertaken within the local area, eg the recent Werris Creek Coal Mine EIS, background particulate matter has been estimated using verified data from 2001 at DEC's Tamworth monitoring site. Background dust deposition values were sourced from monitoring undertaken by WCM around the Whitehaven Mine site between January and December 2001.

Table 3.7
Background Air Quality Environment for Assessment Purposes

Air Quality Parameter	Averaging Period	Assumed Background Ambient Level
PM_{10}	24-hour	Varies[1]
	Annual	14 $\mu g/m^3$
Dust	Annual	1.5 $g/m^2/month^2$

3.13.3 Air Quality Criteria – Particulate Matter and Dust Deposition

The NSW DEC specifies air quality criteria in their document *"Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in New South Wales"*. These goals have been established to protect surrounding residents from adverse health effects and also maintain the amenity of the surrounding environment. The air quality goals used during the air quality assessment are presented in **Table 3.8**.

Table 3.8
Air Quality Goals for Particulate Matter Concentrations

Pollutant	Standard	Averaging Period
Particulate matter <10μm (PM_{10})	50$\mu g/m^3$	24-hour maximum
	30$\mu g/m^3$	Annual mean
Particulate matter <2.5μm ($PM_{2.5}$)	8$\mu g/m^3$	Annual mean
	25$\mu g/m^3$	24-hour maximum

Deposited dust, though not affecting public health can, if present at sufficiently high levels, cause nuisance impacts and reduce the amenity of an area to such an extent that lifestyles or activities such as farming cease to be either enjoyable or viable. The NSW DEC sets criteria for dust deposition levels under which nuisance would be avoided. These criteria are summarised in **Table 3.9**.

Table 3.9
DEC Criteria for Allowable Dust Deposition

Averaging Period	Maximum Increase in Deposited Dust Level	Maximum Total Deposited Dust Level
Annual	$2g/m^2$/month	$4g/m^2$/month
Source: NSW DEC, "Approved Methods & Guidance for the Modelling and Assessment of Air Pollutants in NSW", 2001.		

On the basis of the background dust level identified in **Table 3.7**, RHA (2004(b)) have adopted a dust criterion of 3.5 g/m^2/month (annual average), ie 1.5 g/m^2/month plus 2.0 g/m^2/month.

3.13.4 Safeguards

As noted in Section 1.7.6, WCM currently employs a range of safeguards at its existing approved mine which have been shown by monitoring to have been effective in the minimization of impacts on amenity at nearest non-project-related residences.

As with noise, each of these measures would be continued for the duration of operations within or associated with the Canyon extension and if warranted, beyond the cessation of mining, that is, until an adequate vegetation cover has established on the rehabilitated areas of former disturbance.

In addition to the existing safeguards, the following features of the proposed operations would further reduce any potential for adverse impacts on local air quality.

- Retention of the existing vegetation adjacent to the coal load-out bin and coal load-out access road.
- Reducing the elevation at which overburden and interburden disposal are undertaken. As noted previously, **Figures 2.3 (b), (c)** and **(d)** show that for the majority of the mining activities within the proposed Canyon extension, overburden and interburden transportation and emplacement activities would be undertaken below the natural landform and hence be less exposed to wind induced lift-off and dispersal.
- The progression of the mining activities away from the nearest potentially-affected non-project-related residences.

- Implementation of modified blasting practices. Throwblasting, as currently employed over the total overburden profile within the existing mine, would be replaced by stand-up blasting of the upper 38 m, with throwblasting limited to the lowermost 15m of material within the open cut.
- Undertaking enrichment plantings within areas to the east and west of the proposed Canyon extension. The progressive development of these plantings would increase surface roughness and local entrainment of particulate matter.

3.13.5 Impact Assessment

3.13.5.1 Method

Predictions of deposited dust, PM_{10} and$PM_{2.5}$ emissions during the proposed Canyon activities were undertaken by Richard Heggie Associates Pty Ltd using the AUSPLUME dispersion model developed by the Victorian EPA and the mine operational scenario represented by **Figure 2.3(c).**

Figure 2.3(c) was assessed to represent the worst case scenario with respect to potential air quality impacts due to the:

- quantity of materials to be moved in 2007;
- location of the coal extraction and overburden / interburden emplacement activities;
- area of the mine exposed;
- location of major particulate generating plant; and
- proximity of the mining operations to the non-project-related residences, particularly “Willgai” and “Broadwater”.

