CONTENTS

LIST OF TABLES

5.0 THE LIKELY IMPACT ON THE ENVIRONMENT

Key points

- Maximum cumulative subsidence for the Ashton Coal Project is predicted to be between 5 and 6 metres.
- No exceedences of the noise criteria have been predicted for the operation or construction of the mine under neutral conditions. Some exceedences may be experienced with inversions or windy conditions;
- There are no predicted exceedences of dust emissions if specific management controls are implemented.
- Ground vibration of no more than 2mm/s is predicted to be experienced at the nearest residents;
- Predicted changes in recharge of groundwater to the alluvium are not predicted to have adverse impacts on the quality;
- No endangered flora or fauna were identified in the project area;
- The Ashton Coal Project will provide long term employment for approximately 140 staff;
- It is predicted to generate approximately $24 million into the local economy; and
- The mine will also provide a boost to export income for NSW and Australia.

The design of the project has been strongly influenced by the proximity of the village of Camberwell, natural topographical features, road and rail systems located in the area. Wherever practicable environmental impacts associated with the project aim to be within the relevant environmental criteria or be contained within the Development Application boundaries.

Some properties situated outside or straddling the Development Application boundaries will be impacted to varying degrees by the project. A number of privately owned properties (namely property numbers 104, 111, 114, 115 and 130, refer to **Figure 3.13**) have been identified as being within the zone of affectation for noise for the Glendell Mine.

With the exception of property number 115 an assessment of environmental impacts associated with the Ashton Coal Project has been undertaken for all properties surrounding the proposed mine. Property number 115 is recognised by the proponent as being impacted by the project whereby the impacts, exceed the established amenity criteria.

The proponent has commenced discussions and negotiations with various land owners seeking to negotiate mutually agreeable outcomes to facilitate the project proceeding. These discussions include the proponents of adjoining mines.

5.1 Subsidence

G.E Holt and Associates Pty Ltd were commissioned to provide predictions on subsidence and its impact on the proposed Ashton underground mine. The report is included as **Appendix P** of **Volume 2.**

5.1.1 The Nature of Subsidence

"Subsidence" describes ground movement as a result of mining. Subsidence is the *vertical* distance the ground moves when it is undermined. The ground strains, tilt and curvature are the more important parameters when assessing the impact that subsidence might have on the ground surface and improvements. The natural surface and improvements can tolerate low levels of tilt and strain with no impact. High levels can cause damage. At the same time, many improvements can remain unaffected by subsidence.

Ground strains and curvature associated with substantial subsidence can have significant effects on large or continuous structures. Normal practice is to consider the impact of likely maximum subsidence on each structure separately.

Experience in NSW with rural and the natural environments has shown that the impact of subsidence can be assessed with a high level of certainty. Damage classifications for urban structures are applicable to rural improvements. The level of significance of ground cracking, tilting and related disturbances can be determined from subsidence, strain and tilt predictions, and the location of likely disturbance can be determined by overlaying subsidence predictions on the mine plan.

5.1.2 Subsidence Predictions

The proposed workings will be developed over four coal horizons. The entire mineable area will have four levels of super-imposed workings at completion of mining the Lower Barrett seam. The strata consists of a mix of sandstone, shale and interbedded to finely laminated sandstone/shale with a number of seam splits between. There are no major dykes or faults yet recognised within the proposed mine area.

The predicted subsidence and the maximum tensile, compressive and tilt for each seam to be mined are provided below.

Pikes Gully

The predicted topography of the area after the mining of the Pikes Gully seam is provided in **Figure 5.1**.

Maximum subsidence is predicted between 1.2 and 1.7m. The ranges of strain and tilt are:

Tensile Strain	2.9 - 16.3 mm/m
Compressive Strain	4.3 – 24.5 mm/m
Tilt	21.7 – 122.6 mm/m

Upper Liddell

The predicted topography of the area after the mining of the Upper Liddell seam is provided in **Figure 5.2**.

Maximum subsidence is predicted between 1.2 and 1.7m. The ranges of strain and tilt are:

Tensile Strain	2.2-.6.6 mm/m
Compressive Strain	3.3 – 9.8 mm/m
Tilt	16.7 – 49.2 mm/m

Upper Lower Liddell

The predicted topography of the area after the mining of the Upper Lower Liddell seam is provided in **Figure 5.3**.

Maximum subsidence is predicted between 1.2 and 1.6m. The ranges of strain and tilt are:

Tensile Strain	1.8 – 5.9 mm/m
Compressive Strain	2.6 – 8.9 mm/m
Tilt	13.2 – 44.6 mm/m

Lower Barrett

The predicted topography of the area after the mining of the Lower Barrett seam is provided in **Figure 5.4**.

Maximum subsidence is predicted between 1.0 and 1.6m. The ranges of strain and tilt are:

Tensile Strain	1.5 – 4.0 mm/m
Compressive Strain	2.3 – 6.0 mm/m
Tilt	11.5 – 30.2 mm/m

Cumulative Subsidence

The cumulative subsidence as a result of mining four seams was calculated by adding the maximum subsidence for each individual seam. This results in cumulative subsidence for the Ashton underground mine area being between 5 and 6m. Cumulative subsidence contours are provided in

Figure 5.5.

5.1.3 Impact on Surface Features

Land Surface

The land surface will experience subsidence up to 5.9 m. Subsidence will occur in a continual series of small movements as longwall extraction proceeds along each panel, and repeat for each level of mining. Maximum predicted subsidence over any extraction panel is 1.7m.

Ground cracking can be expected. Once settlement has occurred over the uppermost workings in the Pikes Gully Seam it is likely that ground cracking may concentrate further movements caused by mining of the other three seams.

Subsidence will increase erosion of the ground surface along the eastern ridge. Areas of the ridge have been quarried for ridge gravel, and without protection are actively eroding. Part of the ridge to the north will be covered by the western emplacement area, and rehabilitated.

Dams and Ponding

There are a number of dams over the mine site which are used for stock watering. These may experience water loss due to subsidence.

"Old" Bowmans Creek will be subsided by up to 5.4m. The elongate nature of the subsidence troughs over each panel will produce five distinct areas of ponding around the oxbow over Panels 4, 5 and 6. There will also be two other areas of ponding in the 1m – 2m depth range upstream and downstream of the oxbow.

Figure 5.5 indicates the topography once all seams have been extracted.

Archaeology

There are a number of archaeological isolated finds and scatters over the longwall extraction area. Particular areas which will be prone to cracking will be along Bowmans Creek and the ridgeline. If cracks were to develop near any archaeological sites, there is a potential for damage. This is discussed further in **Section 5.9.1.**

Surface Improvements

The New England Highway and 132kV and 66kV transmission lines are located along the north eastern boundary of the underground mining area. The longwall layout has been designed to avoid disruption of both the highway and the transmission line towers. This is done by finishing each panel offset from adjacent panels.

The offset layout does create an irregular theoretical zero subsidence limit along the north eastern boundary. Since the limit is a theoretical limit based on an angle of draw of 26.5 degrees it is unlikely there will be any impact on the highway from mining the upper three levels. The amount of subsidence will vary between 0mm and 100mm for a 140m length of highway. The cutting on the highway will not be affected by subsidence.

Other 132kV, 11kV and 415V transmission lines cross the area. These will experience subsidence effects to various degrees and could be damaged without remedial measures. The lines will be monitored during subsidence periods and repaired as necessary.

5.1.4 Impact on Bowmans Creek

The current alignment of Bowmans Creek, is over longwall panels 4, 5 and 6, as depicted in **Figures 5.1** to **5.5**. A review was carried out by G.E Holt and Associates, of previous impacts of mining under the creek, for the Liddell and Foybrook leases upstream.

Single and two seam mining was undertaken below Bowmans Creek for the above mentioned leases. From past experiences workings under the creek at less than 200m, would most likely result in water inflows into the workings. Subsidence in the Foybrook lease also resulted in subsidence in the stream bed and disruption of flow.

Alluvial soils and groundwater associated with Bowmans Creek will be affected by subsidence. It can be expected that there will be some drainage of groundwater out of the alluvials into the underlying rocks. Some drainage into underground workings can be expected. There will be cracking in the alluvials. Cracking will occur along the sides of the panels, and in curv-linear fashion along the length of the panels.

