Part 4B
Potentially Impacted Environmental Features, Management Measures and Impacts

The descriptions of potential environmental impacts throughout Part 4B are reliant upon a range of background information common to many of the key environmental issues. This background information on topography, meteorology, land ownership, land uses and surrounding residences is presented as Part 4A.

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4B.1 GROUNDWATER

The groundwater assessment was undertaken by GeoTerra Pty Ltd (GeoTerra). The full assessment is presented as Part 1 of the Specialist Consultant Studies Compendium, with the relevant information from the assessment summarised in the following sections.

4B.1.1 Introduction

Based on the environmental risk analysis undertaken for the Project (Section 3.3 and **Table 3.5**), the potential groundwater impacts requiring assessment and their unmitigated risk rating are as follows.

- Groundwater pollution as a result of leakage or spillage (low to high risk).
- Drawdown of groundwater on and beyond the Project Site (moderate to extreme risk).
- Impacts on groundwater-dependent ecosystems (moderate risk).

In addition, the Director-General's requirements issued by the Department of Planning require that the assessment include a water balance, and refer to the *Guidelines for Fresh and Marine Water Quality* (ANZECC), and the various *State Groundwater Policy* documents.

This section commences with a review of the existing regional and local hydrogeology, local availability and use of groundwater resources and current statutory framework for the management of groundwater. Potential sources of groundwater contamination are then identified and the operational safeguards, controls and mitigation measures described. The section concludes with an assessment of the residual impacts following the implementation of these safeguards, controls and mitigation measures.

4B.1.2 Mine Water Supply Requirements

An anticipated net water requirement of 75ML/yr to 100ML/yr (an average of 2.4 to 3.2L/sec) would be required, depending on seasonal conditions.

A major portion of the total would be required for dust suppression on roads (63ML/yr to 88ML/yr). Coal crushing would require approximately 2ML/yr for conveyor dust suppression, stockpile dust suppression water sprays would require approximately 5ML/yr and approximately 5ML/yr would be required for general dust suppression around the mine.

The predicted groundwater inflow to the open cut pit is expected to provide a substantial proportion of the mine operating water supply. However, additional water would be required and this would be obtained from surface water dams and/or from an existing 31.2ML source within a section of the adjacent Gunnedah N^{o} 5 Entry underground workings. Pit inflows would be stored in two 30ML turkey's nest dams prior to use around the Project Site. If excess pit inflow water is generated, it would be delivered underground via a bore to the old Gunnedah N^{o} 5 Entry underground workings immediately to the south of the proposed open cut area.

A bore capable of providing site requirements would be established into the old Gunnedah Coal Mine N^{o} 5 Entry underground workings to provide an initial water supply and to augment water during the life of the mine should that be required. There is currently 31.2ML of water stored in this section of the old Gunnedah N^{o} 5 Entry underground workings. This water is contained within a down-thrown faulted block in the underground workings closest to and down dip from the proposed open cut pit. This bore would provide a guaranteed water supply for mine start up should dry conditions prevail at that time. However, it would only be used if insufficient water is available when the supply from pit dewatering and dam water is insufficient to meet requirements. The bore would also be used to convey excess pit inflow water from the two 30ML turkey's nest dams into the underground workings.

Ablutions and potable water would be delivered by tanker from the Gunnedah Town Supply, as required.

During and after mining, surface runoff from above the mining area would be directed around the open cut by diversion drains. The water would flow along waterways and would report to sedimentation dams, with some runoff used for the Project Site water supply.

4B.1.3 Sunnyside Project Setting

4B.1.3.1 Surface Hydrology

A brief overview of the surface hydrology is provided given the inter-relationship between surface water and groundwater within and surrounding the Project Site. Further details of the surface water catchments within and surrounding the Project Site are provided in Section 4B.4.

The Sunnyside Project is located on the periphery of the Liverpool Plains within the Upper Namoi River Catchment Management Area. The Namoi River channel is also located approximately 12km east of the Project Site. **Figure 4B.1** shows the main features of the surface hydrology.

The nearest significant local surface watercourses are the ephemeral channels of Coocooboonah Creek and Rock Well Creek, which are approximately 1.2km east and 2km west of the proposed pit.

The Project Site is entirely located on the easterly draining slopes and alluvial flanks of Coocooboonah Creek catchment, with the pit and mine facilities located on colluvial cover over Permian sedimentary basement, upslope of the Coocooboonah Creek alluvium.

Both Rock Well Creek and Coocooboonah Creek drain into Native Cat Creek approximately 4km north of the Project Site, which flows into Collygra Creek and subsequently dissipates into undefined swales within the Quaternary Namoi River alluvium, approximately 13km north of the Project Site.

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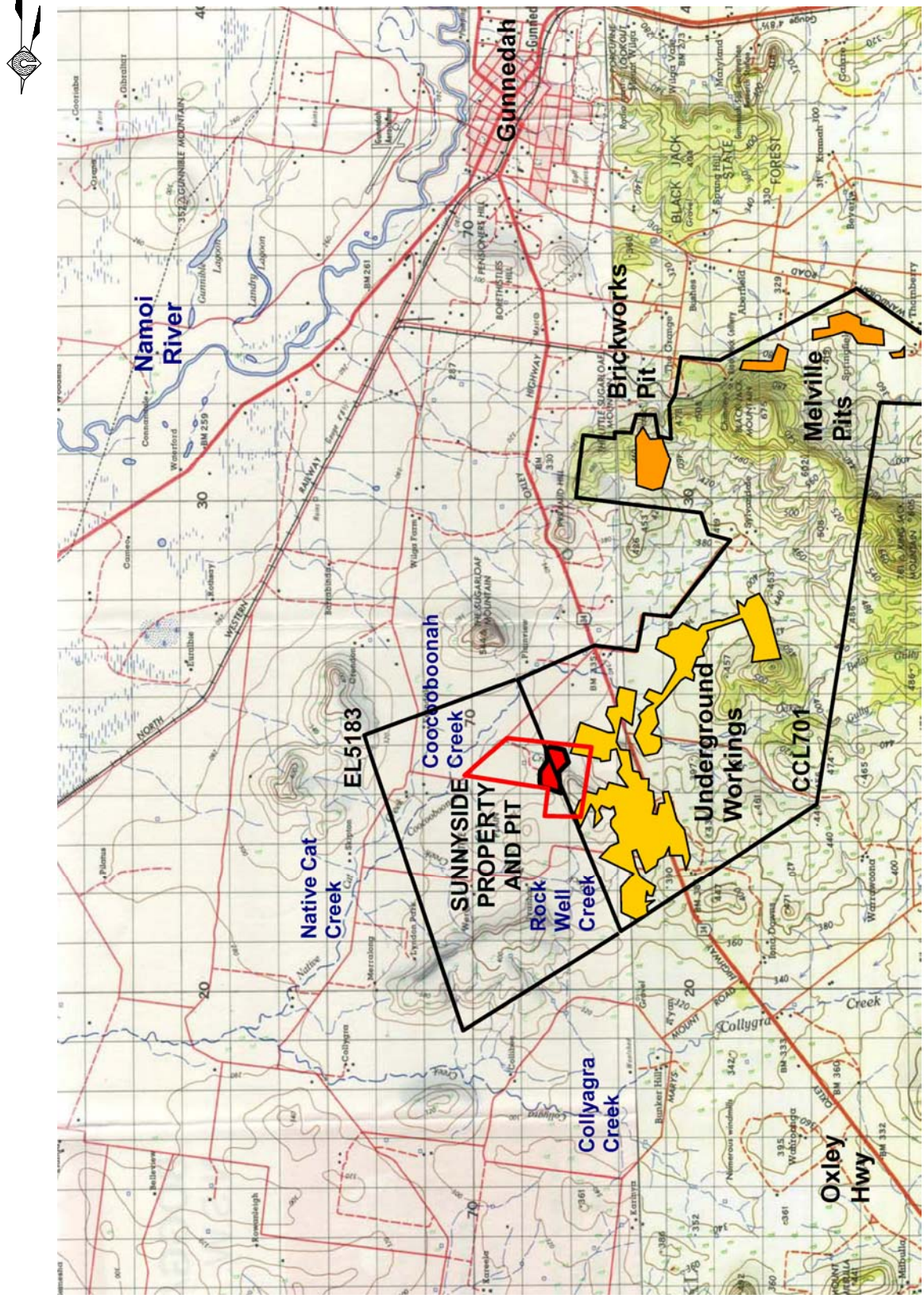


Source: GeoTerra (2008) - Drawing 1

Figure 4B.1
SURFACE HYDROLOGY

Flow characteristics of watercourses traversing the proposed mine site are variable and dependent on many factors including precipitation duration and intensity, soil moisture, degree and type of vegetative cover, as well as the effects of evapotranspiration, catchment aquifer base-flow and catchment modifications.

Runoff and streamflow are closely related to rainfall events, with the main creeks and tributaries being moderately steep in the headwaters to relatively flat in the main valley, with flows prone to rapid peaking and depletion and a tendency to no or low flow over extended periods.

Flooding would be restricted mainly to Coocooboonah Creek, which is approximately 1.2km east of the open cut area, with floods anticipated to be typically brief in extent in the valley floor.

4B.1.3.2 Hydrogeological Setting

The Sunnyside Project Site is located within the exposed Triassic and Permian basement on the periphery of the Quaternary alluvial Zone 4 - Groundwater Management Area 4 (GWMA4) of the Upper and Lower Namoi Groundwater Source (DNR, 2003).

A Water Sharing Plan for the Upper and Lower Namoi Groundwater Sources (DNR, 2003) was gazetted under the *Water Management Act 2000*, with the Water Sharing Plan intended to be introduced on November 1, 2006. Some delays in introducing the plan were encountered, and this has now recently been introduced.

The proposed Sunnyside open cut mine is anticipated to be excavated through up to 5m of colluvial soil. No excavation would be conducted in Coocooboonah Creek or Rock Well Creek, which represent the distal extent of the Upper Namoi River Quaternary Alluvium.

No substantial aquifers are known to be present within the proposed pit area other than groundwater of very limited yield and moderate salinity within the Hoskissons Coal Member.

Overburden in the vicinity of the proposed mine is characterised by 2^{o} to 3^{o} southwesterly dipping, generally semi-confined to unconfined, low yielding, weathered conglomerate, sandstone, shale, coal and tuffaceous stony coal, with intrusives distributed within and above the sequence.

Overburden above the Hoskissons Seam, down dip and to the west of the proposed open cut pit provides limited groundwater supplies of up to 0.51L/sec in bores up to 53.3m deep and standing water levels between 6.4m and 28.7m below surface.

Coocooboonah Creek and Native Cat Creek alluvium has limited extent as it is constrained by the headwaters and foot-slopes of the northeast trending hills, as well as by the outcropping / sub-cropping fractured basement.

Up to 50m of alluvium is located within the Coocooboonah Creek and Native Cat Creek valleys. However, the alluvium of Coocooboonah Creek and Native Cat Creek does not provide a suitable groundwater supply due to the low yield, high salinity and the sediment's limited depth and extent.

Rock Well Creek is located to the west of, and both topographically and stratigraphically higher than the Project Site within an upland confined gully with shallow sediments up to 10m deep.

Rock Well Creek alluvium is not a significant source of groundwater supply to existing domestic or potential users, with all bores in the Sunnyside vicinity obtaining groundwater from the underlying fractured bedrock.

No observed groundwater dependent ecosystems are present within the alluvial valleys of Coocooboonah, Native Cat and Rock Well Creeks.

The Hoskissons Seam consists of up to five plies in inter-layered shale, claystone and fine sandstone that ranges from 6m to 9m thick in the mine vicinity, depending on the development of the seam, presence and effect of intrusions as well as the degree of weathering and erosion. The seam subcrops up to 150m north of the proposed pit. However, it does not extend beneath Coocooboonah Creek, which lies approximately 1km north of the proposed pit.

The piezometric surface in the vicinity of the proposed pit, based on the piezometers alone, mimics the ground surface fall to the north and east.

Measured standing water levels in the Hoskissons Seam range from 12.5m to 60.5m below surface in the vicinity of the pit.

4B.1.3.3 Alluvium

Alluvium within the eastern and northern portion of EL 5183 and eastern portion of CCL701 is associated with Quaternary valley fill along the channels of Coocooboonah Creek and Native Cat Creek, within Native Cat Plain.

The generally shallow, clay dominated valley fill alluvium does not provide groundwater supplies due to its very low yield, high salinity, limited depth and extent and seasonally fluctuating water levels.

No monitoring by the DNR or its predecessors of alluvial groundwater levels in Coocooboonah Creek, Native Cat Creek or Rock Well Creek catchments has been conducted to date as the systems are not significant compared to the Namoi River Valley alluvial system within the Liverpool Plains.

Coocooboonah Creek is interpreted as a "Losing Stream", meaning the creek channel is perched above the alluvial groundwater system, with the stream recharging the underlying groundwater system via seepage through the creek bed, rather than the groundwater system recharging the creek.

It is also postulated that the stream is not "connected" to the underlying groundwater system by a continuous saturated zone, meaning that extraction from bores installed in the fractured basement aquifer under or near the creek is not anticipated to affect flow in the creek.

Alluvium within Coocooboonah Creek is interpreted to be similar to the regional Quaternary Liverpool Plains stratigraphy, however, the Sunnyside open cut pit is located outside the Quaternary Namoi Valley alluvium.

No aquifers are recorded within the overburden of EL 5183, however, water supplies are obtained in deeper, down dip intersections in overburden to the west of the Project Site, with sufficient depth below surface. Water supplies are generally obtained from higher permeability conglomerates and sandstone.

4B.1.3.4 Recharge

Recharge for the Hoskissons Seam in the vicinity of the proposed open cut pit is assessed to primarily occur south and east of the Project Site, with predominant recharge occurring along the alluvial creek channels.

It is also possible that basement groundwater may be upwelling into the base of the alluvial channel of Coocooboonah Creek and the lower portion of Rock Well Creek. The actual rate and location of upwelling has not been identified to date with current data.

Considering the fractured character of the bedrock, it is likely that the hydraulic connection between the alluvial deposits and the bedrock occurs along the more intensely fractured zones, creating preferential pathways for groundwater flow. The magnitude of the potential stream bed leakage resulting in groundwater exchange rates between the alluvium and bedrock are unknown at this stage.

The magnitude of creek induced recharge during wet spells and erratic flood events has not been established to date due to the lack of long term monitoring data along with the lack of sufficient high rainfall events. However, the understanding of the rate of recharge in relation to wet spells and flooding can be developed with ongoing monitoring.