AUSPLUME is an advanced Gaussian dispersion model and is the approved model for the majority of applications in NSW. The model utilizes estimates of particulate emission rates for the various activities which would be undertaken, together with relevant meteorological and topographical information, to predict ground level concentrations of particulate matter. In order to reflect a worst-case scenario for airborne emissions over a 24 hour period, the emission inventory used in the modelling assumed all equipment to be operating concurrently with only limited control measures and, as such, represented a conservative estimation.

The relevant meteorological data, emission factors and an emission inventory are presented in **Appendix 7**.

3.13.5.2 Dust Deposition

RHA (2004(b)) – **Appendix 7** presents the conservatively predicted increases in dust deposition as contour plots and incremental and total values at the nearest sensitive receivers. The results show that the increase in mean monthly dust deposition rates as a consequence of the proposed activities would be less than 1 g/m^2/month at all residences in the vicinity of the proposed

Canyon extension, giving a mean annual total deposited dust level at those residences of less than 3.5 g/m^2/month and thereby satisfying both the incremental and total deposited dust criteria identified in Section 3.13.3.

3.13.5.3 PM10 (24 hour average)

Appendix 7 also presents contour plots and modelled incremental and total values at the nearest sensitive receptors for total 24-hour PM_{10} concentrations. The results of the modelling show that at the nearest residential receptors, the maximum annual 24-hour average concentration of PM_{10}, ie background + increment would approximate 40 $\mu g/m^3$ and, as such, satisfy the goal of 50 $\mu g/m^3$ identified in **Table 3.8**.

3.13.5.4 PM_{10} (Annual Average)

RHA(2004(b)) – **Appendix 7** determined that all the nearest residential receptors total annual average PM_{10} concentration, ie background + increment associated with the proposed Canyon extension would be less than 16 $\mu g/m^3$ and satisfy the goal identified in **Table 3.8**.

3.13.5.5 $PM2_{.5}$

Using particle size distributions from industries covering handling and processing of aggregates and unprocessed ore, it can be assumed that the $PM_{2.5}$ particle size fraction would approximate 30% of PM_{10}. On this basis:

- the worst case 24-hour average $PM_{2.5}$ would be less than 13 $\mu g/m^3$, thereby satisfying the criteria of 25 $\mu g/m^3$; and
- the annual average $PM_{2.5}$ would be less than 5 $\mu g/m^3$, satisfying the 8 $\mu g/m^3$ criterion.

3.13.5.6 Short-term Dust Episodes

Short-term dust episodes relate to temporary increases in the amount of dust raised mainly from disturbed surfaces and other dust containing areas by strong winds in dry weather conditions.

As a rule, dust episodes are more frequent and lead to higher short-term concentrations of wind-blown dust in those areas for which the long-term predictions of annual dust levels indicate a reduction in amenity. Given that the amenity criterion of 2 g/m^2/month (mean annual increment) is not predicted to be reached at any residence, it would not be expected that atmospheric dust would escape during short-term dust episodes and reach the nearest residences in such quantities which could cause temporary dust nuisance in high winds.

3.13.5.7 Nitrogen Sulphur Dioxide and Greenhouse Emissions

Given that the proposed extension of mining activities into the Canyon area would not result in any increase in equipment nor diesel consumption from that currently utilized at the mine and increasing distance from the mining activities to most potential residential receptors, no formal assessment of NO_X, SO_2 or Greenhouse emissions was undertaken. However, based on the outcomes of the recent modelling undertaken for the Werris Creek Coal Mine proposal where similar emissions from similar equipment items and numbers were shown to readily satisfy the NEPM and WHO guidelines, it can be reasonably assumed that a similar situation would apply with respect to the proposed Canyon extension.

A similar conclusion can be extrapolated with respect to Greenhouse emissions where, for the Werris Creek Coal proposal, an estimated 4600 t diesel fuel usage annually was conservatively determined to result in an increase in Greenhouse emissions of approximately 77000 t CO_2 equivalent annually which would equate to increases of 0.054% in the Energy and Transformation sub-sector and 0.015 of the Total Australian Emissions.