To avoid impacts on the underground workings due to water inflows, and also to avoid the disruption of flow in the creek, it is proposed to divert Bowmans Creek around the longwall panels. This is discussed further in **Section 5.5.1.**

5.2 Air Quality

The air quality assessment included in **Appendix F** of **Volume 2** modelled predicted impacts for a number of different scenarios. These included:

- The project with no controls considered in isolation;
- The project with operational controls considered in isolation;
- The project with operational controls considered with emissions from other nearby mines taken into account;
- The project under strong winds with controls;
- The project under strong winds with no controls, and

- The project under light winds.

Emission predictions for the Ashton Coal Project were developed through identifying each activity which may result in dust generation, and then applying an emission factor. Emissions from near-by mines was sourced from either EIS's for the mine for the year closest to Ashton Coal Project Year 4 or from the assumption that a typical Hunter Valley open cut mine produces approximately 1kg of dust per tonne of ROM coal produced.

5.2.1 Dispersion Modelling Results

Modelling conducted for the mine in isolation with no controls predicted the following:-

- The mine in isolation would result in concentrations equal to the 50ug/m^3 US EPA Annual Standard for PM_{10} at the most affected residence, which are located in the northern part of the village. A reasonable allowance for existing background dust would result in the standard being exceeded at least for the ten most affected residences.

- The mine in isolation would be able to comply with the 90µg/m^3 NHMRC Annual Guideline for PM_{10} at all residences in Camberwell. A reasonable allowance for existing background dust results in exceedences for several of the most affected residences; and

- Dust deposition from the mine considered in isolation would be able to comply with the NSW EPA's annual goal for increase in dust deposition for all but one of the residences in Camberwell.

Dispersion modelling was then conducted considering emissions from nearby mines. Mines that are expected to be operating are Rix's Creek, Camberwell, Glendell and Ravensworth East. In addition an allowance of 5µg/m^3, 10µg/m^3 and 0.5g/m^2/month were added to the model predictions for annual average PM_{10}, annual average TSP and annual average dust deposition respectively to account for other sources of dust for example, natural sources, agriculture, power station and remote coal mines.

Modelling for the mine with no operational controls and with cumulative effects concluded the following:-

- All residences in the village would experience PM_{10} concentrations equal to and above the 50µg/m^3 US EPA Annual Standard for PM_{10};

- TSP concentrations equal to 90µg/m^3 NHMRC Annual Guideline for TSP are predicted for the three most affected residences in Camberwell; and

- Dust deposition levels above the NSW EPA's 4g/m^2/month annual goal are predicted for the eight most affected residences.

Dispersion modelling was then conducted for the above scenario, however certain operational controls for the Ashton Coal Project were also included. This scenario also assumes that no operational controls are implemented at other mines.

The results of the modelling are as follows:-

- The results of PM_{10} modelling are shown in **Figure 5.6.** It can be seen from this figure that the project could be operated with operational controls and achieve PM_{10} concentrations that would comply with the 50µg/m^3 US EPA Annual Standard for PM_{10} at all residences in Camberwell;

- The results of TSP modelling are shown in **Figure 5.7**. It can be seen from this figure that the project could be operated with operational controls and achieve TSP concentrations below the 90µg/m^3 NHMRC Annual Guideline at all residences in Camberwell; and

- The results of dust deposition are shown in **Figure 5.8**. It can be seen from this figure that the project could be operated with operational controls and achieve dust deposition levels below the NSW EPA's 4 g/m^2/month annual goal at all residences in Camberwell.

Operational controls, which will be implemented for the Ashton Coal Project, are described in **Section 6.2** of this EIS.

Predicted 24-hour PM_{10} concentrations due to emissions from the project in isolation with a complete cessation of mining under extreme worst-case conditions was modelled. Most affected residences in Camberwell are predicted to experience dust concentrations no greater than 85µg/m^3 due to emissions from the project. This would allow a contribution of 65µg/m^3 from all other source before the US EPA's 150µg/m^3 standard would be exceeded.

5.3 Noise and Vibration

5.3.1 Operational Noise Impact

Predicted noise levels for the various operating scenarios and atmospheric conditions are summarised in Tables 15 to 18 in **Appendix G** of **Volume 2**. Representative noise contour plots are shown in **Figures 5.9** to **5.13**.

Figure 5.9 details noise contours for construction of roads and buildings. **Figure 5.10** details noise contours for full mining operations and dumping at RL110 on the eastern emplacement. **Figure 5.11** details noise contours for full mining operation and dumping at RL125 on the eastern emplacement. **Figure 5.12** details noise contours for full mining operations and dumping at RL90 on the western emplacement. **Figure 5.13** details noise contours for full mining operation and dumping at RL105 on the western emplacement.

It has been assumed that these noise levels may occur at any time during the day or evening, so the lower of the day and evening project specific noise goals in Table 3.7 of **Section 3.4** have been taken as the governing criteria.

Presented in **Table 5.1** is the predicted operational noise levels during the day when dumping is occurring at the final level (RL125). Exceedences during inversion and wind conditions are presented in bold.

TABLE 5.1
PREDICTED DAY/EVENING OPERATIONAL NOISE LEVELS – dB(A),Leq
CPP + TRAIN LOADING + BARRETT PIT + DUMPING ON EAST DUMP AT RL 125

	Predicted level				Exceedence		
Location	Neutral	Inversion	Wind	Criterion	Neutral	Inversion	Wind
(1) A. Bowman	<25	32	33	38	0	0	0
(2) W. Bowman	25	35	37	38	0	0	0
(3) P. Moore	27	37	38	38	0	0	0
(4) C. & M. Lane	28	38	39	38	0	0	1
(5) A. & L. Horadam	29	39	43	38	0	0	**5**
(6) J. Wearmouth	31	40	43	38	0	**2**	**5**
(7) L. Stevens	32	39	42	45	0	0	0
(8) R. & L. Moss	30	38	41	38	0	0	**3**
(9) N. & M. Smiles	27	35	37	38	0	0	0
(10) D. Proctor	28	37	40	39	0	0	**1**
(11) B. & R. Richards	30	36	40	39	0	0	**1**
(12) J. & T. McInerney	34	37	41	38	0	0	**3**
(13) T. Clarke	33	38	41	38	0	0	**3**
(14) D. Scholz	34	37	38	38	0	0	0
(15) G. Donellan	28	38	35	36	0	**2**	0
(16) A. & C. Klasen	30	38	38	36	0	**2**	**2**
(17) B. & R. Richards	30	38	43	36	0	**2**	**7**

Presented in **Table 5.2** is predicted noise operation levels whilst dumping on the western emplacement area at the final height (RL105). Exceedences during inversion and wind conditions are presented in bold.

TABLE 5.2 PREDICTED DAY/EVENING OPERATIONAL NOISE LEVELS – dB(A),Leq CPP + TRAIN LOADING + BARRETT PIT + DUMPING ON WEST DUMP AT RL 105							
	Predicted level				Exceedence		
Location	Neutral	Inversion	Wind	Criterion	Neutral	Inversion	Wind
(1) A Bowman	25	30	30	38	0	0	0
(2) W. Bowman	26	32	35	38	0	0	0
(3) P. Moore	30	34	37	38	0	0	0
(4) C. & M. Lane	30	35	39	38	0	0	**1**
(5) A. & L. Horadam	32	36	41	38	0	0	**3**
(6) J. Wearmouth	33	36	41	38	0	0	**3**
(7) L. Stevens	34	36	41	45	0	0	0
(8) R. & L. Moss	31	36	41	38	0	0	**3**
(9) N. & M. Smiles	28	35	36	38	0	0	0
(10) D. Proctor	28	37	37	39	0	0	0
(11) B. & R. Richards	29	36	36	39	0	0	0
(12) J. & T. McInerney	32	39	40	38	0	**1**	**2**
(13) T. Clarke	32	41	41	38	0	**3**	**3**
(14) D. Scholz	35	40	40	38	0	**2**	**2**
(15) G. Donellan	<25	35	31	36	0	0	0
(16) A. & C. Klasen	<25	34	34	36	0	0	0
(17) B. & R. Richards	25	34	35	36	0	0	0

Table 5.3 shows predicted noise levels from reverse beepers operating simultaneously on the top of environmental bunds at the eastern and western dumps, compared with the sleep arousal criterion of '(lower of the daytime and evening background levels) + 15dB(A)'. Exceeedences during inversion and wind conditions are presented in bold.