In order to address the uncertainty related to the recharge mechanisms and magnitudes and relationship between Quaternary and underlying systems, field infiltration tests and regular groundwater level and stream flow monitoring is required, followed by refinement of the conceptual model when new data is available. This work would be undertaken if shown to be required to interpret Sunnyside Project monitoring data.

4B.1.3.5 DWE Registered Bores and Wells

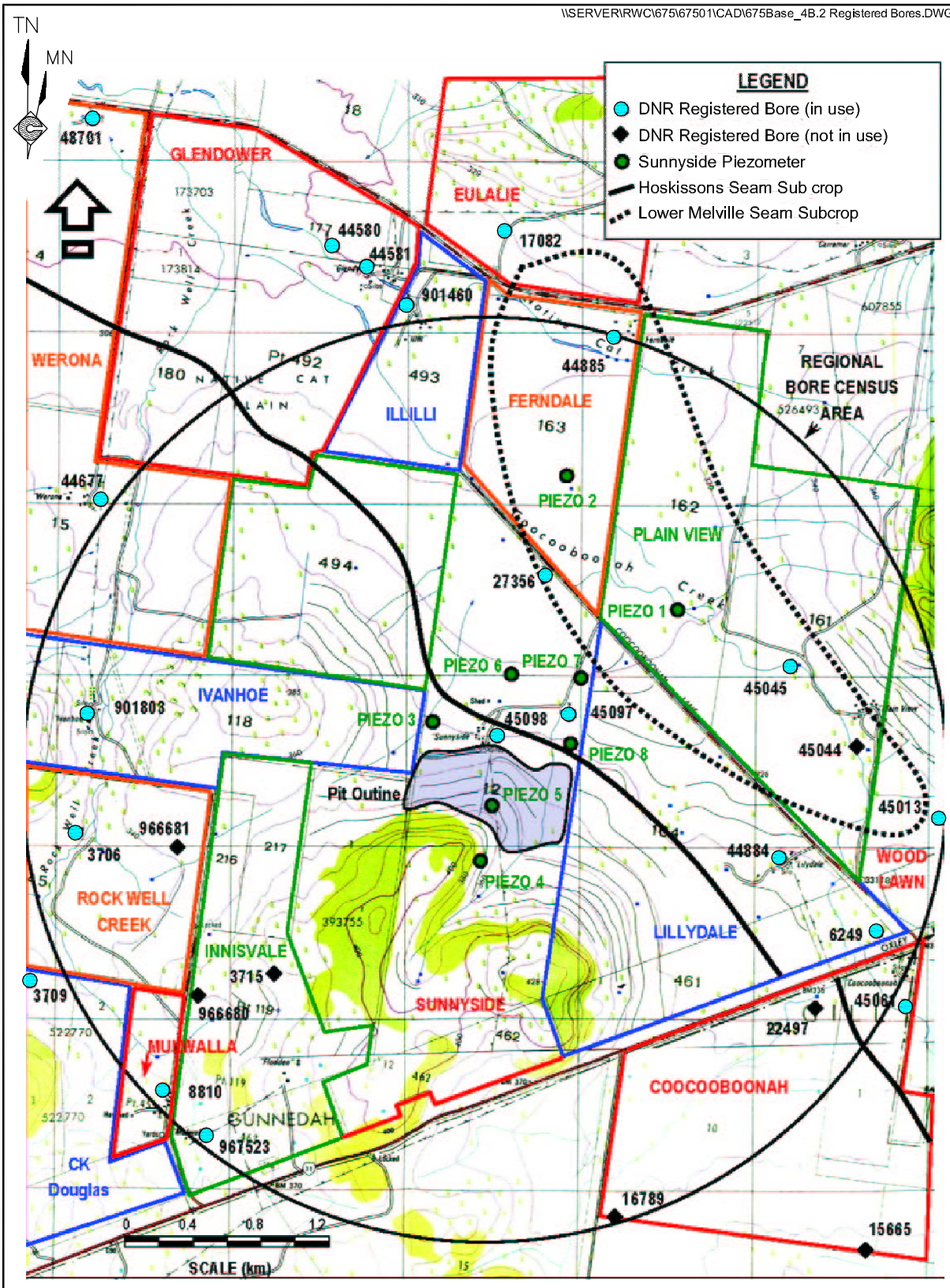
A total of 24 stock and domestic bores, one irrigation bore and eight piezometers are registered within a 3km radius of the proposed Sunnyside open cut as shown in **Table 4B.1**. The locations of these are shown on **Figure 4B.2**.

These bores have yields ranging up to 0.9L/sec. The depth of the stock and domestic bores range from 12.2m to 85.3m. Three bores (GW27356, 45097 and 45098) are on the "Sunnyside" property.

The registered bores directly west and southwest of the proposed open cut pit have their water supply intakes located stratigraphically above the Hoskissons Seam, those to the west of and down dip of the subcropping Hoskissons Seam generally obtain supplies from either or both the Hoskissons and Melville Seams, whilst those to the east of the Hoskissons Seam Subcrop generally obtain water from the Upper and or Lower Melville Seams.

Table 4B.1
DWE Registered Bore Data

Bore	Registered Use	Drilled	Depth	Water Intersection	Drilled Standing Water Level	Yield	Aquifer Intake
INTAKE ABOVE HOSKISSONS COAL SEAM							
3706	Stock	1940	15.2	9.1 / 13.4-15.2	6.4	0.4	Sandstone
3709	Stock	1940	37.5	36.6	19.2	0.46	Shale
3715	Stock	1940	45.1	30.5 / 42.1	? / 28.7	0.04 / 0.2	Shale / sandstone
8810	Stock?	N.A.	53.3	N.A.	N.A.	N.A.	N.A.
15665	Stock	1957	24.4	15.8-16.1	12.2	0.03	Basalt
16789	Stock	1961	23.2	16.8-17.1 / 18.9-21.3	12.2/12.2	0.06 / 0.51	Conglomerate
901803	Stock Domestic Irrigation	N.A.	58	N.A.	N.A.	N.A.	N.A.
966680	Piezometer	1990	5.4	N.A.	N.A.	N.A.	N.A.
966681	Piezometer	1990	2.1	N.A.	N.A.	N.A.	N.A.
967523	Stock domestic	1997	42.36	N.A.	N.A.	N.A.	N.A.
INTAKE WITHIN HOSKISSONS COAL SEAM							
22497	Stock	1965	45.7	28.7-32.1	24.4	0.25	? / coal
44677	Stock Domestic	1926	75.9	N.A.	15.2	N.A.	? / coal
45098	Stock Domestic	1965	44.2	26.5 / 39.6-40.8	N.A.	N.A.	? / coal
INTAKE BENEATH HOSKISSONS COAL SEAM AND / OR WITHIN MELVILLE COAL SEAM							
6249	Stock	N.A.	70.7	68.9	20.7	0.25	Sandstone / coal
17082	Stock	1947	24.4	N.A.	N.A.	N.A.	? / coal
27356	Stock	1966	35.4	27.1 / 31.4-33.5	27.1 / 24.7	0.01 / 0.63	Shale / coal
44580	Stock Domestic	1977	34.0	N.A.	18.0	N.A.	? / coal
44581	Stock Domestic	1977	35	N.A.	18.0	N.A.	? / coal
44884	Stock domestic	?	73.2	N.A.	N.A.	N.A.	? / coal
44885	Domestic	1976	36.6	N.A.	15.3	N.A.	? / coal
45013	Stock	?	76.2	N.A.	N.A.	N.A.	? / coal
45061	Stock	N.A.	84.1	N.A.	N.A.	N.A.	? / coal
45044	Stock domestic	1942	34.1	14.6 / 34.1	N.A.	N.A.	? / coal
45045	Stock	1965	62.5	61	N.A.	N.A.	? / coal
45097	Stock Domestic	1934	85.3	54.9 / 85.3	N.A.	N.A.	? / coal
48701	Stock Domestic	1978	61.0	N.A.	45.7	0.51	? / coal
901460	Stock Domestic	1920	34	N.A.	16.0	N.A.	? / coal
Note: N.A. DNR data not supplied Shading indicates bore in current use							
Source: GeoTerra (2008) – Table 1							



SCALE 1:35 000

500 0 500 1000 1500m

Source: GeoTerra (2008) - Drawing 9

Figure 4B.2
REGISTERED GROUNDWATER BORES

The 27 bores and piezometers were all installed between 1920 and 1997 with groundwater generally extracted by low flow windmills, and to a lesser degree, submersible pumps.

Five of the 27 bores and the two piezometers are no longer used. Of the remainder, 14 are low, variable yielding windmills and six obtain water by submersible pumps.

Water quality ranges from 6.61 to 9.37pH and 1 704µS/cm to 8 440µS/cm electrical conductivity.

All water is extracted from the fractured basement aquifers, with no inspected bores obtaining groundwater from the alluvium of Coocooboonah Creek or Rock Well Creek.

The majority of groundwater in the Rock Well Creek catchment is obtained from basement fractured rocks rather than valley fill alluvium. Standing water levels ranged from 4.9m to 28.7m below surface.

4B.1.4 Groundwater Characteristics

4B.1.4.1 Groundwater Chemistry

Department of Water and Energy (DWE) data in **Table 4B.2** shows that, groundwater in the Sunnyside area has low to moderate salinity within the basement fractured rock aquifers, with electrical conductivity values of between 510µS/cm and 10 080µS/cm and pH between 3.81 and 8.7.

Table 4B.2
Department of Water and Energy Groundwater Chemistry

Piezometer (GW)	Sample Date	Source Aquifer	pH	EC (µS/cm)
3706	23/6/76	Sandstone	**7.6**	**6800**
6249	2/6/76	Sandstone	**8**	**3700**
8810	23/6/76	N.A.	**7.7**	**7100**
16789	1961, 1976, 1992	Conglomerate / N.A.	**6.4** / 7.6 / **3.81**	**10080 / 510 / 1116**
22497	22/6/76	Melville Coal Seam	6.7	**4100**
27356	2/6/76	Shallow Marine Facies / Melville Coal Seam	6.7	**3900**
44884	2/6/76	N.A.	**8.7**	**2680**
44885	2/6/76	Gunnedah Formation?	7.1	**4400**
45013	1976 / 1992	N.A.	**7.9** / 6.9	**6000 / 1470**
45044	2/7/76	Gunnedah Formation? / Melville Coal Seam?	7.4	**6100**
45045	2/7/76	Melville Coal Seam? / Lower Delta Plain Facies?	**8.7**	**1640**
45061	22/6/76	N.A.	**7.9**	**4200**
ANZECC			6.5 – 7.5	30 – 350

Notes
1. **ANZECC 2000** - default trigger values for SE Australian Upland Rivers. Grey Shading indicates exceedance of these trigger values.

Source: GeoTerra (2008) – Table 2

The results of field assessments of piezometer and coal bore water quality are shown in **Table 4B.3**.

Table 4B.3
Field Groundwater Chemistry

Bore (see Figure 4B.3)	Date	Electrolytical Conductivity (µS/cm)	pH
Gunnedah Alluvial Formation			
P1	3/11/06	12580	7.72
P2	3/11/06	18680	9.05
Digby Formation, Goran Conglomerate and Upper Delta Plain Facies			
GW3715	3/11/06	/	/
Hoskissons Coal Seam			
P3	3/11/10/06	7480	7.30
P4	3/11/06	6450	7.40
P5	3/11/06	4560	7.10
Sun 43C	21/10/06	4660	6.65
Sun 44C	21/10/06	2260	6.93
Sun 45C	21/10/06	3780	7.01
Sun 46C	21/10/06	3240	7.12
Sun 47C	21/10/06	4380	6.84
Sun 48C	21/10/06	12290	6.62
Sun 52	21/10/06	8500	6.84
Sun 61	21/10/06	4560	7.19
DDH185	21/10/06	12650	6.91
Shallow Marine Facies and Melville Coal Seam			
GW27356	3/11/06	6170	6.61
GW45045	3/11/06	5310	8.23
GW45098	3/11/06	8440	6.80
P6	3/11/06	5490	7.09
P7	3/11/06	7330	6.99
Sun 38	3/11/06	11430	6.84
Sun 39	21/10/06	2500	7.87
Shallow Marine Facies Melville Coal Seam and Lower Delta Plain Facies			
Sun 57	21/10/06	5380	7.17
Sun 58	21/10/06	3860	7.11
Sun 59	21/10/06	7100	7.02
Sun 60	21/10/06	8350	6.85
P8	20/10/06	8350	6.85
Source: GeoTerra (2008) – Table 6			

The major ions present in bore water samples are shown in **Tables 4B.4** and **4B.5**.

4B.1.4.2 Hydraulic Conductivity and Transmissivity

Site hydraulic conductivity and transmissivity are shown in **Table 4B.6**.

4B.1.4.3 Standing Water Levels

Figure 4B.3 shows the piezometric surface around the Project Site.