In the case of the existing Whitehaven Coal Mine proposed Canyon extension, where total diesel usage is less than 2900 tpa, it can be concluded that the Whitehaven Coal Mine's contribution to Greenhouse gas emissions would be less than 50000 tpa CO_2 equivalent and represent less than 0.034% and 0.009% of the Energy and Transformation sector and Total Australian Emissions respectively.

3.13.6 Monitoring

As noted in Section 1.7.6, WCM maintains an extensive deposited dust monitoring network around its leases and has committed to undertake particulate monitoring in the event of exceedances of the relevant dust criteria. Given the increased distance between the proposed Canyon extension and associated activities and the nearest potential receptors from that to-date, and the general absence of complaints pertaining to air quality, a continuation of this existing programme and commitment is considered appropriate.

3.14 VISUAL ASPECTS

3.14.1 Existing Visibility and Safeguards

The areas of disturbance associated with the existing Whitehaven Coal Mine, though centred on a low ridgeline and projecting up to 30 m above the surrounding plains, is generally well positioned with respect to visual aspects, with features of the existing mine currently visible from six residences at distances up to 4.5 km, from Hoads Lane (north and east of the mine) and from Blue Vale Road (west of the mine). However, from the majority of these vantage points, the views of the existing mine are obstructed to varying degrees by intervening vegetation.

Notwithstanding the above and the rural nature of the locality, ie where substantial areas of land are disturbed on a seasonal basis for agricultural activities, WCM is conscious of potential visual impacts of the existing operation and has implemented a range of safeguards, most important of which are:

- undertaking its activities in accordance with the various management plans applicable to the mine, eg the Dust, Landscape and Vegetation, Soil Stripping and Flora and Fauna Management Plans, all of which incorporate safeguards which indirectly reduce visual impact;
- minimizing the extent of land disturbance / clearing in advance of mining;
- progressive rehabilitation of disturbed areas; and
- sympathetic positioning and direction of lights to avoid them impacting on local residences.

3.14.2 Additional Safeguards and Impacts

WCM would continue to implement all existing safeguards in order to minimize any visual impacts from activities within the proposed Canyon extension. However, in addition to these measures, the following controls and/or features of the proposed Canyon extension would further reduce any potential for adverse impacts on the local visual environment.

(i) Progressive development of the mine to the west, and in the lee of, an existing shallow ridgeline, with most activities undertaken at or below ground level, thereby reducing the visibility of mining from residences to the east.

(ii) Reducing the elevation at which overburden / interburden emplacement activities are undertaken.

(iii) Retention of the existing stand of native vegetation adjacent to the relocated coal bin.

(iv) Reducing the distance travelled by, and visual exposure of, coal product truck movements on unsealed roads.

(v) Undertaking enrichment plantings in what are now areas of open grassland.

(vi) Installation of bunding on the relocated ROM coal pad which would shield local residences from headlights on equipment operating after dark.

Given the above, and in particular, the rehabilitation of the majority of areas of disturbance visible at the existing mine, it is assessed that the visual impact associated with the proposed Canyon extension would decrease from that currently experienced.

3.15 TRANSPORTATION NETWORK

3.15.1 Route and Road Conditions

As noted in Section 1.6.7, all coal despatched from the Canyon extension to the existing Whitehaven Coal Mine would be transported to the Whitehaven Siding via the private mine access road, Hoads Lane, Blue Vale Road, the Kamilaroi Highway and the Siding Access Road (**Figure 1.5**), that is the same route as currently used for the transportation of coal from the existing mine.

Private Mine Access Road

The private mine access road lies wholly within Narrabri Shire, is 2.5 km long and comprises a 0.4 km component formerly within the "Merton" property (purchased by WCM), and a 2.1 km section of Shire road reserve, the easternmost 1.0 km of which formerly comprised a component of Hoads Lane. Both the former sections of Hoads Lane and the Shire road reserve components of the mine access road are leased to the Company by Narrabri Shire Council.

The mine access road comprises an 8 m bitumen seal on a 10 m wide crowned gravel pavement with roadside "V" drains, mitre drains and culverts.