Noise from these exposed beepers will not occur at night when sleep arousal is usually considered. Rather, the day/evening assessment was conducted to determine the potential for disturbing the sleep of shift workers residing in the area.

TABLE 5.3 PREDICTED MAXIMUM NOISE LEVELS – dB(A),Lmax REVERSE BEEPERS ON EAST AND WEST DUMP ENVIRONMENTAL BUNDS							
	Predicted level				Exceedance		
Location	Neutral	Inversion	Wind	Criterion	Neutral	Inversion	Wind
(1) A. Bowman	25	35	30	48	0	0	0
(2) W. Bowman	30	37	37	48	0	0	0
(3) P. Moore	32	40	41	48	0	0	0
(4) C. & M. Lane	32	40	41	48	0	0	0
(5) A. & L. Horadam	34	42	45	48	0	0	0
(6) J. Wearmouth	35	43	45	48	0	0	0
(7) L. Stevens	38	44	46	55	0	0	0
(8) R. & L. Moss	33	40	41	48	0	0	0
(9) N. & M. Smiles	30	37	38	48	0	0	0
(10) D. Proctor	33	39	40	49	0	0	0
(11) B. & R. Richards	35	40	42	49	0	0	0
(12) J. & T. McInerney	44	48	50	48	0	0	**2**
(13) T. Clarke	43	48	49	48	0	0	**1**
(14) D. Scholz	45	49	49	48	0	**1**	**1**
(15) G. Donellan	<25	30	26	46	0	0	0
(16) A. & C. Klasen	25	35	32	46	0	0	0
(17) B. & R. Richards	30	38	40	46	0	0	0

5.3.2 Rail Noise Impact

Nominally, the closest residence to the rail line may be at a distance of 20m in urban areas. At this distance, the number of coal trains should not exceed three (3) per 24-hour period. As the Ashton Coal Project will not typically produce sufficient coal to require more than 2 trains per day, an actual noise level of 53dB(A),Leq(24 hour) is anticipated. This level is exceeded by existing rail traffic and the introduction of up to two additional coal trains per day will not result in a measurable noise increase.

5.3.3 Construction Noise impact

Initial excavation of the Arties Pit and construction of the proposed environmental bunds will occur during the first six months and noise levels are therefore restricted to 'daytime background level + 10dB(A)' at all residences. It has been conservatively estimated that construction noise levels will be as loud as operational noise levels given in **Tables 5.1** and **5.2,** when dumping of overburden behind the bunds has reached the height of the bunds. **Table 5.4** shows the estimated worst-case construction noise levels, taken as the maximum value from **Table 5.1** or **Table 5.2** at each assessed location, with 3dB(A) added to convert from Leq to L10 levels.

TABLE 5.4 PREDICTED CONSTRUCTION NOISE LEVELS – dB(A),L10 INITIAL EARTHWORKS AND CONSTRUCTION OF ENVIRONMENTAL BUNDS							
	Predicted level				Exceedance		
Location	Neutral	Inversion	Wind	Criterion	Neutral	Inversion	Wind
(1) A. Bowman	28	35	36	43	0	0	0
(2) W. Bowman	29	38	40	43	0	0	0
(3) P. Moore	33	40	41	43	0	0	0
(4) C. & M. Lane	33	41	42	43	0	0	0
(5) A. & L. Horadam	35	42	46	43	0	0	**3**
(6) J. Wearmouth	36	43	46	43	0	0	**3**
(7) L. Stevens	37	42	45	52	0	0	0
(8) R. & L. Moss	34	41	44	43	0	0	**1**
(9) N. & M. Smiles	31	38	40	43	0	0	0
(10) D. Proctor	31	40	43	44	0	0	0
(11) B. & R. Richards	33	39	39	44	0	0	0
(12) J. & T. McInerney	35	42	44	43	0	0	**1**
(13) T. Clarke	36	44	44	43	0	0	**1**
(14) D. Scholz	38	43	43	43	0	0	0
(15) G. Donellan	31	41	38	41	0	0	0
(16) A. & C. Klasen	33	41	41	41	0	0	0
(17) B. & R. Richards	33	41	46	41	0	0	**5**

Modelling was conducted for construction noise levels, assuming that earthworks near the coal handling area and construction of the CPP occur simultaneously. The general worst-case condition of a north westerly wind was adopted. Predicted noise levels are assessed against the daytime operational noise goals. Exceeedences during inversion and wind conditions are presented in bold.

5.3.4 Blasting

Table 5.5 and Table 5.6 summarise the 95th percentile blast overpressure and ground vibration levels, respectively, at the nearest residences in Camberwell village.

TABLE 5.5 PREDICTED BLAST OVERPRESSURE LEVELS					
MIC (kg)	Closest Residence	Distance from blast (m)	Overpressure (dB)	Criterion (dB)	Exceedance (dB)
100	L. & R. Thompson	520	113	115	0
250	L. & R. Thompson	770	110	115	0
400	M. & T. De Jong	1000	108	115	0
600	M. & T. De Jong	1230	106	115	0

TABLE 5.6 PREDICTED BLAST VIBRATION LEVELS					
MIC (kg)	Closest Residence	Distance from blast (m)	PPV (mm/s)	Criterion (mm/s)	Exceedance (mm/s)
100	L. & R. Thompson	520	1.3	5	0
250	L. & R. Thompson	770	1.4	5	0
400	M. & T. De Jong	1000	1.4	5	0
600	M. & T. De Jong	1230	1.4	5	0

The proposed maximum charge weights were designed to achieve vibration levels of no more than 2 mm/s at the nearest residence and 20 mm/s at sensitive locations along the rail line, and were based on the standard equation for average ground types. When re-analyses using the site-specific equation, vibration levels were predicted not to exceed 18mm/s at sensitive points along the rail line.

5.4 Surface Water

5.4.1 Changes to Catchment Area/Yields

Water runoff from the area disturbed by the open cut mine, the overburden emplacement areas and the surface facilities will be captured and utilised on site so there will be a very marginal decrease in the water inflow to Bowmans Creek. Likewise subsidence in the area of the longwall panels may also impact the catchment yield by temporarily increasing the percolation characteristics of the strata until the fractures anneal and seal.

5.4.2 Diversion of Bowmans Creek

The diversion channel for Bowmans Creek will be constructed in Year 3 of the project to allow sufficient time for the creek ecosystem to be developed prior to the actual diversion of water in year 5. The diversion will replicate the pool and riffle style of the existing creek, however, the surface extent of flooding will be contained in the northern 1700m of the diversion. The diversion works are designed to contain the 1 in 100 flood in Bowmans Creek as well as limit the extent of back flow of water from the Hunter River in the 100 years recurrence flood events.

5.4.3 Water Quality

Dirty and saline contaminated water will not be discharged from the mine site as the project has been designed on the basis of nil discharge. However, the project proposes to seek permission to discharge some water following retention in sedimentation ponds. These discharges will be licensed under the Hunter River Salinity Trading Scheme and will only occur in exceptional circumstances.

No adverse impact on water quality is anticipated as any discharge will occur under limitations imposed by the relevant bodies. Such discharge would be from final sedimentation dams either at stated quality values, surface water runoff or under conditions of high rainfall/surface runoff.

5.4.4 Groundwater

The impacts of the mining activities on the groundwater were assessed with the aid of computer modelling and are presented in **Appendix H** of **Volume 2.** The model used available hydrogeological data from studies in the area and incorporated the effects of nearby existing mines. Sensitivity studies were performed to assess which parameters impacted most on the model predictions.

5.5 Mine Water Inflows

The predicted groundwater inflows to the proposed Ashton open cut and underground are shown in **Table 5.7** for three representative project years to illustrate the range of expected inflows.