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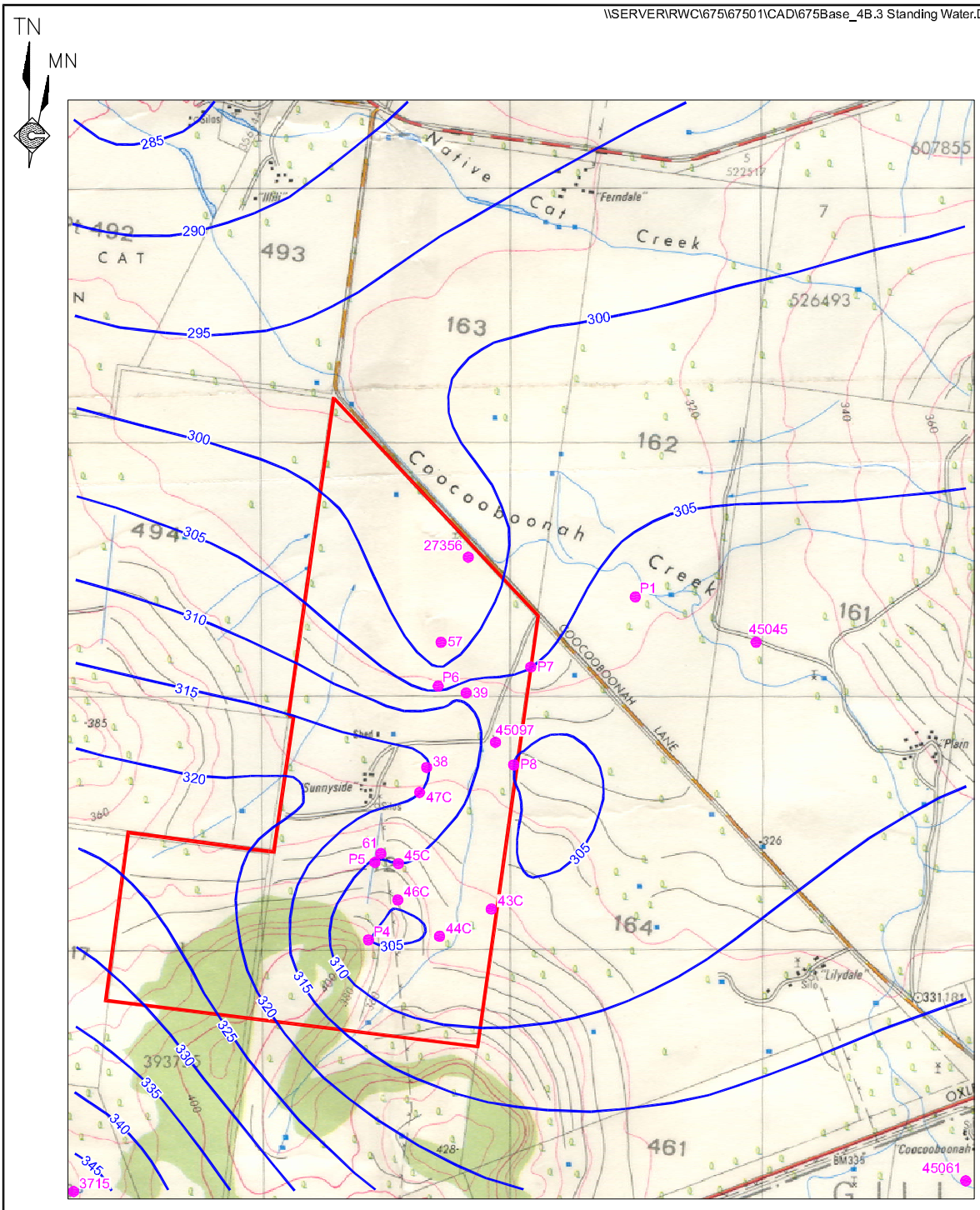

REFERENCE
Project Site Boundary
310 Piezometric Contour (m AHD)(Interval = 5m)
45045 Piezometer

SCALE 1:25 000

250 0 250 500 750 1000 1250 m

Source: GeoTerra (2008) - Drawing 10
Base Map Source: Emerald Hill & Wondoba 1:25 000 Topographic Maps

Figure 4B.3
MONITORING BORES, PIEZOMETERS AND PIEZOMETRIC SURFACE

oec

Table 4B.4
Laboratory Water Chemistry (Major Ions mg/L)

Bore	pH	EC µS/cm	TDS	Na	Ca	K	Mg	Cl	F	HCO_3	SO_4	Tot N	Tot P
Quaternary Alluvium													
P1	**7.6**	**12580**	11900	3350	9.5	6	62	580	0.37	4870	380	**15**	**1580**
P2	**8.7**	**18680**	17000	5210	39	12	225	420	1.0	6720	335	<0.1	**3920**
Hoskissons Coal Seam													
P3	7.2	**7480**	3350	710	155	34	260	1420	0.59	1303	220	**0.9**	**0.15**
P4	**7.9**	**5030**	2450	700	76	55	93	610	.64	1330	200	**1.7**	**9.5**
P5	7.2	**4870**	2150	540	90	46	115	660	0.95	1160	56	**11.0**	0.01
45098	7.0	**8440**	3850	830	160	42	300	1700	0.86	1120	220	<0.1	0.02
No.5 Ug	**8.1**	**5420**	3180	908	102	9.4	102	1150	1.47	1060	<2	**1.3**	**0.07**
Shallow Marine Facies, Lower Delta Plain Facies and Melville Coal Seam.													
P6	7.5	**5490**	2690	690	92	32	180	1120	0.6	1070	93	**4.9**	**0.08**
P7	7.2	**3860**	3360	790	130	19	245	1480	0.37	1010	200	**4.5**	0.02
P8	7.1	**7100**	4590	800	255	21	365	1600	0.3	720	1080	**0.5**	**0.08**
27356	6.8	**6170**	2800	485	155	18	255	1110	0.59	900	240	**1.1**	0.02
45097	**7.8**	**2630**	1440	555	9.4	3.4	7.1	490	3.2	760	<2	**0.5**	0.01
Coocooboonah Creek													
	7.3	272	135	3.8	12	32	12	20	<0.1	120	4	**1.3**	**2.1**
ANZECC*	**6.5-7.5**	**30 – 350**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**0.25**	**0.02**

* ANZECC default trigger values for risk of adverse effects from physical and chemical stressors in SE Aust. Upland Rivers
(Shading indicates values outside ANZECC 2000 criteria)

Source: GeoTerra (2008) – Table 7

Due to its confined nature and 2^o to 3^o dip to the south and west of the pit, groundwater flow within the Hoskissons Seam is down dip along the seam to the southwest, into the hills, with a modification due to topographical effects to the east giving an overall south-easterly flow direction within the pit area.

Piezometer data from mid-October 2006 to mid December 2007 indicates that standing water levels in the coal measures have generally fallen between 0.26m and 1. 33m over the fourteen–month monitoring period. The monitoring period commenced during a drought period, with no rainfall percolation recharge evident in the coal measures, along with an indistinct response to rainfall in the Coocooboonah Creek alluvium. Latter monitoring has not shown a distinctive rise in standing water levels in association with the higher rainfall for both the basement and alluvial groundwater systems.

Table 4B.5
Laboratory Water Chemistry (Filtered metals mg/L)

Bore	Cu	Pb	Zn	Ni	Fe	Mn	As_{Tot}	Se_{Tot}
Quaternary Alluvium								
P1	**0.018**	0.002	**0.012**	**0.03**	0.44	0.14	0.02	<0.01
P2	**0.065**	**0.054**	**1.3**	**0.15**	19	**2.5**	**0.14**	<0.01
Hoskissons Coal Seam								
P3	**0.004**	0.003	0.006	<0.01	0.02	0.02	<0.01	<0.01
P4	**0.002**	<0.001	**0.009**	**0.03**	<0.01	0.04	0.02	<0.01
P5	**0.005**	0.003	**0.009**	<0.01	0.01	0.06	<0.01	<0.01
45098	**0.003**	<0.001	**0.009**	<0.01	<0.01	0.06	<0.01	<0.01
No.5 Ug	0.0008	<0.00005	**0.013**	0.001	0.03	0.001	<0.001	<0.001
Shallow Marine Facies, Lower Delta Plain Facies and Melville Coal Seam.								
P6	**0.002**	<0.001	**0.011**	<0.01	<0.01	<0.01	<0.01	<0.01
P7	**0.002**	<0.001	**0.014**	<0.01	<0.01	0.03	<0.01	<0.01
P8	**0.004**	<0.001	**0.046**	<0.01	<0.01	**2.1**	0.01	<0.01
27356	**0.003**	<0.001	0.005	<0.01	0.03	0.09	<0.01	<0.01
45097	**0.006**	<0.001	**0.01**	<0.01	<0.01	<0.01	<0.01	<0.01
Coocooboonah Creek								
	0.005	0.002	**0.025**	<0.01	2.6	0.12	<0.01	<0.01
ANZECC	**0.0014**	**0.0034**	**0.008**	**0.011**	**-**	**1.9**	**0.024(III) / 0.013(V)**	**0.011**

NOTES : ANZECC 95% trigger values for toxicants
(Shading indicates values outside ANZECC 2000 criteria)

Source: GeoTerra (2008) – Table 8

Table 4B.6
Hydraulic Conductivity and Transmissivity

Bore	Property	Bore Depth (m)	Piezo Diam (mm)	Intake / Screen (m)	Hydraulic Conductivity (m/day)	Transmissivity (m^2/day)
Gunnedah Alluvial Formation						
P1	"Ferndale"	41	50mm	18.0 - 29.5	5.3	N.A.
P2	"Plain View"	31	50mm	18.5 - 30.5	3.8	N.A.
Hoskissons Coal Seam						
P3	"Sunnyside"	41	50mm	32.0 - 40.0	4.0	N.A.
P4	"Sunnyside"	81	50mm	71.0 - 79.0	1.3	N.A.
P5	"Sunnyside"	54	50mm	46.0 - 54.0	0.4	3.0 / 3.1
P5 (recovery)	"Sunnyside"	54	50mm	46.0 - 54.0	0.3	2.1
Hoskissons and Melville Coal Seams						
GW45098	"Sunnyside"		152mm	26.5?– 40.8?	0.1/0.4/1.8	1.6/ 5.2/(26.1)
Shallow Marine Facies and Lower Delta Plain Facies						
P6	"Sunnyside"	30	50mm	20.0 - 23.0	0.7	N.A.
P7	"Sunnyside"	48	50mm	45 - 48	2.1	N.A.

Source: GeoTerra (2008) – Table 4

Groundwater flow in the combined, underlying Shallow Marine Formation, Melville Seams and Lower Delta Plain Facies is to the northwest, which is in the opposite direction to the Hoskissons Seam and conforms to the influence of topography.

The flow pattern represents a combination of:

- recharge within the hills to the southwest of the proposed open cut, with gravity driven flow from the hills to the valleys;
- flow down dip in confined lithologies to the southwest, with modification for topographical effects; and
- unconfined flow to the northeast then north-northwest along the Coocooboonah Creek and Rock Well Creek valleys.

Flow within the area would also be modified by the effect of:

- strata dislocation from faulting;
- possible flow along higher permeability faults; and
- the reduction in Hoskissons Seam and overburden permeability due to the presence of weathered doleritic sills and dykes.

4B.1.4.4 Waste Rock Batch Leachate

The potential waste rock leachate pH and salinity were obtained through coarse crushing of overburden core samples representing waste rock to be placed in the backfilled open cut pit. The results are shown in **Table 4B.7**.

Leach results from the batch testing were incorporated into an assessment of the potential final void salinity. The salinity batch leach results of lithological subgroups was used to indicate their overall void water salinity contribution and allowance made for each lithology's proportional contribution to potential inflow. However, due to a combination of groundwater level predictions, rainfall and evapotranspiration (see Section 4B.1.5.8), it is not expected that a lake would form in the final pit void.

4B.1.4.5 Pit Water Salinity

Geoterra used a modified mass balance approach to assess the potential pit void water salinity. The methodology is explained in detail in Section 6.10 of their report (Geoterra, 2008). They derived a range of pit void salinities for the Decile 1, Decile 5 (mean) and Decile 9 surface water runoff scenarios using surface water runoff data (SCS, 2007). The electrical conductivity values in the pit void would range from 10 999µS/cm for Decile 1, through 8 107µS/cm for Decile 5 and 5 831µS/cm for Decile 9.

Table 4B.7
Waste Rock Batch Leach Results

Bore	Depth (m)	Unit	Lithology	pH	EC[2] µS/cm	Weathering
45C	14.13 – 14.60	Wallala Conglomerate	Pebble Conglomerate	8.31	832	Slightly Weathered
	17.13 – 17.53	Wallala Conglomerate	Claystone	8.28	814	Weathered
	22.84 – 23.30	Benelabri Formation	Siltstone	8.18	936	Fresh
	36.85 – 37.25	Benelabri Formation	Sandstone	8.17	685	Fresh
	49.5 – 50.00	Hoskissons Seam Ply C	Carb claystone / tuff	8.29	1199	Fresh
46C	22.72 - 23.12	Wallala Conglomerate	Conglomerate	8.13	795	Slightly Weathered
	31.62 – 32.00	Benelabri Formation	Sandstone	8.05	947	Slightly Weathered
	32.90 – 33.35	Benelabri Formation	Siltstone / sandstone	8.19	724	Slightly Weathered
	35.63 – 36.00	Benelabri Formation	Siltstone	6.97	2590	Slightly Weathered
	36.22 – 36.32	Benelabri Formation	Coal	7.66	1677	Slightly Weathered
	58.86 – 59.28	Hoskissons Seam Ply C	Carb. claystone / tuff	8.43	1330	Fresh
Note: EC[2] indicates months of leaching						
Source: GeoTerra (2008) – Table 9						

These results provide an indication of the potential pit void salinities that may occur within the pit void. The pit void salinity is highly dependent on the degree of fresh water dilution provided from surface runoff, as the groundwater salinity is relatively constant. Additionally, evaporation is also a strong determining factor.

4B.1.4.6 Acid Rock Drainage

Preliminary assessment of the acid rock drainage (ARD) potential was conducted by undertaking a Net Acid Production Potential (NAPP) analysis on selected samples of core that represent waste rock to be extracted from the Sunnyside Open Cut. The results are shown in **Table 4B.8.** The methodology used to determine the NAPP provides a worst case scenario.

Laboratory analyses for the test work are shown in Appendix 4 of GeoTerra (2008).

Table 4B.8
Net Acid Producing Potential Results

	%	%	%	kgH_2SO_4/t	% $CaCO_3$	kg H_2SO_4/t	
Sample	**SO_4**	**Tot S**	**S-**	**MPA**	**ANC**	**NAPP**	**ANC/MPA**
45C 14.13-14.6	0.001	0.004	0.004	0.112	1.2	-1.09	10.69
45C 22.84-23.3	0.011	0.039	0.035	1.082	0.54	0.54	0.50
45C 36.85-37.25	0.008	0.012	0.009	0.286	4.0	-3.71	13.97
45C Ply C	0.01	0.12	0.117	3.571	3.2	0.37	0.90
46C 35.63-36	0.031	0.015	0.005	0.146	0.64	-0.49	4.38
46C 36.22-36.4	0.021	0.62	0.613	18.760	2.8	15.96	0.15
46C 58.86-59.2	0.014	0.075	0.070	2.154	2.2	-0.05	1.02
Source: GeoTerra (2008) – Table 10							

The analysed samples are all non acid producing apart from a narrow (18cm), small volume coal seam in the overburden of SUN46C at 36.22m to 36.4m below ground level. The small, thin coal seam represents approximately 1% of the overall waste rock volume, and therefore the acid production potential would be dominated by the non acid producing waste rock.

The out-of-pit emplacement and in-pit waste rock is not anticipated to generate Acid Rock Drainage, and therefore no adverse pH or levels of dissolved metals in leachate water is anticipated outside of the moderately saline, circum-neutral pH leachate generated from the coal measures waste rock.

Any sulfides that may have been present in the overburden above the fresh overburden / weathered overburden interface have been weathered out to depths of up to 36m below surface, and would no longer be a potential source of acid drainage.