Hoads Lane

The Hoads Lane component of the transport route (**Figure 1.5**) is 5.2 km in length and was upgraded by WCM in accordance with Condition 7.3(a) of DA 72-03-2000 to include an 8 m wide crowned bitumen pavement with "V" drains and mitre drains. The northernmost 1.3 km of this road lies within Narrabri Shire, with the remaining 3.9 km being located within Gunnedah Shire. Agreements are in place with both Narrabri and Gunnedah Shire Councils for the maintenance of their component sections of this road.

Hoads Lane / Blue Vale Road Intersection

The Hoads Lane / Blue Vale Road intersection was modified in accordance with DA 72-03-2000 and provides for the uninterrupted movement of vehicles from Hoads Lane to/from Blue Vale Road. A T-intersection and "Give Way" sign have been installed on Hoads Lane to cater for local traffic entering and leaving Blue Vale Road to/from the west.

Blue Vale Road

The Blue Vale Road component of the transport route (**Figure 1.5**), ie between its intersections with Hoads Lane and the Kamilaroi Highway, is 18.4 km in length and comprises a 6 m to 7 m wide sealed pavement with 1 m wide gravel shoulders. Construction of Blue Vale Road to this standard was undertaken to provide an all weather access to the Vickery Coal Mine suitable for up to 690 coal truck and 170 employee light vehicle movements per day, as well as local traffic.

The pavement condition along Blue Vale Road is generally good, but with some localized areas exhibiting pavement deformation/swelling/breakup as a consequence of poor sub-grade and basecourse conditions and flooding damage. An agreement is in place between WCM and Gunnedah Shire Council for routine inspection and maintenance of Blue Vale Road. The speed limit on Blue Vale Road is signposted at 100 kph and both barrier and centre line markings are provided.

Blue Vale Road / Kamilaroi Highway Intersection and Kamilaroi Highway
The intersection of Blue Vale Road and the Kamilaroi Highway (**Figure 1.5**) comprises:

- a free flow slip lane and acceleration lane for eastbound vehicles leaving Blue Vale Road;
- a lane for west-turning vehicles leaving Blue Vale Road. The right turn lane and free flow slip lanes are separated by a concrete barrier and island;
- a deceleration lane for eastbound vehicles on the Highway entering Blue Vale Road; and
- separate slip-through lane for eastbound vehicles on the Kamilaroi Highway. The eastbound slip-through and acceleration lanes extend from the intersection to the east of the entrance to the Project Site. Dual westbound 3.5 m wide lanes extend from approximately 200 m west of the Blue Vale Road entrance to the Siding Access Road. Visibility east and west along the Kamilaroi Highway at the intersection exceeds 1 000 m.

The left-turn free flow slip lane at the intersection is subject to regular repairs to account for light and heavy vehicles turning the corner at speed and drainage problems / flooding problems and is currently in a satisfactory condition. Maintenance of the intersection forms part of the agreement between WCM and Council.

The Kamilaroi Highway pavement between Blue Vale Road and the entrance to the Whitehaven Siding, though generally in good condition, does exhibit areas of pavement deformation, principally in the northern-most lane.

East and west of the Whitehaven Siding entrance – Blue Vale Road dual lanes, the Kamilaroi Highway comprises a minimum 6 m wide sealed pavement in good condition, with barrier and centre line marking provided. The highway speed limit is 100 kph.

Kamilaroi Highway / Siding Access Road Intersection
The Kamilaroi Highway / Siding Access Road intersection (**Figure 1.5**) is similar in form to the intersection of the Kamilaroi Highway and Blue Vale Road and was designed and installed to service the former Vickery (now Whitehaven) rail siding / train loader and a projected 690 coal truck movements per day. The intersection comprises:

- a free flow slip lane, merge taper and secondary lane for westbound vehicles leaving the Siding Access Road;
- a lane for right-turning vehicles leaving the Siding Access Road. The right turn lane and the free flow left slip lane are separated by an island with concrete kerbing to the north and east and by an 0.9 m high concrete barrier to the west; and
- a deceleration taper for westbound vehicles on the Highway entering the Siding Access Road.

Visibility along the Kamilaroi Highway at this intersection is 600 m to the west, and approximately 800 m to the east. Warning signs indicating trucks crossing are positioned to the east of the Siding Access Road intersection and lighting is provided at the intersection.

The pavement at the Kamilaroi Highway / Siding Access Road intersection has recently been repaired and is assessed as in "good" condition.