TABLE 5.7
PREDICTED UNDERGROUND INFLOWS FROM PROPOSED MINING

Project Year	Open Cut Operation Ml/day	Underground Operation Ml/day	Total Inflows Ml/day
2	0.367	0.000	0.367
5	0.214	0.914	1.128
12	0.214	1.726	1.940

In practice, groundwater inflows may well be significantly less than predicted by the model based on experience at similar mines in this part of the Hunter Valley.

The quality of the extracted water is expected to be similar to that being extracted from underground workings in the Cumnock Mine, where the salinity ranges from 8,000 to 9,000 S/cm. The recharge to the groundwater system from rainfall will be slightly enhanced after mining, but the increase will decay with time as subsidence fractures seal.

Seepage from Alluvium

The water seeping from the alluvium due to mining operations has been calculated as the difference between flows calculated in the active mining scenario and flows calculated in the calibration model. Results are presented in **Table 5.8**. Underground mine water inflows will be used in the CHPP.

TABLE 5.8
PREDICTED SEEPAGE RATES FROM ALUVIUM DURING PROPOSED MINING OPERATIONS

Project Year	Hunter River Alluvium Ml/Day	Bowmans Creek Alluvium Ml/Day	Glennies Creek Alluvium Ml/Day
2	-0.004	-0.008	0.065
5	0.161	0.180	0.319
12	0.303	0.397	0.563

5.5.1 Groundwater Level Changes

The mining will lower the groundwater or piezometric levels in the surrounding and overlying coal measures. The pattern of draw down in the groundwater levels, or cone of depression, predicted by the modelling for the shallower coal measures is elliptical in a north westerly direction due to the cumulative effects of the Ashton Project with the Ravensworth South and Narama open cuts. The cone of depression is confined to the east due to the coal measures aquifers outcropping in the steep slopes above Glennies Creek, but extends about 2km to the south under the Hunter River alluvium. Predicted draw downs in the overlying Hunter alluvium are minimal due to the recharge effects of the river. The sensitivity studies indicate that a reduction in the permeability of the weathered coal measures under the alluvium, significantly reduces the impacts on the groundwater losses and water level changes in the Hunter alluvium.

5.5.2 Subsidence Effects on Bowmans Creek Alluvium

A conceptual model was developed to predict the likely seepage losses from the shallow groundwater stored in the Bowmans Creek alluvium if, and when, open subsidence fractures connect the underground mine to the base of the alluvium. The model, which calculates drainage of the groundwater stored in the alluvium, predicts peak seepage losses of about 2.5Ml/day that decay over about 10 months to a rate equivalent to the estimated rainfall recharge rate of around 0.1ML/day. For mine water balance modelling purposes, it has been assumed that these seepage losses are in addition to the mine inflows predicted by the groundwater model of the coal measures and are equivalent to an average increase in mine inflows of about 1Ml/day over a 12 month period.

5.5.3 Interaction of Open Cut with Glennies Creek

There is natural seepage passing from the coal measures to Glennies Creek. During the open cut operation this is likely to be reversed when the floor of the mine is lower than the creek. Following completion of mining the groundwater seepage is expected to go back to previous natural condition with similar levels of flow back to Glennies Creek. The water quality is expected to be same as the existing flows from the coal measures.

5.5.4 Post Mining Recovery

The water level in the goaf and overlying coal measures are expected to rise to about 1m to 3m higher than their pre mining levels, inducing an increased potential for upward groundwater leakage from the goaf into the Bowmans Creek alluvium. As a consequence it is expected that there will be a small rise in salinity in Bowmans Creek of about 5µ5/cm, which is well within the pre-mining and natural fluctuations of the creek salinity.

Table 5.9 shows the predicted changes in seepage across the bedrock/alluvium interface before and after mining.

TABLE 5.9 CHANGES IN SEEPAGE ACROSS THE BEDROCK/ ALLUVIUM INTERFACE			
	Pre Mining (Ml/day)	Post Mining (Ml/day)	Change (Ml/day)
Hunter River alluvium	-0.103	-0.074	+0.029
Bowmans Creek alluvium*	-0.248	+0.022	+0.270
Glennies Creek alluvium	+0.279	+0.330	+0.051

** That part of the alluvium extending from the Bowmans Creek diversion to the Hunter River.*

5.5.5 Impacts on Groundwater Users

No registered water bores occur in the coal measures within the areas where the predicted draw downs are significant. However, there are a seven registered bores or wells in the Bowmans alluvium within 3km upstream of the mine. There is also one well in the Glennies Creek alluvium in Camberwell and one well in the Hunter alluvium south of the mine. Most are shallow large diameter wells reportedly dug for domestic or stock water supplies, however it is not clear how many are still in use. The predicted draw downs in the alluvium at these wells minimise so the yields of these wells are unlikely to be affected by the Ashton Project.

5.6 Land Use

5.6.1 Land Capability

Figure 5.14 shows the land capability of the Ashton Coal Project, once mining has been completed. The area of class III land has been reduced due to the mining activities. The post mining land capability assessment has been produced from consideration of the predicted final landform. This includes the placement of soil and overburden and the ability of such material to sustain agricultural and pastoral pursuits on a sustainable basis.

It should be noted that the details on land capability should also be aligned to the proposed final land use for the site. Particular consideration should be given to the conceptual design for revegetation of the Ashton Coal Project Area. This should increase the areas returning to native species planting and enhancement of native habitats across much of the site.

5.6.2 Agricultural Suitability

Post mining, the Ashton Coal Project will be seeking to enhance the utilisation of the Class 1 agricultural soils along the southern reaches of Bowmans Creek and on the Hunter River alluvial soils, for the production of lucerne crops.

The agricultural suitability of the land will be altered in the section where Bowmans Creek will be realigned and where predicted subsidence and ponding of water may occur. The planting of riparian vegetation within these areas will enhance the native habitat rehabilitation.

The movement and long-term placement of soil and subsurface material would facilitate the increase in the area of Class 4. These areas are proposed to be planted to native species especially along the ridgelines of the project area. Further details on the rehabilitation of the project area are covered in Section 6 of the EIS.

5.7 Flora, Fauna and Aquatic Habitat

5.7.1 Flora and Fauna Impacts

Flora

The most significant impacts to the flora of the site will occur where the open cut mine, spoil emplacements, surface facilities and relocation of Bowman Creek will occur. Two thirds of the surface vegetation north of the New England Highway will be modified to a significant extent by these activities. The woodland in this area will be removed as part of the open cut mining operation. This woodland is in a modified state due to past agricultural practices, but does contain shrub species that have declined in the local area as a result of clearing and over grazing. None of the plant species are threatened or regionally significant. The Bull Oak communities are common as they are regeneration as a result of the clearing of the original woodland cover. The dry grasslands, dominated by native species, are not significant as they are also the result of past clearing and agricultural practices and are found throughout the local area and region.

The majority of the vegetation communities that are present south of the New England Highway will have only subtle changes as a result of subsidence. Surface impacts include cracking and it is expected that some aquatic habitats will be drained at least in the short term. Cracks are likely to fill with sediment and the aquatic environments may re-establish once mining, and further cracking, ceases. Troughs caused by the subsidence may lead to a moister environment than is present. If this occurs it is likely that exotic vegetation associated with the former agricultural practices will dominate, as will Juncus and sedges, as has occurred between the former under ground mine entrance and Bowman Creek north of the New England Highway.

No significant impact is expected to occur to the dry pastures as a result of subsidence. Without management erosion will occur within woodlands as a result of subsidence. Erosion would increase where the shrubs and living ground cover is poorly developed, for example where Bull Oak forms dense stands.

The relocation of Bowman Creek to the west is likely to result in the loss of some River Oak as water stress increases. Recruitment of juveniles into the community is likely to cease. This should be offset by the careful re-vegetation of the proposed relocation of Bowman Creek. No significant loss of shrubs or trees is expected to occur under the River Oak canopy as the grazing of cattle heavily impacts the present lower vegetation layer.

Fauna

The proposed development will result in the removal of some grassland, Bull Oak dominated woodland and Eucalyptus dominated woodland. The grassland communities are utilised for foraging purposes by bird species. It is intended that surface cover and land use will be returned to a state of at least equivalent to or better than at present.

The removal of the woodland to the north of the New England Highway is unlikely to have a significant impact on the local fauna. Small bird species will experience some impact as roost and nesting habitat will be lost.