No significant observable sulfides have been identified at Sunnyside, further reducing the possibility of ARD development. Stored water within the Gunnedah N^{o} 5 Entry underground workings has a near neutral pH range further precluding the likelihood of acid generating conditions.

4B.1.5 Groundwater Modelling

Golder Associates Pty Limited (Golders) undertook a groundwater modelling exercise to assess the likely impact of the Sunnyside Coal Project on the local groundwater. The report of their assessment is included as Appendix 5 in GeoTerra (2008) and the following subsections summarise the relevant information from their study.

4B.1.5.1 Potential Impact on Local Groundwater Systems and Groundwater Users

The potential drawdown effect on private bores within the Sunnyside Project study area are shown in **Table 4B.9.**

Table 4B.9
Potential Private Bore Drawdown

Page 1 of 2

Bore	Property	Bore Depth (m)	Measured / Drilled SWL (m)	Aquifer Intake	Potential Drawdown (+5 yrs) (m)	Potential Drawdown (+10 yrs) (m)	Potential Drawdown (+30 yrs) (m)
Intake above Hoskissons Coal Seam							
3706	Rock Well Ck	15.2	6.4	Sandstone	0	0	0
3709	CK Douglas	37.5	19.2	Shale	0	0	0
8810	“Mulwalla”	53.3	N.A.	N.A.	0	0	0
901803	“Ivanhoe”	58.0	N.A.	N.A.	0	0	0
967523	“Innisvale”	42.36	N.A.	N.A.	0	0	0
Intake within Hoskissons Coal Seam							
44677	“Werona”	75.9	15.2	Overburden / coal	0	0	0
45098	“Sunnyside”	44.2	N.A.	Overburden / coal	<2	<1	<0.5
22497	“Coocooboonah”			Overburden / coal	<1	<0.5	<0.5

Table 4B.9 (Cont'd)
Potential Private Bore Drawdown

Bore	Property	Bore Depth (m)	Measured / Drilled SWL (m)	Aquifer Intake	Potential Drawdown (+5 yrs) (m)	Potential Drawdown (+10 yrs) (m)	Potential Drawdown (+30 yrs) (m)
Intake Beneath Hoskissons Coal Seam and/or within Melville Coal Seam							
6249	"Lilydale"	70.7	20.7	Sandstone / coal	<1	<0.5	<0.5
17082	"Eulalie"	24.4	N.A.	Overburden / coal	0	0	0
27356	"Sunnyside"	35.4	27.1 / 24.7	Shale / coal	<1	<0.5	<0.5
44580	"Glendower"	34.0	18.0	Overburden / coal	0	0	0
44581	"Glendower"	35.0	18.0	Overburden / coal	0	0	0
44884	"Lilydale"	73.2	N.A.	Overburden / coal	<1	<0.5	<0.5
44885	"Ferndale"	36.6	15.3	Overburden / coal	0	0	0
45013	"Woodlawn"	76.2	N.A.	Overburden / coal	0	0	0
45061	"Coocooboonah"	84.1	N.A.	Overburden / coal	<1	<0.5	<0.5
45045	"Plain View"	62.5	N.A.	Overburden / coal	0	0	0
45097	"Sunnyside"	85.3	N.A.	Overburden / coal	<2	0.5	<0.5
48701	"Werona"	61.0	45.7	Overburden / coal	0	0	0
901460	"Illilli"	34.0	16.0	Overburden / coal	0	0	0
NA = Not Available							
Source: GeoTerra (2008) – Table 15							

4B.1.5.2 Strata Overlying the Hoskissons Seam

Regional groundwater drawdown in strata overlying the Hoskissons Seam is not interpreted to extend into the drawing area of private bores located outside of the mine vicinity down dip to the west and north of the proposed pit.

As these bores are completed stratigraphically above the Hoskissons Seam, and do not obtain water from the Hoskissons Seam, their groundwater supply is not anticipated to be affected by mining.

4B.1.5.3 Hoskissons Seam

Operation of the Sunnyside open cut would draw down the piezometric surface around the open cut pit within the confined Hoskissons Seam during mining, with the water table gradually returning, albeit to a lower level due to enhanced evaporation.

Two registered bores owned by NMPL which are extracting groundwater from within the Hoskissons Seam and underlying strata on the "Sunnyside" property would be affected by groundwater drawdown of up to 2m as a result of mining within the Sunnyside open cut pit.

Modelling indicates that one bore on the "Coocooboonah" property to the southeast of the "Sunnyside" property that extracts water from the Hoskissons Seam may be affected by mine operations. However, field investigation determined that there was no bore present at the location shown in the DWE records.

4B.1.5.4 Strata Underlying the Hoskissons Seam

Immediately east of the Sunnyside Project Site there are two bores in the "Lilydale" property, which extract water from strata underneath the Hoskissons Seam. It has been predicted that these bores may be affected by a groundwater drawdown of less than 1m. GeoTerra predicted that at this level of drawdown, both the potential longevity that each bore could be pumped at current extraction rates and the bore yield would not be adversely affected.

No private bores to the east and north of Coocooboonah Lane are anticipated to be affected by drawdown due to mining the Sunnyside open cut pit. This occurs as the eastward progression of the drawdown cone is stopped due to the Hoskissons Seam subcropping / outcropping in the vicinity of Coocooboonah Lane.

4B.1.5.5 Quaternary Aquifers

No Quaternary alluvial aquifers would be mined as part of the proposed mining process. The cone of depression in the Hoskissons Seam and the overburden would not develop significantly outside of the immediate pit vicinity and would not extend outside the outcrop/subcrop of the Hoskissons Seam, which lies approximately 1km south of the main southern channel of Coocooboonah Creek.

Groundwater within alluvial aquifers associated with Coocooboonah Creek, Rock Well Creek, Native Cat Creek or the regional aquifers associated with the Namoi River would not be affected by mining the proposed Sunnyside open cut pit.

4B.1.5.6 Potential Pit Inflows

It is predicted that excavation of the Sunnyside open cut pit may generate low inflows due to the:

- shallow depth of cover;
- water inflows only noted during drilling from the Hoskissons Seam and underlying strata; and
- the low yields and transmissivities in the Sunnyside area.

Modelling has indicated that the open cut pit may generate low to moderate groundwater inflows with an increasing annual inflow up to approximately Year 2.5 as the pit deepens, then would experience a reduction to Year 5 as the pit progresses toward the mostly dry underground workings of the Gunnedah No 5 Area. The modelling incorporates the effect of doleritic intrusions in the Hoskissons Seam as well as the essentially dry state of the N^{o}5 underground.

Detailed annual inflows are included in **Table 4B.10** and show that the modelled cumulative annual inflow of groundwater seeping into the pit is anticipated to vary between an initial 79ML/yr increasing to 106ML/yr in the middle of mining and reducing to 64ML/yr during the last year. The modelled inflow rates do not account for potential evaporation within the pit and from the surface of any storage dams which would significantly reduce the actual amount of stored water as the average annual evaporation (1 752mm/year) is approximately 2.5 times the annual rainfall of 636mm/yr.

Table 4B.10
Pit Inflow Water Balance Using Pit Inflow as Water Source (ML)

	Year 1	Year2	Year 3	Year 4	Year 5
Groundwater Pit Inflow	79	102	106	67	64
Rainfall into Pit and Dams	27.7	27.7	27.7	27.7	27.7
Total Pit Inflow	**106.7**	**129.7**	**133.7**	**94.7**	**91.7**
Mine Water Consumption	88.0	88.0	88.0	88.0	88.0
2x30ML Dam Surfaces Evaporation	5.4	5.4	5.4	5.4	5.4
Pit Evaporation from rock surface	43.8	52.5	59.5	82.3	43.8
Total Pit Outflow and Evaporation	**137.2**	**145.9**	**152.9**	**175.7**	**137.2**
Balance	**-30.5**	**-16.2**	**-19.2**	**-81.0**	**-45.5**
Cumulative input to Old Workings	0	0	0	0	0
Remaining Void Volume Available (Originally 1523ML)	**1523**	**1523**	**1523**	**1523**	**1523**

Source: NMPL

The workings are mostly dry with a minimum volume of 1 523ML of open void space in the workings downgrade of the proposed open cut. This volume was determined for a section of the underground workings and there is additional void space available beyond the section that has been drilled. Consequently, there is void space available for water storage that is well in excess of the minimum 1 523ML. There is a small pocket of standing water (31.2ML) in an isolated and downthrown section of the underground workings. This is located immediately below the proposed water supply bore.

Mining records showing details of all seals and potential egress points for water to escape from the underground workings indicate that there are no adits or other known discharge points that could directly connect and enable the discharge of waters from the underground workings to surface water bodies.

No known registered bores other than the decommissioned GW16789 directly intersects the Gunnedah N^{o} 5 Entry underground workings. Two bores on the "Lilydale" property (GW6249 and GW44884) extract water from stratigraphically beneath the old N^{o} 5 Entry workings.

The water within or near the underground workings has a pH range from 6.90 to 7.03 and the salinity ranges from 3 590µS/cm to 7 360µS/cm. The pH becomes more acid down dip into the deeper workings, while the salinity increases down dip, away from the proposed open cut.

Table 4B.10 summarises a pit inflow water balance using the predicted pit inflow water for the mine water supply. This table also includes a comparison of the cumulative placement of water underground and the available void space.

Pit inflow water would be pumped to the higher of two 30ML turkey's nest dams constructed to the south of the open cut pit. These dams would not have any external catchment and would provide a surface storage for groundwater inflows only. The water they contain would be used primarily for dust suppression around the Project Site. If excess water occurs, it would gravitate to the lower of the two dams and eventually be directed via a bore into the Gunnedah N^{o} 5 Entry underground workings.

Groundwater inflows to the open cut pit would be collected in a sump within the pit. The groundwater pit inflows were determined by modelling. Rainfall represents an average rainfall over the 5 year mining period.

The mine water supply requirement has been estimated to be 88MLpa average over the 5 year life of the mine. **Table 4B.10** has assumed an evaporation rate of 1.752mpa from the bare rock surface exposed during each year of the mining operation and from the surface of the turkey's nest dams.

Table 4B.10 shows that it is most likely that it would not be necessary to discharge excess pit water into the Gunnedah N^{o} 5 Entry underground workings The pit inflows have been conservatively modelled, whilst survey plans of the underground workings indicate additional available void space, if required. These factors further increase the level of confidence in predicting that the availability of adequate storage volume would be well in excess than may be required in a worst case scenario.

The two 30ML turkey's nest dams would handle all predicted pit inflows and discharge underground would provide more than adequate back up should the dams fill.

4B.1.5.7 Potential for Pit Water Placed Underground to Migrate into Underlying Aquifers

GeoTerra (2008) predicted that pit water discharged into the underground workings would preferentially flow into the secondary fractured overburden above the Hoskisson Coal Seam workings rather than drain under gravity into the underlying and unfractured Shallow Marine Facies. The units of this rock type contain a strongly bioturbated low permeability siltstone/silty sandstone which is up to 15m thick in the upper section of the strata.

GeoTerra based their predictions on:

- the predominantly dry void space within the N^{o} 5 underground workings;
- the south easterly dip of the workings; and

- the permeability of the underlying rock which is significantly lower than that of both the infinite permeability of the underground workings void and the higher permeability of the secondary fractured overburden above the underground workings.

GeoTerra anticipated that any pit water placed into the underground workings would fill void space by initially draining to the lowermost section of the workings. These extend approximately 5km southeast of the proposed Sunnyside open cut pit. The workings would then fill updip to the northeast, toward the proposed open cut pit.

As the water height gradually rises above the underground void space, and due to the likely presence of subsided and cracked goafing above the workings, the introduced water would flow into the secondary fractured rock. It is predicted to do this preferentially, rather than drain under gravity into the underlying unfractured Shallow Marine Facies which contain a strongly bioturbated low permeability strata up to 15m thick in the upper section.

4B.1.5.8 Post Mining Pit Void Water Levels, Water Quality and Regional Groundwater Level Recovery

The pit void filling process would involve groundwater inflow, surface water inflow and losses from the open water body due to evaporation of any exposed pit water. Model estimates of pit water level recovery include groundwater seepage only, and do not account for surface water inflow to the pit or importantly, any evaporation.

The modelled groundwater level recovery scenario indicates that water levels in the pit would return to approximately 293m AHD assuming low hydraulic conductivity, or possibly up to 302m AHD for a higher conductivity scenario after the pit has been rehabilitated and excluding the effect of evaporation.

Estimates of rainfall and pit void runoff water that may be captured within the pit void are estimated at between 15.7ML/yr (10^{th} percentile) to 35.4ML/yr (90^{th} percentile) (SCS, 2007). This quantity of water is interpreted to be insufficient, in addition to the groundwater inflows, to raise the standing water level in the base of the rehabilitated pit above the proposed backfill level of 305m AHD. On this basis, the combined groundwater inflow and surface water capture in the pit would not generate a pit void lake, as there is insufficient inflow to raise the pit water level above the proposed basal level of 305m AHD.

If the ponded water becomes exposed at an isolated location in a low backfill area, it would be subject to the high local evaporation rate which would subsequently lower the stored water level in the void and effectively significantly reduce the extent or presence of an in-pit lake.

4B.1.5.9 Potential Connection to Underground Workings

The current mining operation would not break through into the Gunnedah N^{o} 5 Entry underground workings from the pit highwall.

The underground workings are mostly dry. One isolated section within 40m of the southeastern section of the proposed pit contains approximately 31.2ML of water in a down dip, down thrown block faulted section of the underground workings. It is not envisaged that an inrush of water from the underground workings to the open cut would occur, and that a short duration and low volume of seepage may occur through the pit highwall until the head in the fault bounded underground workings and the exposed pit base equalise. In addition, the underground workings would be separated from the open cut pit by a minimum of 50m thick coal barrier and are down dip, and at an equal to lower elevation than the proposed pit base, further reducing the likelihood of a water inrush. Notwithstanding this, should inflows from the underground workings occur they would be managed within the open cut pit water management system.

4B.1.5.10 Potential Impact on Local Streams

It is not anticipated that stream flow in Coocooboonah Creek or Rock Well Creek would be affected by mining the proposed pit as the cone of depression does not extend as far as the creek channels.

The potential effects are further reduced as the creeks are "Losing / Disconnected" streams where water flows from the creek into the underlying shallow groundwater system.

It is not proposed to discharge site water into the local surface water system that does not conform to ANZECC 2000 criteria for SE Australian Upland Rivers.