Siding Access Road

The private Siding Access Road is 700 m in length and comprises a 6 m wide crowned and bitumen-sealed pavement which leads to the ROM coal stockpile area at the Whitehaven Siding CHPP. A truck wash is used to minimize the potential for materials being tracked onto the sealed private and public road surfaces.

3.15.2 Traffic Levels

Table 3.10 presents classified traffic data collected by Gunnedah Shire Council in February / March 2002 for the Kamilaroi Highway between the Blue Vale Road and Siding Access Road intersections, and for Blue Vale Road immediately south of Hoads Lane collected in July 2002. Coal truck movements past the Kamilaroi Highway and Blue Vale Road counter stations, ie at a production level of 750 000 tpa from the Whitehaven Coal Mine, are also presented. Given the low level of usage of Blue Vale Road west of the Hoads Lane intersection since the sealing of Hoads Lane, the traffic levels for Blue Vale Road can also be considered representative of those on Hoads Lane at the time.

Table 3.10
Traffic Levels

Traffic Counter Location (see Figure 1.4)	Count Period	Total Vehicle Movements	Light Vehicles	Heavy Vehicles			5-day Average *[1]		7-day Average *[2]	
				Total	Coal	Other	Light	Heavy	Light	Heavy
Kamilaroi Highway	04.03.02 to 10.03.02	14846	10745	4100	888	3212	1570	698	1535	585
Blue Vale Road (south of Hoads Lane)	01.07.02 to 07.07.02	1920	753	1167	952	215	124	205	115	167
	08.07.02 to 14.07.02	1998	706	1292	860	432	108	221	101	185
*[1] Monday – Friday *[2] Monday – Sunday										
Sources: Gunnedah Shire Council and Howard Haulage Pty Ltd										

As noted in Section 1.6.7, transportation of 1.1 Mtpa coal from the Whitehaven Coal Mine currently involves the movement of approximately 4 200 t coal per day 261 days per year, corresponding to an average of 140 semi-trailer loads, or 280 coal truck movements daily. The 261 days approximates 48 weeks coal transportation activity annually, at an average of 5.5 days per week. Between 8 and 10 trucks are routinely used in the coal transportation activities, with a maximum of 24 truck movements occurring in any one hour.

At the approved production rate of 1.25 Mtpa, 158 semi-trailer loads of coal (316 movements) would be required per day, 261 days per year or 185 loads (290 movements) per day 288 days per year. DA 72-03-2000 permits WCM to haul coal on a 6 day a week basis, 15 hours per day basis.

Based on the classified count data provided in **Table 3.10**, existing and approved coal truck movements constitute:

- approximately 73 per cent of heavy vehicle movements on Hoads Lane and Blue Vale Road, and 36 per cent of all heavy vehicle movements on the 500 m section of the Kamilaroi Highway between Blue Vale Road and the Siding Access Road;
- approximately 67 per cent of total vehicle movements on Hoads Lane and Blue Vale Road and less than 12 per cent of total vehicle movements on the Kamilaroi Highway.

Given that Blue Vale Road was constructed to a standard which would readily enable the transportation of approximately 2 Mtpa coal from the Vickery Coal Mine and that Hoads Lane has been constructed to an equivalent or higher standard, haulage at the current approved rate is well within the capacity of both roads.

3.15.3 Bus Services

Table 3.11 identifies those periods of the day when school buses are likely to be travelling on the Blue Vale Road / Hoads Lane component of the coal transportation route.

Table 3.11
School Bus Utilization of Blue Vale Road / Hoads Lane

Local Road	Morning			Afternoon			Comments
	Time	Direction	Status	Time	Direction	Status	
Hoads Lane / Blue Vale Road	7.15 am to 7.30 am	O	NC	3.35 pm to 3.50 pm	O	C	3 stops, only at bus bays
	8.05 am to 8.20 am	I	C	4.10 pm to 4.30 pm	I	NC	
O = Outbound, ie from Gunnedah C = Children on board				I = Inbound, ie to Gunnedah NC = No children on board			
Source: G Lee							

Traffic along the Kamilaroi Highway, a main link between Gunnedah (and areas east) and Boggabri / Narrabri (and areas west), consequently includes both tourist and school buses.