No species within the north eastern woodland are regionally significant, however there is a resident population of the regionally significant Grey-crowned Babbler within the southern woodland. The southern woodland will be impacted by subsidence. The woodland habitat is expected to increase in value to this species and species displaced by the removal of the north-eastern woodland.

No significant impact is expected to occur to larger native mammal species, as the present faunal assemblage is typical of grassland in a rural environment. The greatest impact to these species is likely to occur as a result of the loss of some aquatic habitats that act as watering points. The loss of some aquatic habitat may result in the local decline of wetland species until new habitats establish as a result of subsidence or stock dams re-establish after draining from cracking caused by subsidence. Lake Liddell is a large dam to the north-west. The lake is a far greater habitat resource for wetland dependant birds within 15 km of of the study area.

5.7.2 Aquatic Impacts

With respect to aquatic habitat for the Ashton Coal Project, the only expected impacts relate to subsidence, as all surface runoff water from the mine lease area will be collected into impoundments within the lease area for re-use on-site. That is, there will be no mine waste-water discharge to the creeks.

Owing to the proposal for multiple pass longwall mining, subsidence will occur in relation to the underground mine. Subsidence will not impact Glennies Creek or the Hunter River, as mining is isolated from the stream alluvials. In general terms, subsidence can have two effects:

- Formation of in-stream depressions resulting in ponded areas for surface waters; and

- Formation of depressions with surface cracking and diversion of surface waters to ground water via fissures.

The formation of in-stream depressions without water loss is expected to occur over much of the site, with consequent alterations to the minor drainage lines and to the stock watering ponds across the study area.

Other than the subsidence impacts for Bowmans Creek, formation of surface depressions and ponding of surface waters over the remainder of the site is not in itself a problem, as most of the site drainage lines are minor and provide no fish or aquatic habitat. Observations of subsidence impacts in other mining areas in the region indicate that production of in-line ponded areas may well provide additional aquatic habitat areas which would be utilised by macroinvertebrates and possibly by fish, especially if some active works are done to enhance aquatic habitat.

Loss of Bowmans Creek waters to ground water via surface cracking is more problematic, particularly given its status as a Class 1 stream, and, as subsidence is predicted, with surface cracking and diversion of water for most of the section of Bowmans Creek located under longwalls 4, 5 and 6.

The predicted severity of cracking and water loss is such that in-stream remedial works could not be undertaken successfully without unacceptable risks of mine flooding. It has therefore been concluded that the most beneficial mitigation measure for balancing risk and loss of creek environmental attributes is a permanent diversion of a section of Bowmans Creek.

5.8 Cultural Heritage

5.8.1 Aboriginal Archaeological Heritage

Significance Assessment

Provided in **Table 5.10** is an assessment of the significance of each site recorded in the Ashton Coal Project area.

TABLE 5.10
SIGNIFICANCE ASSESSMENT OF ARCHAEOLOGICAL SITES

Site	Site Type	Research Potential	Overall Significance Assessment
ASH1	Artefact Scatter	Some erosion on minor creek line, widely spread scatter with potential for sub-surface deposit	Medium
ASH2	Artefact Scatter	3 artefacts in eroded patch on slope of ridgeline minimal potential for sub-surface deposit	Low
ASH3	Isolated Find	Isolated artefact visible due to destruction by pipeline	Low
ASH4	Artefact Scatter	Very large scatter including rarer artefact types spread across slope and ridge into drainage gully.	High
ASH5	Artefact Scatter	Part of complex of sites along creek tributaries leading to Bowmans Creek. As a whole the creek line has very high potential for sub-surface deposit.	High (as site complex)

ASH6	Artefact Scatter	Part of complex of sites along creek tributaries leading to Bowmans Creek. As a whole the creek line has very high potential for sub-surface deposit.	High (as site complex)
ASH7	Artefact Scatter	Part of complex of sites along creek tributaries leading to Bowmans Creek. As a whole the creek line has very high potential for sub-surface deposit.	High (as site complex)
ASH8	Artefact Scatter	Small scatter with small potential for sub-surface deposit due to presence of 1 silcrete core and some possible debitage although not clearly indicated by deposit	Low
ASH9	Artefact Scatter	Large scatter over 40-50 metres of a variety of artefacts, part of a complex of sites along tributaries of Bettys Creek including a variety of artefacts and tool manufacture debitage will include sub-surface deposits.	High (as part of overall area)
ASH10	Artefact Scatter	This site is spread along an exposed track beside the rail line between the two tributaries which contain sites 9, 11, 12 and 13. This is obviously an area of extensive artefact deposit and forms part of a larger activity area.	High (as part of overall area)
ASH11	Artefact Scatter	Scatter, part of a complex of sites along tributaries of Bettys Creek some areas will include sub-surface deposits. Some burnt clay present at this site.	High (as part of overall area)
ASH12	Artefact Scatter	Scatter, part of a complex of sites along tributaries of Bettys Creek some areas will include sub-surface deposits.	High (as part of overall area)
ASH13	Artefact Scatter	Scatter, part of a complex of sites along tributaries of Bettys Creek some areas will include sub-surface deposits.	High (as part of overall area)
ASH14	Artefact Scatter	Scatter, part of a complex of sites along tributaries of Bettys Creek some areas will include sub-surface deposits. This area further up gully line on ridge contains at least 10 small debitage places, knapping floor	High (as part of overall area)
ASH15	Artefact Scatter	Part of complex of sites along creek tributaries leading to Bowmans Creek. As a whole the creek line has very high potential for sub-surface deposit.	High (as site complex)

ASH16	Artefact Scatter	Located on terrace overlooking Bowmans Creek, some disturbance to site but potential for further deposit along terrace scattered over 20-30 metres.	Medium
ASH17	Artefact Scatter	On ridge near terrace overlooking Bowmans Creek, visibility poor, some low density artefacts with some potential for sub-surface deposit.	Low
ASH18	Artefact Scatter	On ridge near terrace overlooking Bowmans Creek, visibility poor, some low density artefacts with some potential for sub-surface deposit.	Low
ASH19	Isolated Find	1 core near ridge overlooking Hunter River, beside well used vehicle track, unlikely to be in situ.	Low
ASH20	Artefact Scatter	Small scatter in gully line, no sub-surface deposit visible.	Low
ASH21	Isolated Find	1 mudstone flake located near farm buildings probably disturbed	Low
ASH22	Artefact Scatter	Disturbed exposure containing 2 artefacts, low potential for sub-surface deposit	Low
ASH23	Isolated Find	Isolated artefact located beside old highway route. Clearly disturbed context.	Low
ASH24	Artefact Scatter	This site is spread along an exposed track beside the rail line near a tributary of Bettys Creek and is associated with sites 9, 10, 11, 12 and 13. This is obviously an area of extensive artefact deposit and forms part of a larger complex of activity areas.	High (as part of overall area)

Some of the sites have been assessed as significant in terms of being part of a complex of inter-related sites within an area. Although each site on its own may have some research potential as a group the information potentially to be gained is increased.

Predicted Impacts

Along with locating areas of archaeological potential and assessing sites it is also important to consider these in relation to the proposed impacts. The predicted impacts from mining to the sites are:

- Extensive surface disturbance in the area of the new channel for Bowmans Creek, which would most likely destroy any sites present. It would also involve some disturbance to the area where the current channel is to divert;

- Subsidence impacts due to longwall mining. This will need to be carefully assessed. According to

NSW National Parks and Wildlife Service advice if it is found that there is a less than 10% chance of an individual site being subject to subsidence impact, no consent to destroy will be required. Assessment of subsidence likelihood has been provided on behalf of the proponent and is presented in **Appendix L** of **Volume 2.**

The relationship between archaeological sites recorded and likely subsidence impacts. The potential impacts are summarised below:-

- The dumping of overburden or coal products in the western dump area has the potential to damage any sites located within the dumping area. The sites to be impacted by the area proposed are sites 4, 5, 15, 17, 18, 21 and 22; and

- Open cut mine and infrastructure north of the New England Highway including the mine extension area and dump areas to the extreme east of the study area. Eleven sites were recorded which would be impacted by the current plan for these areas.