Due to the low pit inflow rates, low rainfall and high evaporation in the area, it is not anticipated that pit dewatering or on site surface water storage volumes would be exceeded. Consequently, off site discharge of saline water is not required. Should the need to discharge saline site water arise, it would be directed underground via the water supply bore to the Gunnedah N^{o} 5 Entry workings.

4B.1.5.11 Potential Impact on the Namoi River and its Associated Alluvial Groundwater Resources

Groundwater drawdown from mining the proposed Sunnyside Pit would not extend significantly into or within the alluvium of Coocooboonah Creek, and would not extend into the alluvium of Native Cat Creek, Rock Well Creek or tributaries of the Namoi River.

Mining the Sunnyside open cut would not affect river flow or groundwater supplies associated with the Namoi River alluvium.

4B.1.5.12 Sunnyside Project Water Supply

Modelling estimates suggest that the mine water requirement of 75ML/yr to 100ML/yr would not be met by seepage into the pit for its 5 years of operation. Additional water would be obtained from surface water dams and/or from the existing 31.2ML of water contained nearby in the Gunnedah N^{o} 5 Entry underground workings.

The majority of open cut coal mines in the Gunnedah Coalfield with a similar scale and geological setting to Sunnyside do not have significant groundwater pit seepage, and are operated as "dry" mines, even though groundwater models generally indicated they would have inflows. GeoTerra considers that this is due to the significant evaporative loss of groundwater inflows.

It is therefore possible that the Sunnyside model may also overestimate the actual operational inflows that would be encountered during mining.

If inflows are insufficient, pumping from the adjacent flooded underground Gunnedah No.5 workings would augment the site water supply. Pumping from the underground would extract water from a downthrown section of the workings that is below the level of the base of the open cut pit.

Any extraction from the N^{o} 5 underground workings would be appropriately licensed with the DWE prior to extraction.

4B.1.5.13 Potential Impacts on Groundwater and Surface Water Quality

Open Pit Void Water Quality

The pit water quality will alter depending on the variable proportion of groundwater seepage, waste rock leachate, inflowing clean stormwater, dirty surface water runoff and evaporation effects.

Based on their assessments conducted to date, GeoTerra (2008) predict that electrical conductivity values of in-pit water would range from approximately 5 800µS/cm during wet periods to approximately 11 000µS/cm during extended dry periods. The in-pit water is anticipated to have a pH ranging between 6.90 and 8.43.

An "after-mining" lake will not result from the Sunnyside Coal Project. The combined groundwater inflow and surface water capture in the pit would not generate a pit void lake, as there is insufficient inflow to raise the pit water level above the proposed basal level of 305m AHD (Refer Section 4B.1.5.8).

Placing Open Pit Void Water Into Old Underground Mine Workings

A purpose built bore will be installed close to the southern edge of the open cut pit to both enable a pocket of ground water to be accessed should it be required for start-up water supply and to enable pit water to be injected into the workings should that ever be required. The location of the bore is shown on **Figure 2.1**.

Although this bore will be located in a "down-thrown" fault area of the underground workings, water will drain downdip along the worked out seam, once it has reached the spill level of the down thrown area.

A comprehensive drilling program and assessment has indicated that there is adequate volume of dry underground workings to contain at least 1 523ML of water (refer Section 4B.1.5.6). However, if additional water placement is required updip of this point, or elsewhere, additional bores could be installed following consultation and licensing from DWE.

Analysis undertaken by GeoTerra to date has shown that:

- water in the N^{o} 5 Entry underground workings has a range of electrical conductivity values between 3 590µS/cm and 7 360µS/cm, with a pH range between 6.90 and 8.10;
- the groundwater in the Hoskissons Seam and associated overburden has a range of electrical conductivities between 2 260µS/cm and12 650µS/cm, with a pH range between 6.62 and 7.9;
- the strata underlying the Hoskissons Seam has a salinity ranging between 2 500µS/cm and 11 430µS/cm and a pH ranging between 6.61 and 8.23;
- the open pit water may have a range of electrical conductivity of between approximately 5 800µS/cm and 11 000µS/cm with a predicted pH ranging between 6.90 and 8.43; and
- there is no indicated potential for acid mine drainage from overburden or coal.

Based on these analyses, placing of pit water into the No. 5 Entry underground workings does not constitute pollution in terms of pH. However, the upper potential electrical conductivity of 11 000µS/cm could exceed that in the No. 5 Entry underground workings but not the upper level of the Hoskissons Seam. NMPL would use surface water to control, by dilution, the salinity levels in the water discharged from the turkey's nest dams. Pre-discharge monitoring will confirm salinity levels prior to discharge underground. In order to avoid potential degradation of Hoskissons Seam and N^{o} 5 Entry underground workings water quality, a water quality management system will be implemented as described in Section 4B.1.6.1 – Gunnedah N^{o} 5 Entry Underground Workings.

In addition, the predicted in-pit salinities show that it is only during dry periods that the pit water is predicted (conservatively) to exceed existing water quality criteria. The diluted pit water in the dams would only be discharged underground when excess water exists. This is most likely to be at a time when salinities would be at the lower end of the predicted range due to surface water dilution. Any excess water would always be pumped from the second turkey's nest dam to ensure the preferred salinities are achieved.

Regional Groundwater

Dewatering associated with the Sunnyside pit is not anticipated to have an adverse impact on groundwater quality within the Hoskissons Seam, or the strata over or underlying the Seam.

No adverse effect is anticipated on the surface water quality in Coocooboonah Creek and other streams due to groundwater movement as the Sunnyside cone of depression does not extend as far as the creek channel. Depressurisation in the basement strata under or near the creek is not anticipated due to the isolated dewatering of the Hoskissons Seam.

No adverse effect is anticipated on water quality within Rock Well Creek as depressurisation of the Hoskissons Seam is not anticipated to sufficiently propagate up through strata above the Hoskissons Seam to the creek bed.

The cone of depressurisation is not predicted to extend as far north as Native Cat Creek, and therefore no adverse effects on stream water quality are anticipated.

4B.1.5.14 Potential Salt and Contaminant Migration Pathways

It is not anticipated that an increase in salinity levels in Coocooboonah Creek would occur due to leakage of groundwater out of the proposed pit or abandoned underground workings should water be pumped into them. This is a result of the pit forming an inward cone of depression and the underground workings to the south being mostly dry.

The abandoned workings also have an estimated minimum capacity of 1523ML for storage of excess pit water which if totally filled with groundwater inflow from the open cut pit, would only raise the water level in the workings to the top of the seam. Saline water would not rise sufficiently to affect the surface water system.

Based on the lack of anticipated groundwater flow effects on stream salinity, solute transport modelling was not considered necessary. Some salt generation through rainfall recharge/discharge from the waste rock emplacements may occur, although this is planned to be captured in the mine dirty water system and either used on site or stored in the underground workings, if necessary.

It is also anticipated that no contaminants would be transported off site via the groundwater system due to the inward flowing cone of depression. Off-site migration of contaminants via the surface water system should be contained within the mine dirty water system.

4B.1.5.15 Potential Impacts on Groundwater-Dependent Ecosystems

No groundwater-dependent ecosystems (GDEs) have been identified within the Sunnyside Project Site, and therefore there are no anticipated adverse effects on GDEs in the study area.

4B.1.6 Management and Mitigation Measures

The following management actions would be implemented for the Sunnyside Coal Project.

4B.1.6.1 Monitoring

A groundwater monitoring program as outlined below would be initially conducted for 1 year, and extended with any modifications following an annual review and assessment of additional data.

The annual report would contain an interpretation of the data along with:

- a basic statistical analysis (mean, range, variable, standard deviation) of the results for the parameters measured;
- interpretation of water quality and standing water level changes supported with graphs or contour plots; and
- interpretation and review of the results in relation to the impact assessment criteria.

The groundwater monitoring program would be extended beyond the active mine life in order to assess the potential long term change in groundwater re-pressurisation and water quality, with the program continuing for a period agreed with the DWE / DPI-MR after closure of the relevant mining operations.

Groundwater Levels and Groundwater Quality

NMPL would implement a monitoring program that utilises two water level loggers reading at 12 hourly intervals, quarterly measurement of field pH and EC and annual laboratory analysis of groundwater samples. The AEMR would document and interpret the collected data.

The monitoring program would be consistent across the Project Site and have emphasis on capturing real time data from bores located in the vicinity of surface water systems and in close proximity to the proposed open cut pit and abandoned underground workings.

Groundwater samples would be collected annually from locations P1 to P8 as identified in GeoTerra (2008) and analysed for major ions (TDS, Na, K, Ca, Mg, Cl, HCO_3, NO_3, SO_4 and hardness) and selected metals at a NATA registered laboratory.

Sampling and testing procedures would be conducted according to the Australian Guidelines for Water Quality Monitoring and reporting (ANZECC, 2000)

Private Bore and Well Groundwater Levels, Yield and Quality

There are two operational private bores on the "Lilydale" property that have potential drawdown of less than 1m as a result of mine dewatering.

If agreed by the landowner, NMPL would undertake quarterly measurement of the standing water level within the "Lilydale" bores as well as field assessment of pH and EC. An annual laboratory analysis of groundwater samples would be conducted, with periodic reports documenting and interpreting the collected data.

If agreed to by the owner of "Lilydale", the pre-mining yield of the bores would be tested to determine current status. This would provide a comparison for follow-up testing of mine dewatering effects if required.

The monitoring of the "Lilydale" bores would be initiated prior to extraction of the pit, with ongoing review and possible modification of the program as further data is interpreted. Providing ongoing access is available, groundwater samples would be collected annually and analysed at a NATA registered laboratory for major ions and selected metals.

Available private bores outside the "Sunnyside" and "Lilydale" properties would be monitored in the field for standing water levels as well as field pH and EC every 6 months, with ongoing review of the data as the mine proceeds, to assess whether modification to the scheduled monitoring is required.

Mine Water Pumping

The volume of water pumped into and out of the mine and underground workings would be monitored to compare the actual volume of pumped water to the predicted water management volumes.

Gunnedah N^{o} 5 Entry Underground Workings

Following consultation and agreement with the DWE, NMPL would install dedicated piezometers, with sealed screen intakes, beneath the Hoskissons Seam at agreed locations in the vicinity of the proposed open cut pit and the N^{o} 5 Entry underground workings to enable monitoring of groundwater level and groundwater quality changes that may occur due to aquifer depressurisation and/or placement of pit water into the underground workings. These piezometers would augment the existing piezometer network.

A management plan would be developed to avoid degrading the water quality in the N^{o} 5 Entry underground workings, the Hoskissons Seam and underlying strata as a result of placement of the open pit water. The plan would include, but not be limited to the following strategies.

- Water would not be put into the workings if it exceeds the upper bound water quality of the Hoskissons Seam or N^{o} 5 Entry underground workings.
- Monitoring of water in the open cut void water, N^{o} 5 Entry underground workings, Hoskissons Seam and underlying strata and the pit dewatering storage dams.
- If required, shandying the in-pit void water with excess stored surface water before placing it in the underground workings.

There would be a number of management strategies implemented to minimise the likelihood of hydrocarbon contamination. These are fully discussed in Section 2.9.1.2 of the *Environmental Assessment.*

However, should there be an unexpected spill the following measures would be implemented to avoid manage the consequential impacts.

- Should any hydrocarbons be detected within the pit sump they would be removed by tanker and taken to the oil storage tanks within the bunded section at the maintenance workshop. They would be collected by a licensed waste recycling contractor along with other site waste hydrocarbons. Should the spill be large, the tanker would take the material off site for appropriate treatment and disposal.
- NMPL, would have access to a floating containment boom as part of the Whitehaven Group's oil spill response equipment located in the Gunnedah vicinity. This response equipment would be available for use at Sunnyside, if required. Relevant employees would be trained in its use.
- Not all water would be removed when water is pumped from the pit sump. This would ensure that floating hydrocarbons remain within the sump and be available for removal and recycling as described above. There would be no soluble oils used on site and should there be an accidental spill, all hydrocarbons would float on the surface of the pit water.
- When pit water passes from the first turkeys nest dam into the second, it would pass through a combined solid and flexible barrier oil skimmer arrangement. This would minimise the likelihood of any surface floating hydrocarbons being delivered to the second turkeys nest dam.
- When water is directed from the second turkeys nest dam and placed in the underground workings, not all water in the dam would be discharged. This would retain any floating hydrocarbons within the second turkeys nest dam from where they would be removed as required.

- Monitoring would be undertaken to ensure the quality of pit water pumped into the first turkeys nest dam, the quality of the water in the second turkeys nest dam immediately prior to discharge, and the quality of the water within the underground workings. Records would also be kept of the volumes of water delivered into the dams and placed underground. The parameters tested by monitoring would include, pH, electrical conductivity, oil and greases and Total Suspended Solids (TSS).
- Monitoring of the water being delivered into the first turkeys nest dam would identify any potential contamination and enable management measures to be implemented to control the quality of water if it is necessary to discharge it underground. Monitoring immediately prior to discharge would confirm the quality of water. Monitoring of water within the underground workings would confirm water quality within that aquifer. Measuring the volumes of water would enable water balances to be maintained and ensure that storage volumes are adequate for ongoing operations.

Rainfall

Rainfall would be monitored daily at the on-site weather station for the duration of mining.

Groundwater Contamination Control and Prevention

Site specific controls are proposed by NMPL to ensure the prevention of potential groundwater contaminants from seeping into the ground or into surface water management structures. They include and are not restricted to the following.

- All hydrocarbon products variously consumed onsite would be securely stored in accordance with the appropriate Australian and WorkCover Standards and Procedures.
- All mining equipment with the exception of some limited mobility plant would be refuelled, serviced and repaired within designated areas outlined for such activity in the Project Site Facilities Area.
- All hydrocarbon product storage tanks would be either self bunded tanks or bunded with an impermeable surface and be constructed to hold a capacity equal to a minimum 100% of largest storage tank capacity.
- All water from wash-down areas and workshop areas would be directed and/or pumped to oil/water separators and containment systems.

Quality Assurance and Control

QA/QC should be attained by calibrating all measuring equipment, ensuring that sampling equipment is suitable for the intended purpose, using NATA registered laboratories for chemical analyses and ensuring that site inspections and reporting follow procedures outlined in the ANZECC 2000 Guidelines for Water Quality Monitoring and Reporting. NMPL is committed to the implementation of a range of Site Operating Procedures specifically related to the prevention and containment of hydrocarbon-based contaminants from entering the surface and subsurface regimes.

4B.1.6.2 Contingency Measures

Notwithstanding the relevant Site Operating Actions and Procedures outlined above, contingency procedures would be developed for the proposed mining operations. These measures would be used to manage any impacts identified by monitoring that may indicate the groundwater management strategies and procedures may have failed to predict or adequately manage the groundwater system's response to mining.