3.15.4 Rail Network and Usage

The Gunnedah / Narrabri region is serviced by the North-Western railway line which extends from Walgett to immediately south of Werris Creek. Near Werris Creek, the North-Western railway line meets the Main Northern line which extends through to Newcastle.

The current rail timetable incorporates four dedicated coal train paths per day to service the WCM facilities, one arriving at about 7.30 am and the other at about 11.30 am. Utilization of the four paths, or two coal despatch loads per day would enable WCM to despatch in excess of the 2 Mtpa current approved production limit for the Whitehaven Siding. Additional paths, dedicated to other purposes, eg grain transport, are also available for coal transportation from time to time.

3.15.5 Safeguards

For the proposed Canyon extension, WCM would continue to implement all safeguards with respect to the movement of light and heavy vehicles on the public road network which are currently in place for the existing Whitehaven Coal Mine and which, with few exceptions, have been proven to be effective in minimizing conflict with other road users and providing an appropriate mechanism for required and ongoing road maintenance.

3.15.6 Assessment Impacts

Given that the application for the proposed Canyon extension to the Whitehaven Coal Mine does not seek any increase in the rate of coal production annually nor would it result in any increase in employment, there would be no increase in light or heavy vehicle movements from those currently experienced and approved. Furthermore, with the continued implementation of the existing safeguards and management procedures, and the extension of the existing road maintenance agreements, no adverse impact on local road conditions or road users would be expected.

A review of the NAASRA Rural Arterial Road Service Assessment Criteria shows that on all public roads comprising the transportation network, service would be classified as “good”.

3.16 SOCIO-ECONOMIC ASPECTS

The Whitehaven Coal Mine lies in an area where agricultural enterprises are the primary employment and most important income generating sector, with the level of commercial activity within the local centres of Gunnedah, Boggabri and Narrabri dependent largely on the profitability of those ventures.

Mining, though currently only a minor employment generator, is a substantial contributor to the local economy: some $2.5M is injected annually into the local economy by WCM through wages and salaries paid to the mine’s employees, with additional monies injected into the community directly and indirectly as a consequence of WCM’s support for local service industries and suppliers. In addition to the above and as noted in Section 1.7.11.2, WCM is also a supporter of local community and charitable groups.

An approval for extension of the Whitehaven Coal Mine into the Canyon area would provide continued employment for the mine workforce, provide continued injection of funds into the community both directly and indirectly whilst enabling WCM to develop other ventures in the local area which will ensure its long-term presence in the area and long-term social and economic contributions to the local community.

3.17 CUMULATIVE IMPACTS

The proposed Canyon extension to the existing Whitehaven Coal Mine would simply represent a continuation of existing activities, with the cumulative impact of its approval primarily relating to the additional area of disturbance and impacts on flora, fauna and agricultural land.

Both flora and fauna aspects and the impacts of the proposed extension were examined by specialist consultancies, with the results of their assessments provided in **Appendices 3** and **4**. However, in both cases, it was concluded that the proposed activities would have no significant adverse impact, ie both in terms of the extension and the total mine development. In the longer term, WCM's existing practices with respect to rehabilitation and its commitments to extension of native vegetation and fauna habitat both on and external to areas mined would represent a positive consequence of the mining operation.

The proposed Canyon extension would lead to the disturbance of a further 50 ha land with capabilities assessed as Class III and Class II (based on a preliminary assessment and to be confirmed by detailed soils investigations), that is, in addition to the predominantly Class V land disturbed by the existing mine. WCM's proposals with respect to rehabilitation and, in particular to the stripping and replacement of the soil profile both at the existing mine and within the Canyon extension, would ultimately result in no net loss to Class II land and a minor reduction in Class III land, with all other areas of the post mining landform theoretically suitable for a grazing land use.

Although WCM is investigating further coal mine developments within the local area, none is located within close proximity to Whitehaven Coal Mine and, consequently, even if operating concurrently, would not be expected to result in cumulative impacts with respect to noise or air quality nor to result in any significant cumulative impact with respect to ecological issues. There may, however, depending on the timing of commencement and rate of production build-up of one or more of these ventures, be some potential for cumulative impacts with respect to coal transportation and traffic levels on, for example, Hoads Lane and Blue Vale Road. However, given that neither these details nor the potential integrated production rates from the various operations are yet finalized, it is considered appropriate that these matters be addressed in the Development Applications for the new ventures.