5.8.2 Non Indigenous Heritage

There are no predicted impacts on items of non-indigenous heritage resulting from the Ashton Coal Project.

St Clements Anglican Church and the Camberwell Community Hall are listed on the Singleton LEP 1996 as being items of environmental heritage of local significance. These items will not be affected by vibration due to blasting within the mine. Blasts have been designed so that vibration levels do not exceed 2mm/s.

5.9 Social Impacts

Information provided by WML has indicated that the Ashton Coal Project will ultimately provide employment for around 140 full time staff. WML has committed to employing local residents of Camberwell in preference to residents at other localities. This commitment has been presented to the Camberwell community during the public consultation process. At the time of preparation of this EIS, some Camberwell residents had expressed an interest in employment at the Ashton Coal Project.

It is estimated that the mine construction will be conducted over an 18 month period. Peak employment levels of 200 personnel are expected to occur between months 6 to 13, with the average number of employees likely to be 50.

5.9.1 Impacts on the Provision of Services

The proposed Ashton Coal Project will utilize a workforce made up predominantly of people from the local area. The numbers of people employed in the coal mining industry in the Hunter Valley has dropped markedly from 6,358 to 4,770 between 1997 and 2000 respectively.

Even if WML only recruits a small portion of its workforce from the Camberwell area, the evidence suggests that the opening of a new mine will not cause an influx of new residents into the Singleton LGA. Singleton Council itself has reported that 50% of workers at mines situated within the shire do not reside within the LGA. This indicates a relatively mobile mine workforce that does not necessarily want or need to live near the mine that employs them. In fact many miners appear to live at distance from their respective mines.

Bearing these two factors in mind, it is unlikely that there will be significant additional demands placed on existing services.

Singleton Council has established a Section 94 Contributions Plan for public facilities and services. The amount of contribution is based upon the number of employees the mine will generate. It is contended that such a contribution is to apply to full time employees and not construction workers. Such a contribution would more than adequately compensate for any additional demands on existing services in the Singleton LGA. However, there also will be increased employment opportunities resulting from the construction activities associated with the mines. It is anticipated that an 18 month construction period will apply.

The combination of short construction period for a low number of employees likely to be brought into the area suggests minimal impacts on services can be expected from the construction phase of the proposed development.

5.9.2 Housing Impacts

The proposed development is likely to generate 140 full time positions. It is not anticipated that people moving into the Singleton area will fill the bulk of these positions. Therefore, there will not be an influx of people into the Singleton LGA that will create pressure upon existing housing stocks.

It is likely that around 40 construction contractors will require accommodation during the construction phase. Discussions with local real estate agents indicate there are sufficient rental properties in quality and variety to meet the needs of those workers requiring longer term accommodations. There is adequate casual accommodation available in the form of hotels, motels and caravan parks to cover the more short term stays. The Singleton area has developed great experience in housing such contractors associated with larger resource and infrastructure developments.

It is highly unlikely that the proposed development will cause adverse impacts upon housing supply in the area.

5.9.3 Employment

It is expected that the proposed development will have positive social impacts mainly through the generation of 140 full time and 200 temporary construction jobs associated with the project.

As reported in the various coal industry profiles, the number of people employed in the Hunter Valley coalfield has dropped from 6,358 in 1997 to 4,770 in 2000. The loss of these 1588 jobs represents 25% of the workforce. The Department of Mineral Resources, in its Strategic Study of Northern NSW Coalfields (1999) estimated further direct job losses over a 3 year period to 2002 at 9%.

The opening of the Ashton Coal Project can only assist in reversing or stemming the number of job losses in the mining sector. The coal mining industry is the most important source of employment in the Singleton LGA. In 1996 18.8% of the workforce and 27.5% of employed males obtained employment from the mining sector.

The project will not only provide direct employment, it will also provide indirect and induced employment largely in areas surrounding the mine. Such employment opportunities exist in the mine servicing industry, transport and service related industries. There have been a number of attempts to qualify the multiplier effect relating to mine employment. Many of these studies have been in relation to specific coal mining operations in the upper Hunter Valley. Some calculated multiplier effects are listed below in **Table 5.11**.

TABLE 5.11
INDICATIVE INDUSTRY EMLOYMENT MULTIPLIER

Activity	Source	Multiplier
Dartbrook Mine (1990)	Hunter Valley Research Foundation	2.437
Bulga Coal Mine	Hunter Valley Research Foundation	2.00
Ravensworth East Mine (1999)	Hunter Valley Research Foundation	2.65
Non Specific 1995	Australian Bureau of Statistics	2.977
	Average	2.516

The figures listed in **Table 5.11** show a range of multipliers from 2.0 to 3.0 with an average of 2.5. Applying the average to the proposed Ashton Coal Project workforce it is possible that 350 people could be directly or indirectly employed through the mines operation. That is, 140 persons employed directly at the mine plus 210 persons (indirectly or induced) employed as a consequence of the project proceeding.

5.10 Economic Impacts

As previously discussed in **Section 3.13**, the coal mining industry is the major contributor to the local and regional economy. It also plays a significant role in state and regional economics.

WML has estimated to expenditure in relation to the Project, as follows:-

- Average wages per year, from both the open cut and underground operations are anticipated at $11.2M per year. Construction wages are likely to be in the order of $18M;
- Capital expenditure on the establishment of the mine is expected to be $42M;
- During peak production the operations will spend in the order of $22M per year on materials and services;
- Average operating years contribute $17Mpa to port and rail services income streams; and
- Average operating years contributes around $5Mpa in government royalties.

As with the case for employment generation, attempts have been made to identify and quantify multiplier effects pertaining to various economic factors. An income multiplier of 1.66 has been used in assessing the impacts of a number of upper Hunter Valley coal mines such as Nardell, Ravensworth East and Mount Pleasant, based on information supplied by the Hunter Valley Research Foundation. The income component is applied to the wages and salary component of the mines expenditure.

Using the multiplier the extended mine can be expected to generate an addition flow on income of $7.4 million per year during open cut and underground operations. This means the Ashton Coal Project is likely to generate around $18.6 million of income per annum during peak production.

Assuming, 50% of the workforce resides in the Singleton LGA, it can be reasonably expected that these monies will remain within the area. This represents $9.3 million per annum yearly benefit for the Singleton LGA.

It is estimated that $18 million will be paid as wages to contractors during the construction period. Again applying the income multiplier of 1.66 it is anticipated that around $30 million in wages could be generated by the mines construction. As previously identified, around 80% of construction workers will be sourced locally. This means around $24 million of the income generated is likely to stay within the district.

It is estimated that $42 million will be spent on construction works establishing the mine. Using Australian Bureau of Statistics and Hunter Valley Research Foundation information, an average output multiplier for construction works of 1.8 has been determined. In this instance the flow on expenditure from the proposed construction works is $75.6 million.

The mine once constructed, expects to outlay an average of $22 million per year for materials and services. Capital expenditure (excluding construction) per year is estimated at $4 million. This means an average yearly output of $26 million is possible. Output multipliers have been determined for other coal mines in the upper Hunter Valley region by the Hunter Valley Region Foundation.

TABLE 5.12 INDICATIVE INDUSTRY OUTPUT MULTIPLIER		
Activity	Source	Multiplier
Dartbrook Mine (1990)	Hunter Valley Research Foundation	2.1285
Bulga Coal Mine	Hunter Valley Research Foundation	1.5
Ravensworth East Mine (1999)	Hunter Valley Research Foundation	1.86
Non Specific 1995	Australian Bureau of Statistics	1.136
	Average	1.66

Applying an average output multiplier of 1.66 the annual yearly output of $43.2 million. It can be expected that the mining operations will generate an additional flow on expenditure of $17.2 million. This expenditure is expected to be concentrated in the Hunter Valley. For example, in relation to the proposed Kayuga Coal Mine, it was estimated that 20% of proposed capital and operating expenditure would remain in the Hunter Valley with 75% remaining in Australia (Kayuga Coal Project 1997).

Through income taxes alone the Commonwealth Government can be expected to raise average yearly revenue of around $3.4 million, based on an average tax rate at 30%. Including indirect flow on employment the tax revenue per year could be in the order of $5.6 million.