Activation of contingency procedures would be linked to assessment of monitoring results, including water quality and aquifer pressure levels, as well as the rate of water level changes as outlined above.

Performance indicators would be identified and agreed to by DWE/ DPI-MR prior to mining, and in order to detect when a significant change has occurred in the groundwater environment, a statistical assessment would be undertaken prior to mining.

The assessment would benchmark the pre-mining natural variation in groundwater quality and standing water levels, and from this trigger levels would be set for accepting accountability.

4B.1.6.3 Impact Assessment Criteria

Groundwater Levels

There are no specific groundwater level or aquifer depressurisation criteria developed for the mine area as there is no monitoring data available prior to mining.

Impact assessment criteria investigation trigger levels would be set at an overall 3m sustained reduction in monitored groundwater levels in a private bore over a 3 month period.

The monitoring, management and rehabilitation strategy used would comply with the relevant aquifer interference policies of the Department of Water and Energy.

It is proposed that regular water level monitoring would be plotted and interpreted every four months, and if there is a significant increase in the rate of rise or fall in aquifer water levels, based on interpretation by a qualified hydrogeologist, then an assessment would be conducted to determine the cause of the change and to consider potential rehabilitation measures that may be adopted.

Groundwater Quality

Groundwater quality impact assessment criteria are sourced from the Australian Water Quality Guidelines for Fresh and Marine Waters (ANZECC, 2000) for Primary Industries (Irrigation Water) as shown in **Table 4B.11**. These criteria have been selected because the water is too saline to be used for stock and domestic or drinking use, and is not discharged to the local streams**.**

Table 4B.11
Groundwater Quality Impact Assessment Criteria

Indicator	Irrigation Criteria
pH	<6.5 or >8.5 or >10% variation over 3 months compared to previous 12 months data
Conductivity	>10% variation over 3 months compared to previous 12 months data
TDS	>13,000mg/L or >10% variation compared to previous 12 months data
Na	>460mg/L or >10% variation compared to previous 12 months data
K	>10% variation compared to previous 12 months data
Ca	>1000mg/L or >10% variation compared to previous 12 months data
Mg	>10% variation compared to previous 12 months data
Cl	>700mg/L or >10% variation compared to previous 12 months data
$HC0_3$	>10% variation compared to previous 12 months data
$N0_3$	>400mg/L or >10% variation compared to previous 12 months data
$S0_4$	>1000mg/ or >10% variation compared to previous 12 months data
Hardness	>350mg/L as CaCO3 or >10% variation compared to previous 12 months data
Source: GeoTerra (2008) – Table 17	

A trigger to assess the cause and effects on groundwater quality would be implemented when there is a prolonged and extended non conformance of the outlined criteria at a particular piezometer.

If a parameter is outside the designated criteria for at least three months in a sequence, or alternatively, exceeds its previous range of results by greater than a 10% variation for at least 3 months, then the cause would be investigated, and a remediation strategy proposed, if warranted.

The criteria and triggers would be reviewed after the 12 months of data is interpreted and may be modified as appropriate, depending on the results.

If the impacts on the groundwater system resulting from mining are demonstrated to be greater than anticipated, NMPL would:

- assess the significance of these impacts;
- investigate measures to minimise these impacts; and
- describe what measures would be implemented to reduce, minimise, mitigate or remediate these impacts in the future to the satisfaction of the Director-General.

4B.1.6.4 Piezometer Maintenance And Installation

The current network would be maintained by protecting the wellhead from damage by cattle and from scrub fires by maintaining their steel sealed wellheads.

If required, the piezometers may be cleaned out by air sparging if they become clogged. All new bores, wells or piezometers would be installed by suitably licensed drillers after obtaining the relevant bore licence from DWE.

4B.1.6.5 Rehabilitation

Remedial action may be required if monitoring results indicate the agreed standards or performance indicators are not being achieved due to failure or ineffectiveness of NMPL's management strategies.

Due to the localised dewatering effect from the proposed pit, it is not anticipated that groundwater system rehabilitation would be required.

4B.1.6.6 Reporting

Relevant monitoring and management activities for each year would be reported in the Sunnyside Mine Annual Environmental Management Report (AEMR).

The AEMR report would contain an interpretation of the data along with:

- a basic statistical analysis (mean, range, variable, standard deviation) of the results for the parameters measured,
- interpretation of water quality and standing water level changes supported with graphs or contour plots, and
- interpretation and review of the results in relation to the impact assessment criteria.

At the completion of the mine, a report would be prepared that summarises all relevant monitoring. The report would outline any changes in the groundwater or surface systems within the study area.

4B.2 NOISE AND VIBRATION

The noise and vibration assessment was undertaken by Spectrum Acoustics Pty Ltd. The full assessment is presented in Part 2 of the Specialist Consultant Studies Compendium, with the relevant information from the assessment summarised in the following subsections.

4B.2.1 Introduction

Based on the environmental risk analysis undertaken for the Project (see Section 3.3 and **Table 3.5**), the potential environmental noise impacts requiring assessment and their unmitigated risk rating are as follows.

- Increased noise levels associated with the Project Site activities causing annoyance, distractions, ie. amenity impacts (high to extreme risk).
- Increased noise and/or vibration levels associated with the Project road and rail traffic causing annoyance, distractions, ie. amenity impacts (moderate risk).
- Maximum noise levels causing sleep disturbance (high risk).
- Increased noise levels associated with the Project leading to reduced agricultural production, ie. impacts on livestock (moderate risk).

In addition, the Director-General's requirements issued by the Department of Planning require that the assessment of noise and noise impacts refer to the *NSW Industrial Noise Policy*, *Environmental Criteria for Road Traffic Noise* and *Environmental Noise Control Manual* (Department of Environment and Climate Change).

The objectives of the *Industrial Noise Policy* relevant to the Project 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 *Protection of the Environment Operations Act 1997* (POEO Act).

The following subsections assess the existing noise environment, environmental noise criteria, proposed operational safeguards and mitigation measures and an assessment of the residual impacts following the implementation of these safeguards and mitigation measures.

4B.2.2 Existing Meteorological Environment

The atmospheric conditions most relevant to noise assessments are temperature inversions, gentle winds which provide an indication of wind shear and relative humidity.

In the absence of local information and based on their experience in the Gunnedah area, Spectrum (2008) assumed that mild temperature inversions are a feature of the area during winter. They therefore adopted the Department of Environment and Climate Change (DECC) default value of +4°C/100m vertical temperature gradient for use in the models during night-time in winter.

Heggies (2007) developed wind roses for the Project Site using the Air Pollution Model (TAPM). This information is detailed in their Report which is included as Part 5 in the *Specialist Consultant Studies Compendium*. The general topography of the Project Site demonstrates a slope of the land from the southeast down towards the northwest. A 2m/s east-southeast drainage flow was added to the inversion default for modelling purposes.

Hourly wind data from Gunnedah airport covering the period December 2001 to August 2006 were analysed to determine the percentage occurrence of winds from various directions. This analysis enabled the predominant or prevailing wind directions to be determined. The analysis showed that prevailing winds up to 3 m/s (summed over all relevant vector components) are from the east-northeast and south-southwest in all seasons. Analysis of wind data for noise modelling purposes is significantly different to that used to generate wind roses and the two representations of wind data often bear little resemblance. Wind vector components up to 3 m/s from the ENE and SSW are required to be assessed under the DEC's Industrial Noise Policy (INP) and were modelled using a wind speed of 3m/sec at 10m.

Typical calm daytime conditions of no wind, 70% relative humidity and -1^0C/100m vertical temperature gradient was also modelled.

4B.2.3 Ambient Noise Levels

All of the receivers are in a rural setting with no industrial noise present. It has been assumed that the background noise level at all receivers is at or below 30dB(A), L_{90} day, evening and night.

4B.2.4 Noise and Vibration Criteria

Project noise and vibration criteria were developed for potentially affected residential properties not owned by NMPL. **Table 4B.12** records the residences surrounding the mine site and their proximity to the Project Site.

Table 4B.12
Residential Receivers Surrounding the Project Site

R1 "Flodden"	R7 "Woodlawn"	R13 "Merralong"
R2 "Ivanhoe"	R8 "Sugarloaf"	R14 "Skipton"
R3 "Werona"*	R9 "Lilydale"	R15 "Glendower"
R4 "Illili"	R10 "Mulwalla"	R16 "Carramar"
R5 "Ferndale"	R11 "Mulwalla" (2)	R17 "Crendon"
R6 "Plain View"	R12 "Lyndon Park"	R18 "Glenfenzie"
Source: Spectrum Acoustics (2008) Table S1 * Project-related		

The locations of these residential receivers are shown on **Figure 4A.5**.

4B.2.4.1 Construction Noise

Recommended construction noise criteria vary depending on construction duration, as outlined in Section 157 of the DEC's Environmental Noise Control Manual (ENCM) and reproduced below:

- Construction period less than 4 weeks: $L_{10(15minute)}$ level restricted to background (L_{90}) + 20dB.
- Construction period more than 4 weeks but less than 26 weeks: $L_{10(15minute)}$ level restricted to background (L_{90}) + 10dB.

The DECC recommends construction during daytime hours only. For construction periods longer than 26 weeks, the operational noise criteria are assumed to apply.

It is expected that construction of the Coocooboonah Lane re-alignment would be completed within the first 3 months of the Project and the criterion of 'daytime background level + 10dB(A)' or 40dB(A), $L_{10(15minute)}$ would apply. Excavation of the pit access ramp and construction of site facilities and environmental bunds would occur within the following 3 months and would also be subject to the construction noise criterion. Completion of the out-of-pit overburden emplacement would take a further 6 months and the operational noise criterion discussed in the following section have been applied, subject to modification by the predicted noise levels.

4B.2.4.2 Operational Noise Goals

The INP specifies two noise criteria. These criteria are an intrusiveness criterion which limits short-term L_{eq} noise levels from the industrial source to a value of 'background plus 5dB' and an amenity criterion which aims to protect against excessive noise levels where an area is becoming increasingly developed.

Since there is no existing industrial dominating noise at or near the Project Site, and there are relatively low levels of road traffic noise, only the intrusiveness criteria are relevant. The Project-Specific Noise Levels (PSNL) are therefore 35dB(A),$L_{eq(15minute)}$ day, evening and night at all receivers near the Project Site, subject to modification by predicted noise levels.

4B.2.4.3 Sleep Disturbance

To help protect against people waking from their sleep, due to Project-related noise, the DECC recommends that 1-minute L1 noise levels (effectively, the L_{max} noise level from impacts, etc) would not exceed the background level by more than 15dB(A) when measured/computed at a building facade. The sleep disturbance criterion is only applicable to night-time operations.

The sleep disturbance criterion at each receiver location is equal to the intrusiveness criteria plus 10dB(A), that is, 45dB(A),$L_{1(1\text{-minute})}$, and applies to maximum noise emissions.

4B.2.4.4 Train Noise Criteria

The operation of Sunnyside Coal Mine would result in additional train movements on the rail line between the Whitehaven Rail Loading Facility and Port Newcastle. There would be a corresponding marginal increase in noise exposure at residences adjacent to the rail line.

The train noise levels specified in Chapter 163 of the ENCM are included in **Table 4B.13**.

Table 4B.13
Train Noise Level Criteria

Descriptor	Planning Levels	Maximum Levels
$L_{eq,\ 24\ hour}$	55dB(A)	60dB(A)
L_{max}	80dB(A)	85dB(A)
Source: Spectrum Acoustics (2008) Section 4.4.1		

Spectrum (2008) used these criteria as the DECC preferred maximum levels from train noise generated by the Project.

The Australian Rail Track Corporation (ARTC) operates the rail line to Port Newcastle. ARTC's Environmental Pollution Licence (EPL 3142) does not contain environmental noise limits but states the objective of progressive reduction of noise levels from rail lines through Pollution Reduction Programs (PRPs).

While the Main Northern Line is not currently subject to a PRP, Section U1.1 of EPL 3142 provides the following goals to work towards in developing a PRP.

Descriptor	Design Goal
$L_{eq,\ (15\ hour),}$ day	65dB(A)
$L_{eq,\ (9\ hour),}$ night	60dB(A)
$L_{max\ (24\ hour)}$	85dB(A)

These criteria were also used in the assessment of cumulative train noise levels as a result of the Sunnyside Coal Mine.

4B.2.4.5 Train Vibration Levels

Various authorities have set maximum limits on allowable ground and building vibration in different situations. Vibration criteria for this assessment were obtained from the DEC publication "Assessing Vibration: A Technical Guideline" (AVTG, 2006). Using these guidelines, Spectrum (2008) derived a maximum allowable vibration velocity criteria of 2.82mm/s.

4B.2.4.6 Road Traffic Noise

Trucks transporting coal to the Whitehaven Rail Loading Facility would first use the re-aligned section of Coocooboonah Lane to be constructed on the "Plain View" property parallel to the existing Lane.

Trucks would turn left out of Coocooboonah Lane and proceed eastwards along the Oxley Highway before turning left into Blackjack Road. At the end of Black Jack Road, trucks would turn right into Quia Road. They would then turn left and pass under a rail overpass, then immediately turn left again and proceed directly to the Whitehaven Rail Loading Facility. There are residences adjacent the Oxley Highway, Torrens Road and Quia Road.

Noise criteria for the generation of additional traffic on public roads were sourced from the DEC Environmental Criteria for Road Traffic Noise (ECRTN). Blackjack Road and Quia Road are collector roads and, while the Oxley Highway is a highway, it carries a relatively small traffic volume and was considered as a collector road for the purposes of setting noise criteria. Torrens Road carries very little traffic and is assessed as a local road. The applicable ECRTN criteria are listed in **Table 4B.14**. No coal transport during night-time hours would normally occur.

Table 4B.14
Noise Criteria on Public Roads

Category	Day (7am to 10pm)	Night (10pm to 7am)
Land use development with potential to create additional traffic on collector roads.	60dB(A),$L_{eq(1hr)}$	55dB(A),$L_{eq(1hr)}$
Land use development with potential to create additional traffic on local roads.	55dB(A),$L_{eq(1hr)}$	50dB(A),$L_{eq(1hr)}$
Source: Spectrum Acoustics (2008) - Section 4.5		

4B.2.4.7 Blasting

Noise and vibration levels from blasting are assessable against annoyance criteria proposed by the Australian and New Zealand Environment and Conservation Council (ANZECC) in their publication "Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration – September 1990". These criteria are summarised as follows.