It is expected that the bulk of the coal produced will be exported to Asian markets. Japan is expected to be the destination for the majority of the coal. The extended mine will improve Australia's balance of payments and reduce trade deficit.

5.11 Transportation

5.11.1 Roads and Traffic

Construction

The construction phase of the project is to be undertaken over an 18 month period. It is envisaged that an average of 50 construction workers will be on site at any one time during the period.

The traffic mix will consist of light vehicle traffic and heavy truck deliveries of equipment and materials. Construction workers will be directed to use Glennies Creek Road to access the site.

An old alignment of the New England Highway just to the east of the Bowmans Creek bridge also forms an access to the surface facilities. This road will be used as an oversize vehicle access during the construction phase, but only when necessary.

Operational Phase

During the operational phase of the mining operation it is proposed that a maximum of 140 persons will be employed on site. These people will be employed at either the open cut mine, the underground mine, the CHPP or the administrative offices, with a variety of work rosters also being used. It is therefore envisaged that a maximum of 66 employees will be on site at any one time. Typical car pooling patterns indicate less than 50 vehicle movements at the start and end of staggered shifts. The Glennies Creek Road access will be used by all employees.

The number of vehicle movements is well within the capacity of Glennies Creek Road and its intersection with the New England Highway, but to facilitate safe entry and exit to the site, the Ashton Coal Project propose to:-

- Improve the radius of the turn onto the New England Highway;
- Resurface Glennies Creek Road from the highway to the realigned section of road north of the mine entrance;
- Provide a mine entry intersection to AUSTROADS Standard; and
- Realign Glennies Creek Road on the corner near the Open Cut where it turns east.

Most operational traffic will be contained within the open cut area to the north of the New England Highway, but it will be necessary to transport approximately 5Mbcm of overburden to the Western emplacement area during the first 2 years of operation. A haul road will be constructed under the Bowmans Creek bridge as shown in **Figure 4.17**. This road may also be used for the haulage of coal to Macquarie Generation's conveyor system during the early phases of the project when the rail loading system is not operational. An at-grade intersection with Brunkers Lane will be necessary in this circumstance, with traffic flows constructed by stop signs.

The blasting of overburden in the open cut mine will also impact on traffic. Blasts in the Arties Pit and at the southern extremities of the Barrett Pit will necessitate short closures of the New England Highway on an irregular basis. Glennies Creek Road will need to be closed for almost all blasts in the Barrett Pit. A blasting protocol will be developed to ensure that road closures are managed in a safe and efficient manner.

5.11.2 Rail

The northern area of the Ashton Coal Project is formed by the Main Northern Railway. A rail siding with a loading bin is proposed to allow loading from within the project area. The siding will be capable of accommodating 9,000t unit coal trains. No coal is proposed to be transported on the public road system. The capacity of the Hunter Valley rail network is 120 Mtpa, which is well in excess of current user requirements.

Blasting is also likely to occur in the vicinity of the railway line. A protocol will be developed with the Rail Infrastructure Corporation to ensure that the integrity and safety of the railway line is maintained, and to avoid interrupting scheduled train services.

5.12 Visual

As addressed in **Section 3.10,** the existing visual amenity applying to the development site has been described as moderate. Views to the proposed activities occur from the New England Highway in particular, and to a lesser extent from the village of Camberwell. Other rural dwellings in the locality will have views to the development.

5.12.1 Underground Operations

The underground mining operations take place on the southern side of the New England Highway. Little or no land disturbance is required for these operations to take place. However, it is expected that subsidence of up to 6 metres will occur. There will be potential for breaks or cracking of the ground surface at the edges of the subsidence zones. Thus, there will also be the potential for erosion at these points.

The underground operations require the relocation of Bowmans Creek. It is anticipated that the relocation will be undertaken over a 2 year period, between years 3 and 5 of the Ashton Coal Project. The creek relocation works will be carried out first and will involve the excavation of a new watercourse and then the planting of appropriate species vegetation prior to diversion of flows. Some of these works will take place adjacent to the New England Highway and will be visible to highway motorists.

In terms of visual amenity, the impact from the proposed underground mining is considered to be moderate due to the partial diversion of Bowmans Creek.

5.12.2 Western Emplacement and Haul Roads

It is expected that the western emplacement will be completed within 2 years of commencement of the Ashton Coal Project. Overburden material is to be transported to the emplacement area from the eastern side via an underpass beneath Bowmans Creek bridge. The volume of overburden is estimated at 5Mbcm.

The location and final height of the western emplacement is shown in **Figure 4.5**. The existing high point of the main ridge in the vicinity of the dump is approximately 100m AHD. It is proposed that the emplacement will achieve a maximum height of 105m AHD. It is also proposed to build an environmental bund, to height of 105m AHD along the ridge line to screen the development from Camberwell. Views to the proposed development from within the village of Camberwell and near the intersection of McInerney Street and the New England Highway are shown in **Figure 5.15** and **Figure 5.16**. The spoil forming the emplacement area will be placed on the western side of the bund to the same height. This means that the top of the emplacement has the potential, without any mitigation measures, to be viewed from locations to the south, including higher parts of Camberwell and northbound traffic travelling along the New England Highway. Travel time along the relevant section of the highway is about 80 seconds.

The main portion of the emplacement will be placed on the western side of the ridge and bund, down to height of approximately 70m AHD. The emplacement will be viewed by southbound highway traffic. The emplacement will come into view just north of the Brunkers Lane and the New England Highway intersection. Travelling at a speed of 100kph, viewing time will be approximately 40 seconds. The west emplacement will also be viewed by northbound motorists, but not to the same extent.

5.12.3 Open Cut Operations and Surface Infrastructure

These elements of the proposed development will not be viewed from the southern side of the main ridgeline. The main visual impact will be upon southbound motorists travelling on the highway. Less expansive views will be obtained by north bound motorists.

South bound motorists will first have distant views of the open cut and infrastructure just south of Hebden Road, some 3.2 kilometres north of the development site or approximately 2.5 minutes travelling time.

However, views to open cut and surface infrastructure will not be constant along this stretch of the highway. Vegetation, south of Hebden Road, filters views of the development and the winding nature of the road at this locality takes the development site in and out of view. Views from the highway to the open cut pit are also greatly protected by riparian vegetation along Bowmans Creek north of the development site. The greatest visual impact upon motorists will be the views of the development from the straight stretch of highway adjacent to the site from north of Bowmans Creek to the highway cutting where the highway crosses through the ridge, a distance of 1.5 kilometres or around 50 seconds travelling time.

5.12.4 Eastern Emplacement

Existing views from Camberwell to the location where the eastern emplacement is to be situated appear in **Figure 5.17**. The volume of the proposed eastern emplacement is estimated at 12Mbcm. It is proposed to initially develop the emplacement as an environmental bund along Glennies Creek Road and then progress from east to west until in-pit dumping becomes available. It is proposed to complete the eastern emplacement in Year 3 of mining operations. The proposed emplacement is expected to reach a maximum height of 125m AHD. Existing maximum height of the ridge in this locality is around 110m AHD. The bund will be constructed to a height of 125m AHD.

Much of the southern face of this emplacement and the environmental bund will be viewed from the south. This includes residents of Camberwell, although existing vegetation along Glennies Creek Road will act as a screen for the emplaced material. This emplacement will also be viewed from the highway south of Camberwell. The existing vegetation will also lessen the impact on the highway users as will the fact that the views of Camberwell village and distant Bayswater Power Station will attract motorist’s attention.

The main impact from the proposed eastern emplacement is to the east of the proposed mine site. The section of Glennies Creek Road, stretching 2 kilometres north-east from the railway crossing, contains a number of dwellings. These residences will have direct views of the emplacement area. Most of these residences are owned by Glendell and were acquired in association with the proposed Glendell Mine. There appears to be 2 privately owned residences in this locality.

5.12.5 Night Lighting

Night lighting will be concentrated around the surface facilities situated on the northern side of the New England Highway and Glennies Creek Road. Lighting will be provided around the offices, car parking areas, at the CPP and the access point off Glennies Creek Road.

The open cut operations will predominantly take place during daylight hours. However, operations are likely to extend to 10.00pm, which during winter, means that lighting will be required for periods of up to 5 hours. A 10.00pm finish would see around 2 hours of night lighting at the open cut operations in summer. When the pit is not operating, low level security and safety lighting only will be required.

For the first 18 months coal could be hauled from the northern side of the New England Highway to the Macquarie Generation over land conveyor system. Coal haul trucks will cross the highway via an underpass at the Bowmans Creek Bridge. Haulage of overburden to the western emplacement area is also to occur for a 2 year period. Coal haulage is to be limited to day and evening periods (7.00 am to 10.00 pm).

Truck movements at night, with associated headlights, can cause impacts, as the lights may be flashing or moving. It is also important that headlights are not directed towards motorists using the New England Highway or Glennies Creek Road. Truck movements under the New England Highway at night are limited to the first 2 years of operation. During winter around 5 hours of (on site) road haulage outside daylight hours could occur. The haul road is to be constructed at around 64m AHD, which is some 6 metres below the level of the New England Highway. There is little likelihood of truck headlights being aimed directly at vehicles using the highway at night. On site road haulage impacts as seen along Glennies Creek Road will screened by the environmental bund constructed along the road.

5.13 Hazards

A Preliminary Hazard Analysis (PHA) was conducted by HLA Envirosciences, and is included as **Appendix Q** of **Volume 2.**

A hazard identification table was developed for the proposed Ashton Coal Project, this table is presented in **Appendix A** of the PHA report. As a result of the hazard analysis study, a number of incidents were identified with the potential to impact offsite, these are:

5.13.1 Open-Cut Mining

- Topsoil Stripping Scraper Operations - Hydraulic oil or fuel spill under the scraper, ignition of fuel resulting in fire;
- Drill Pad Preparation, Overburden & Coal Mining, Truck, Excavator & Dozer Operations - Hydraulic oil or fuel spill, ignition of fuel resulting in fire;
- Mix truck accident leading to rollover, fuel spill, ignition and pool fire;
- Detonators and primer initiated in shotfirers vehicle resulting in localised explosion;
- ANFO mixing in the pump and pipe work on the mix truck initiates and leads to an explosion; and
- Blast pattern explosion leading to flyrock.

5.13.2 Pit Top Facilities

- Surge Bin – Dust explosion;
- Hazardous/Dangerous Goods Storage and Handling
  - Diesel fuel storage fire;
  - Ammonium Nitrate storage explosion;
  - Magazine explosion.

A detailed hazard analysis was undertaken for each of the above potential incidents. Based on the hazard analysis, a number of incidents were carried forward for consequence analysis. These being:-

- Scraper, Dozer, Truck, Mix Truck fuel leak and fire;
- Explosion on the shotfirers vehicle;
- Premature explosion of the ANFO mix on the mix truck;
- Diesel fuel storage fire; and
- Magazine explosion.

A detailed consequence analysis was conducted for each of the hazardous incidents. The detailed analysis is contained in Appendix B of the PHA report included in **Appendix Q** of **Volume 2. Table 5.13** summarises the results of the consequence analysis.

TABLE 5.13 CONSEQUENCE ANALYSIS	
FIRE INCIDENT	HEAT RADIATION DISTANCE TO 4.7kW/m^2
Scraper, dozer, truck fire	12m
Mix truck fire	31.9m
Diesel storage bund fire	31.9m
EXPLOSION INCIDENT	EXPLOSION OVERPRESSURE DISTANCE TO 7kPa
Shotfirers vehicle – detonators and cords explosion	44m
Mix truck ANFO explosion	34m
Magazine explosion	119m

Figure 5.18 shows the various consequence impact contours on a site map of the Ashton Coal Project. The contours are shown as examples of the various locations of trucks, mix trucks, shotfirers vehicles and magazines during the daily site operations.

The consequence analysis concluded the following:-

- All hazardous incidents underground (e.g. fires, etc.) would be confined within the underground workings and would not result in an offsite impact;
- The impact of the consequences of all identified hazards in the surface mine and pit top facilities, with the exception of the magazine explosion, do not have the potential to impact off site due to the application of a 100m buffer zone around the open cut workings; and
- In the event the portable explosives magazine was placed on the edge of the 100m buffer zone, and an explosion occurred in the magazine, there would be an off site overpressure in excess of 7kPa for 20m beyond the site boundary.

5.14 Greenhouse Gas Emissions

The predicted output of greenhouse gas emissions has been provided in **Appendix F** of **Volume 2**.

The predicted emissions of CO_2 from the Ashton Coal Project during both open cut and underground operations will be:-

- 37,000tpa attributable to electrical energy;
- 27,600tpa due to combustion of diesel in mobile plant; and
- 4,455tpa attributable to the use of explosives is a total of 69,055tpa.

In addition, exposed coal seams and the underground mine will release methane to the atmosphere. Methane emissions from the open cut are not accurately known, but the effective carbon emitted via methane emissions is believed to be minor compared with the emissions from the combustion of the coal and the other sources considered above.

The mine has the capacity to add of the order a maximum of 4.28Mtpa of carbon to the atmosphere as a result of combustion of the coal produced and a total of 52.3Mt over the 20 year life of the project.

5.15 Cumulative Impacts

5.15.1 Air Quality

The air quality assessment predicted impact of the Ashton Coal Project on the village of Camberwell, was considered in isolation, as well as emissions from other mines. These mines include Camberwell, Narama, Rixs Creek and the proposed open cut at Glendell. The contribution that other more distant mines and the other possible sources identified above were dealt with by adding 0.5g/m^2/month to the annual average dust deposition rate, 10µg/m^3 to the annual average TSP concentration and 5µg/m^3 to the annual average PM_{10} concentration. These estimates were intended to account for the regional dust from the more distant mines and from non-mining sources. The Ashton Coal Project and its immediate neighbours were included in the modelling.

The modelling which accounted for dust emission from the surrounding mines did not predict any exceedences in air quality criteria, if specific management controls were implemented.

5.15.2 Noise

The noise contribution from other mines was considered in the Noise and Vibration Assessment contained in **Appendix G** of **Volume 2**.

An assessment of predicted mining noise levels, from sources other than Ashton, was conducted by referring to EIS's for Camberwell, Ravensworth/Narama, Lemington, Rix's Creek and the approved Glendell mine. The predicted noise levels from each nearby mine are discussed in **Appendix G** of **Volume 2**.

Table 5.15 shows the predicted maximum total noise levels from existing and approved mines at the assessed locations under each of the 3 atmospheric conditions. The EPA criteria for establishing operational noise levels (refer to **Table 3.11**) at various receiver locations includes noise generated from existing and approved mines under 3 different atmospheric conditions.

Table 3.11 establishes the operation noise levels for the Ashton Coal Project. Without any noise management controls exceedence of the EPA criteria would occur.

TABLE 5.14 COMBINED NOISE LEVELS FROM EXISTING AND APPROVED MINES, dB(A)Leq			
Location	Neutral	Inversion	NW wind
Camberwell Village	30	36	35
Bowman property	28	35	31
Proctor	27	39	32
Donellan	34	40	36

Note that the highest mining noise levels at each location occur under inversion conditions. This is to be expected, because sound spreads relatively evenly during inversions and each mine may simultaneously contribute to noise levels, whereas noise propagation during winds is highly directional and noise from down-wind sources is greatly reduced

5.15.3 Water

The modelling for groundwater indicates there is a cumulative impact from the Ashton Project and the adjoining Ravensworth South and Narama open cut mines on groundwater levels. However, this impact occurs within mined areas and has little significance to groundwater users in the area nor to any dependent ecosystems. Drainage of the Bowmans Creek alluvium can be attributed only to the Ashton Coal Project and therefore there is no cumulative impact on groundwater levels or quality in this section of the alluvium.

5.15.4 Visual

The Ashton Coal Project will introduce some cumulative visual impacts due to operation of another mine in the locality. However, the visual impact will largely be for motorists other than the residents of Camberwell. Due to the prominence of mining in the region, the cumulative impact of the Ashton Coal Project is regarded as minimal.

The most obvious short term cumulative impact will be from the eastern and western emplacements. These emplacements will be progressively rehabilitated, particularly in areas where they have the highest visual impact.

The long term visual impact on the landscape without implementing any safeguards would be moderate.