- The recommended maximum overpressure level for blasting is 115dB.
- The level of 115dB may be exceeded for up to 5% of the total number of blasts over a 12 month period, but would not exceed 120dB at any time.
- The recommended maximum vibration velocity for blasting is 5mm/s Peak Vector Sum (PVS).
- The PVS level of 5mm/s may be exceeded for up to 5% of the total number of blasts over a 12 month period, but would not exceed 10 mm/s at any time.
- Blasting should generally only be permitted during the hours of 9:00am to 5:00pm Monday to Saturday, and would not take place on Sundays and Public Holidays.
- Blasting would generally take place no more than once per day.

Building damage assessment criteria are nominated in AS 2187.2-1993 "Explosives – Storage, Transport and Use. Part 2: Use of Explosives" and summarised in **Table 4B.15**.

Table 4B.15
Building Damage Blast Criteria (AS2187)

Building Type	Vibration Level (mm/s)	Airblast Level (dB re 20 μPa)
Sensitive (and Heritage)	5	133
Residential	10	133
Commercial/Industrial	25	133
Source: Spectrum Acoustics (2008) - Table 3		

The annoyance (ANZECC) criteria are more stringent than the building damage criteria and were used as the governing ones for the Sunnyside Coal Project.

4B.2.5 Assessment Methodology

Section 5 of Spectrum (2008) contains a detailed description of the assessment methodology.

4B.2.5.1 Construction Noise

For modelling purposes, it was assumed that excavation of the open cut access ramp, road construction and construction of surface facilities would not take place simultaneously. Construction of the Coocooboonah Lane realignment would be followed by the excavation of the pit ramp, establishment of amenity bunds and construction of surface facilities. A year 0 (construction) scenario assessing completion of the out-of-pit overburden emplacement was considered as an operational activity. Noise levels for typical construction machinery have been sourced from Spectrum's extensive noise database and were used in the assessment.

Assessment of construction noise was conducted using RTA Technology's Environmental Noise Model (ENM) v3.06. Noise levels under calm (neutral) conditions and the prevailing winds were calculated. Although not formally required under the INP, inversion conditions were also assessed to determine worst case potential impacts.

4B.2.5.2 Operational Noise

Assessment of operational noise was conducted using RTA Technology's Environmental Noise Model (ENM) v3.06. The noise sources were modelled at their known (for stationary sources such as the truck loading area) or most exposed (for mobile sources such as haul trucks and dozers) positions and noise contours and/or point calculations were generated for the surrounding area.

Noise data for significant sources associated with the Project were obtained from Spectrum's extensive database of measured plant items. All sound power levels used in the modelling were obtained from measurements results at other operating mines in the Gunnedah area. Sound power levels of operational noise sources are shown in Appendix A of Spectrum (2008).

All design / operational safeguards and controls to be adopted have been reflected in the modelling.

Modelling was conducted for the following atmospheric conditions.

- **Daytime** lapse – 20^{o}C, 70% relative humidity (RH), no wind, -1^{o}C/100m vertical temperature gradient (dry adiabatic lapse rate, DALR).
- **Inversion –** 10^{o}C, 70% R.H., +4^{o}C/100m vertical temperature gradient.
- **Winds –** 20^{o}C, 70% R.H., 3m/s wind from SSW and ENE.

In addition to the Year 0 (construction) scenarios, noise models were generated for Year 1, Year 2 and Year 5 mining operations, for each of the above atmospheric conditions. Noise sources for these three additional scenarios are shown respectively in Figures B1 to B3 within Appendix B of Spectrum (2008).

4B.2.5.3 Rail Noise

Additional rail traffic generated as a result of the Project would be of an intermittent rather than constant nature. There are many methods available for calculating the cumulative noise impact arising from intermittent signals of various shapes. The methodology employed by Spectrum was sourced from the US Environmental Protection Agency document No. 550/9-74-004 "Information on Levels of Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, March 1974".

4B.2.5.4 Rail Vibration

Vibration levels from laden and unladen coal trains have been widely studied in the Hunter Valley. A thorough assessment conducted by Wilkinson Murray Pty Limited in 1997 along the Jerry's Plains Rail Spur forms the basis of the rail vibration assessment undertaken by Spectrum (2008).

4B.2.5.5 Off-site Road Traffic Noise

Spectrum (2008) used standard equations for calculating off-site road traffic noise.

4B.2.5.6 Blasting

Spectrum (2008) used standard equations for predicting blast overpressure and ground vibration levels. These equations were sourced from the United States Bureau of Mines and endorsed by ANZECC. Blast data from coal mines in the Hunter Valley were analysed to determine suitable correction factors that would align the equations with actual measured results. The modified equations were then used to predict blast overpressure and vibration levels from the Project.

4B.2.5.7 Blast Overpressure

Unweighted airblast overpressure levels were predicted from another standard equation that has inputs based on distance from blast and the weight of explosives.

4B.2.5.8 Blast Vibration

The basic equations for calculation of peak particle vibration levels from blasting have similar inputs to those for calculating blast overpressure.

4B.2.6 Design and Operation Safeguards

Safeguards to limit the noise generated by the Project and received at non-project-related residences surrounding the Project Site include a combination of:

- design features of the mine itself;
- the sequence of the mine's development;
- noise controls;
- operational procedures to limit noise generation; and
- operating shift hours.

The nearest non-project-related residences to the proposed mining and coal processing activities on the Project Site are highlighted in **Table 4A.2**. In recognising the potential for impact of Projected related noise on these nearby residences, NMPL proposed to implement management and amelioration proposals.

Construction Noise Management and Amelioration Measures

As much as practical, site establishment and construction noise would be restricted to only one noisy activity at a time, eg. topsoil stripping, amenity bund and road construction activities.

Operational Noise Management and Amelioration Measures

The operational noise management and amelioration measures would include the following.

- The initial emplacement of overburden within the footprint of the overburden emplacement area would be confined to an area approximately parallel and as close as practicable to the northern surface limit of the Sunnyside Pit development. This action, in conjunction with the initial emplacement of overburden for the construction of the Coal Processing Area, amenity bund would provide an effective acoustic shielding between the open pit / coal processing area and the nearby residences early in the initial development of the mine.
- Dependant on prevailing winds at the time, overburden emplacement and elevated haul truck tipping would be restricted whenever practical, to the leading side of the emplacement area. This would locate the noise source the maximum distance possible from the nearest residence downwind.
- Operational hours of work (**Table 2.7**) for the Sunnyside operation would be confined between the hours of 7:00am and 10:00pm Monday to Friday and 7:00am to 4:00pm on Saturday.
- Use of mid frequency broadband reverse beepers.

- The selection of specific mining equipment would involve the assessment of noise power levels for most plant, where practical.
- Regular servicing and maintenance of all equipment.
- A Noise Management Plan would be prepared by NMPL prior to commencement of mining and coal processing operations and would incorporate specific procedures in relation to the above measures.

Transport Noise Management and Amelioration Measures

The transport noise management and amelioration measures would include the following.

- All roads comprising the coal transport route would be sealed and regularly maintained under a contribution plan with Gunnedah Shire Council.
- Strict adherence to approved hours of coal transportation.
- Truck operating procedures would be developed with the Coal Transportation Contractor. All truck drivers would be instructed to avoid the use of engine brakes between the coal processing area and the intersection of Coocooboonah Land and the Oxley Highway and on Torrens Road. Notwithstanding the road safety considerations, the use of engine brakes would be minimised where possible at each of the public road intersections along the coal transport route.
- Testing of truck noise compliance with Australian design Rule ADR 28/01 prior to commencement of coal transportation.
- Routine traffic noise measurements on Torrens Road.

Blast Design and Management

Central to all safeguards would be the conservative design and careful implementation of each blast to minimise impacts, ie. designing each blast to satisfy environmental and public safety requirements as the first priority, with ongoing blast design refinement based on measured operational and environmental performance. Blast design and implementation would be undertaken by a suitably qualified blasting engineer and/or experienced and appropriately certified shot-firer.
Careful design is also fundamental to safe, successful blasting. Industry has developed best practice procedures centred around the design of blasts that ensure:

- airblast overpressure and ground vibration levels are within nominated limits;
- the require fragmentation (the size of broken rock) is achieved; and
- all rock that is blasted is contained in a pre-determined blast envelope.

Blast design for the Project would include the following features to meet these industry standards.

- Ensuring that burden distances and stemming lengths are such that explosion gases are almost completely without energy by the time they emerge into the atmosphere.
- Ensuring that charges consistently detonate in carefully designed sequences.

Noise and airblast generation would be controlled by ensuring that all, or nearly all, of the explosion energy is consumed in fragmenting and displacing the overburden by the time the gases vent (via the broken burden rock and/or ejected stemming material) into the atmosphere. This objective would be met by ensuring that:

- blasthole spacing is implemented in accordance with blast design;
- the burden distance and stemming length are carefully selected and then implemented precisely;
- appropriate materials, eg. 20mm aggregates, are used for stemming;
- charges detonate in the correct sequence and with inter-row delays that provide good progressive release of burden; and
- the maximum weight of explosive detonated in a given delay period (the maximum instantaneous charge (MIC)) is limited to conservative and proven levels.

Ground vibration would be controlled by ensuring:

- the minimum practicable weight of explosive detonates at an instant, ie. minimising the MIC, by using the maximum number of delay periods in each blast; and
- most of the energy liberated by the charge(s) on a given delay number is consumed in providing good fragmentation, adequate displacement and/or a loose, highly diggable muckpile, rather than in creating ground vibrations, ie. by ensuring that the burden distance and effective sub-drilling are not too large.

Blast-generated dust would be minimised by ensuring that stemming columns are not ejected for considerable distances into the atmosphere. Stemming column lengths would be such that their ejection velocities are low.

Additionally, the blasting contractor would be required to use aggregates for blasthole stemming and to use nonel delay-type or electronic detonators to initiate charges. The use of nonel-type delay or electronic detonators would avoid the requirement for detonating cord downlines and, with the absence of detonating cord trunklines (ie. surface lines), prevents the dust cloud that is formed when such trunklines detonate on a dry dusty surface.

Given that blast-generated noise is impulsive and may startle people if unexpected, NMPL would employ the following blast notification procedures.

- The proposed blasting schedule would be provided to all occupiers of residences identified on **Figure 4A.5**. The notification procedures, which would include advance notice of the intended date and time of each proposed blast and a verbal confirmation on the day of the blast, would be continued throughout the life of the Project with agreement from the relevant occupier(s). Documentary evidence of the notification, together with the results of the blast monitoring, would be retained at the mine office.
- NMPL would erect a blast notice board near the mine entrance on Coocooboonah Lane notifying passing motorists when the next blast is programmed, and at what time.

4B.2.7 Predicted Impacts

This section of the *Environmental Assessment* presents predicted noise and vibration levels and provides mitigation recommendations where criterion exceedances are predicted. Representative noise contours for various operational scenarios are drawn from Spectrum (2008).

4B.2.7.1 Construction Noise

Predicted noise levels for earthworks during the initial construction period are shown in **Tables 4B.16** to **4B.18** .

Noise from off-site road construction and site construction works is assessed against a construction noise criterion of 40dB(A),$L_{10(15min)}$ and site noise is assessed against the operational noise criterion of 35dB(A),$L_{eq(15min)}$. All criterion exceedances are highlighted in bold type. Exceedances of 5dB or more are shaded grey.

Table 4B.16 shows levels from construction of the southern section of Coocooboonah Lane, **Table 4B.17** summarises results for construction of the northern section and Table **4B.19** summarises noise emissions during construction of site facilities, pit access ramp and amenity bunds. All criterion exceedances are highlighted in bold type.

Table 4B.16
Predicted Construction Noise Levels – Southern Section of Coocooboonah Lane ((dB(A)$L_{eq(15min)}$)

Location*	Meteorological Condition				Criterion
	Calm	ENE wind	SSW wind	Inversion	
R1 "Flodden"	<20	24	<20	25	40
R2 "Ivanhoe"	<20	20	<20	23	40
R4 "Illili"	<20	<20	<20	<20	40
R5 "Ferndale"	<20	<20	<20	<20	40
R6 "Plain View"*	32	28	35	35	N/A
R7 "Woodlawn"	28	25	30	32	40
R8 "Sugarloaf"	21	20	21	26	40
R9 "Lilydale"	**44**	**46**	**41**	**45**	40
R10 "Mulwalla" (1)	<20	21	<20	23	40
R11 "Mulwalla" (2)	<20	<20	<20	<20	40
R12 "Lyndon Park"	<20	<20	<20	<20	40
R13 "Merralong"	<20	<20	<20	<20	40
R14 "Skipton"	<20	<20	<20	<20	40
R15 "Glendower"	<20	<20	<20	<20	40
R16 "Carramar"	<20	<20	21	24	40
R17 "Crendon"	<20	<20	20	23	40
R18 "Glenfenzie"	<20	<20	21	24	40
* This location is subject to an agreement with NMPL concerning the re-alignment of Coocooboonah Lane on the "Plain View" property. This location is therefore project-related with respect to construction and use of this section of Coocooboonah lane by NMPL.					
Source: Spectrum Acoustics (2008) - Table 5					

Table 4B.17
Predicted Construction Noise Levels – Northern Section of Coocooboonah Lane ((dB(A)$L_{eq(15min)}$)

Location*	Meteorological Condition				Criterion
	Calm	ENE wind	SSW wind	Inversion	
R1 "Flodden"	<20	25	<20	27	40
R2 "Ivanhoe"	<20	23	<20	25	40
R4 "Illili"	<20	<20	<20	<20	40
R5 "Ferndale"	<20	<20	<20	<20	40
R6 "PlainView"*	28	25	30	31	N/A
R7 "Woodlawn"	<20	<20	<20	20	40
R8 "Sugarloaf"	<20	<20	<20	<20	40
R9 "Lilydale"	27	28	24	30	40
R10 "Mulwalla" (1)	<20	21	<20	24	40
R11 "Mulwalla" (2)	<20	21	<20	24	40
R12 "Lyndon Park"	<20	<20	<20	20	40
R13 "Merralong"	<20	<20	<20	<20	40
R14 "Skipton"	<20	<20	<20	<20	40
R15 "Glendower"	<20	<20	<20	<20	40
R16 "Carramar"	<20	<20	20	22	40
R17 "Crendon"	<20	<20	<20	22	40
R18 "Glenfenzie"	<20	<20	20	23	40
Source: Spectrum Acoustics (2008) - Table 6					

Table 4B.18
Predicted Construction Noise Levels – Site Facilities, Pit Access Ramp, Bunds* ((dB(A)$L_{eq(15min)}$)

Location*	Meteorological Condition				Criterion
	Calm	ENE wind	SSW wind	Inversion	
R1 "Flodden"	<20	31	<20	33	40
R2 "Ivanhoe"	<20	36	<20	35	40
R4 "Illili"	<20	24	35	37	40
R5 "Ferndale"	21	26	37	38	40
R6 "Plain View"*	22	24	33	37	N/A
R7 "Woodlawn"	<20	<20	26	34	40
R8 "Sugarloaf"	<20	<20	20	32	40
R9 "Lilydale"	22	26	27	36	40
R10 "Mulwalla" (1)	<20	32	<20	34	40
R11 "Mulwalla" (2)	<20	30	<20	31	40
R12 "Lyndon Park"	<20	<20	<20	25	40
R13 "Merralong"	<20	<20	<20	24	40
R14 "Skipton"	<20	<20	23	28	40
R15 "Glendower"	<20	22	32	35	40
R16 "Carramar"	<20	<20	29	32	40
R17 "Crendon"	<20	<20	24	27	40
R18 "Glenfenzie"	<20	<20	28	31	40
* Bunds assessed included the 15m amenity bund and eastern face of the out-of-pit emplacement with equipment operating at an elevation of 10m above natural ground level on both bunds.					
Source: Spectrum Acoustics (2008) Table 7					

Location R9 ("Lilydale") may receive noise levels up to 6dB(A) above the criterion when the southern end of the Coocooboonah Lane re-alignment is being constructed. The maximum noise criterion exceedances at R9 would only be short-term (two weeks or less) when the Coocooboonah Lane re-alignment is under construction at the nearest point to this receiver (approximately 200m). Road construction noise levels would be as low as 24dB(A) when activities are at the northern end of the road realignment, which is well below the construction noise criteria. A Construction Noise Management Plan (CNMP) would be implemented to reduce the short-term construction noise impacts at this receiver. This may include measures such as turning engines off when plant is not in use, use of residential grade mufflers, communication with the affected receiver(s) to establish critical times for noise nuisance and other appropriate actions.

Spectrum Acoustics calculated that the occupants of "Lilydale" may experience noise levels of up to 43dB(A) for between one to two days under the assessed meteorological conditions for construction noise when soil stripping occurs in at the southeastern extremity of the Project Site.

4B.2.7.2 Operational (Mine) Noise

Predicted Year 0 Noise Levels

Predicted noise levels for the Year 0 operational scenario are shown in **Table 4B.19**. Criterion exceedances are highlighted in bold type.

Table 4B.19
Predicted Year 0 (out-of-pit emplacement) Noise Levels ((dB(A)$L_{eq(15min)}$)

Location	Meteorological Condition				Criterion dB(A)
	Calm	ENE wind	SSW wind	Inversion	
R1 "Flodden"	19	34	17	**36**	35
R2 "Ivanhoe"	20	**38**	20	**40**	35
R4 "Illili"	32	32	**39**	**37**	35
R5 "Ferndale"	33	32	**39**	**37**	35
R6 "Plain View"*	30	28	32	**36**	35
R7 "Woodlawn"	26	22	28	31	35
R8 "Sugarloaf"	23	21	25	29	35
R9 "Lilydale"	27	26	25	31	35
R10 "Mulwalla" (1)	17	34	15	32	35
R11 "Mulwalla" (2)	16	33	14	30	35
R12 "Lyndon Park"	13	24	15	27	35
R13 "Merralong"	13	21	19	25	35
R14 "Skipton"	22	25	28	28	35
R15 "Glendower"	30	30	**36**	33	35
R16 "Carramar"	20	19	34	32	35
R17 "Crendon"	18	16	30	31	35
R18 "Glenfenzie"	18	16	32	31	35

* This location is subject to an agreement with NMPL concerning the re-alignment of Coocooboonah Lane on the "Plain View" property. This location is therefore project-related with respect to construction and use of this section of Coocooboonah lane by NMPL.

Source: Spectrum Acoustics (2008) - Table 8

Predicted noise levels under all modelled adverse conditions that may occur day or evening. After completion of the pit access ramp, amenity bunds, surface facility and road construction during the initial 6-month period, overburden would continue to be placed on the out-of-pit emplacement for approximately a further 6 months before in-pit emplacement areas would be available. Minor to moderate (1dB to 4dB) criterion exceedances are predicted at R1, R3, R4, R5, R6 and R15 from activities at the out-of-pit emplacement. These locations are generally north and west of the Project Site (they do not receive shielding from the 15m amenity bund along the eastern edge of the emplacement) and experience worst case noise levels under inversions and prevailing wind conditions. A major (5dB) exceedance is predicted at R2 under inversion conditions.

Noise emissions from the out-of-pit area would be difficult to reduce, from the point of view of these receivers to the north and west, due to the slope of the Project Site and the placement of amenity bunds. The out-of-pit emplacement area is at a lower elevation than the extraction area and the emplacement would not be sufficiently high to provide acoustic shielding for haul tracks travelling between the two areas (the 15m eastern amenity bund would provide attenuation for receivers to the east). The bulldozer working on the out-of-pit emplacement

would also generally be visible at these residences. The main noise issue associated with tracked dozers is track-slap while vehicles are travelling in reverse. Spectrum measured track-slap noise from a D9R dozer at the Whitehaven CHPP during December 2007 and determined that it was 7 to 8dB less when travelling in first gear than when travelling in second gear. The Noise Management Plan would include a requirement that only first gear would be used by a dozer travelling in reverse gear on the upper surface out-of-pit emplacement during adverse conditions.

Reducing haul truck noise emissions to below criterion by applying noise attenuation packages would be prohibitively costly and would not be economically feasible given the comparatively small scale of the operation. Activities on the out-of-pit emplacement would not occur during inversion conditions which may result in delaying the commencement of the day shift starting time on clear calm mornings during winter.

Spectrum (2008) recommend that predicted levels in **Table 4B.19** that are less than 5dB in excess of the assessment criteria be set as criteria for the maximum six-month period (ie. after completion of construction activities) required to complete the out-of-pit emplacement.

Predicted Year 1 Noise Levels

Predicted noise levels for the Year 1 operational scenario are shown in **Table 4B.20** where it is assumed that a pair of scrapers is operating at natural ground level ahead of (ie. to the east of) the mining operation. Criterion exceedances are highlighted in bold type. **Table 4B.21** shows predicted noise levels without the scrapers operating.

Table 4B.20
Predicted Year 1 Noise Levels (With tandem scrapers) ((dB(A)$L_{eq(15min)}$)

Location	Meteorological Condition				Criterion dB(A)
	Calm	ENE wind	SSW wind	Inversion	
R1 “Flodden”	<20	32	<20	31	35
R2 “Ivanhoe”	<20	32	<20	30	35
R4 “Illili”	24	23	**37**	**36**	35
R5 “Ferndale”	23	20	**36**	35	35
R6 “Plainview”	26	25	30	33	35
R7 “Woodlawn”	20	<20	26	29	35
R8 “Sugarloaf”	<20	<20	<20	23	35
R9 “Lilydale”	26	25	27	34	35
R10 “Mulwalla” (1)	<20	30	<20	30	35
R11 “Mulwalla” (2)	<20	28	<20	29	35
R12 “Lyndon Park”	<20	22	20	25	35
R13 “Merralong”	<20	20	<20	23	35
R14 “Skipton”	<20	<20	26	27	35
R15 “Glendower”	22	22	**36**	35	35
R16 “Carramar”	<20	<20	24	24	35
R17 “Crendon”	<20	<20	21	20	35
R18 “Glenfenzie”	<20	<20	23	21	35
Source: Spectrum Acoustics (2008) - Table 9					

Table 4B.21
Predicted Year 1 Noise Levels (No scrapers) ((dB(A)$L_{eq(15min)}$)

Location	Meteorological Condition				Criterion dB(A)
	Calm	ENE wind	SSW wind	Inversion	
R1 "Flodden"	<20	32	<20	31	35
R2 "Ivanhoe"	<20	32	<20	30	35
R4 "Illili"	22	22	35	34	35
R5 "Ferndale"	21	20	35	33	35
R6 "Plainview"	24	21	28	30	35
R7 "Woodlawn"	21	<20	24	26	35
R8 "Sugarloaf"	<20	<20	<20	22	35
R9 "Lilydale"	26	24	24	31	35
R10 "Mulwalla" (1)	<20	30	<20	30	35
R11 "Mulwalla" (2)	<20	27	<20	29	35
R12 "Lyndon Park"	<20	<20	<20	22	35
R13 "Merralong"	<20	<20	<20	21	35
R14 "Skipton"	<20	<20	26	26	35
R15 "Glendower"	<20	<20	34	33	35
R16 "Carramar"	<20	<20	23	23	35
R17 "Crendon"	<20	<20	20	<20	35
R18 "Glenfenzie"	<20	<20	22	20	35
Source: Spectrum Acoustics (2008) - Table 10					

Table 4B.20 shows that with the scrapers operating, the total mining noise results in minor (1dB to 2dB) criterion exceedances at R4, R5 and R15 under south-southwest winds and temperature inversion conditions. **Table 4B.21** shows no criterion exceedances under the same mining scenario without the scrapers. The scrapers would be subcontracted for short campaigns of less than two weeks to clear ground for several months of upcoming mining. Should these periods coincide with winter months, their use would be delayed to commence at some time after 7:00am when inversions (if present) have lifted. Under adverse wind conditions, the number of scrapers in use would be reduced from two to one, if noise is identified as an issue through monitoring or complaints. This would generally reduce noise levels in **Table 4B.20** by 1dB and reduce the exceedances to a 1dB exceedances at R4.

Since the predicted exceedances are minor, the machinery is owned by subcontractors and would only be used occasionally, it is not considered feasible to apply noise control, beyond reducing the number of scrapers from two to one under adverse conditions. Any scrapers to be used on site would, however, be limited to daytime (7:00am-6:00pm) use only.

Predicted Year 2 Noise Levels

Predicted noise levels for the Year 2 operational scenario are shown in **Tables 4B.22** and **4B.23**, with and without scrapers operating, respectively. Criterion exceedances are highlighted in bold type. Results for low-level (Low) and high-level (High) in-pit overburden emplacement are shown for the adverse meteorological conditions.

Table 4B.22
Predicted Year 2 Noise Levels (With tandem scrapers) ((dB(A)$L_{eq(15min)}$)

Location	Meteorological Condition							Criterion dB(A)
	Calm	ENE wind		SSW wind		Inversion		
		Low*	High*	Low	High	Low	High	
R1 "Flodden"	<20	30	30	<20	<20	30	30	35
R2 "Ivanhoe"	23	31	31	<20	20	30	30	35
R4 "Illili"	24	23	24	35	**38**	34	**37**	35
R5 "Ferndale"	25	23	24	35	**38**	34	**36**	35
R6 "Plainview"	29	25	27	32	**36**	32	**37**	35
R7 "Woodlawn"	24	20	22	25	29	28	32	35
R8 "Sugarloaf"	21	<20	<20	21	23	27	30	35
R9 "Lilydale"	31	30	31	32	33	35	**39**	35
R10 "Mulwalla" (1)	<20	27	28	<20	<20	28	28	35
R11 "Mulwalla" (2)	<20	26	26	<20	<20	27	27	35
R12 "Lyndon Park"	<20	22	24	20	22	25	27	35
R13 "Merralong"	<20	21	22	<20	<20	22	25	35
R14 "Skipton"	<20	<20	20	29	30	29	30	35
R15 "Glendower"	24	22	24	34	**36**	33	35	35
R16 "Carramar"	<20	<20	<20	27	28	25	25	35
R17 "Crendon"	<20	<20	<20	22	24	22	23	35
R18 "Glenfenzie"	<20	<20	<20	24	25	22	24	35
* Low-level and high-level in-pit overburden emplacement as shown in Figure B2, Appendix B.								
Source: Spectrum Acoustics (2008) - Table 11								

Table 4B.23
Predicted Year 2 Noise Levels (No scrapers) ((dB(A)$L_{eq(15min)}$)

Location	Meteorological Condition							Criterion dB(A)
	Calm	ENE wind		SSW wind		Inversion		
		Low	High	Low	High	Low	High	
R1 "Flodden"	<20	30	30	<20	<20	29	30	35
R2 "Ivanhoe"	<20	31	31	<20	<20	28	29	35
R4 "Illili"	23	22	24	35	**38**	33	**36**	35
R5 "Ferndale"	25	23	24	34	**38**	34	35	35
R6 "Plainview"	29	25	26	32	35	31	**36**	35
R7 "Woodlawn"	23	20	22	25	28	28	32	35
R8 "Sugarloaf"	21	<20	<20	21	21	27	29	35
R9 "Lilydale"	30	28	30	30	32	34	**37**	35
R10 "Mulwalla" (1)	<20	27	27	<20	<20	27	28	35
R11 "Mulwalla" (2)	<20	25	24	<20	<20	26	27	35
R12 "Lyndon Park"	<20	<20	<20	<20	<20	24	25	35
R13 "Merralong"	<20	<20	20	<20	<20	22	23	35
R14 "Skipton"	<20	<20	<20	29	29	28	28	35
R15 "Glendower"	22	21	23	33	35	32	34	35
R16 "Carramar"	<20	<20	<20	26	27	23	24	35
R17 "Crendon"	<20	<20	<20	22	23	22	22	35
R18 "Glenfenzie"	<20	<20	<20	24	25	22	23	35
Source: Spectrum Acoustics (2008) - Table 12								

Tables 4B.22 and **4B.23** generally show only a 0dB to 2dB difference in noise level due to the presence or absence of the scrapers. Both tables show minor to moderate (1dB to 4dB) criterion exceedances at R4, R5, R6, R9 and R15 when a high-level emplacement location is used. These exceedances can be mitigated under all atmospheric conditions by utilising a low-level in-pit overburden emplacement area. This mitigation measure would be reasonably

simple to implement and would be clearly detailed in a Noise Management Plan (NMP). Noise level exceedances at R9 with the scrapers in operation become marginal under inversion conditions and it may be necessary, depending on noise monitoring results, to avoid the use of more than one scraper at locations directly exposed to R9 early on calm winter mornings.

Predicted Year 5 Noise Levels

Predicted noise levels for the Year 5 operational scenario are shown in **Tables 4B.24** and **4B.25**, with and without scrapers operating, respectively. Criterion exceedances are highlighted in bold type. Results for low-level (Low) and high-level (High) in-pit overburden emplacement are shown for the adverse meteorological conditions.

Tables 4B.24 and **4B.25** show a similar pattern of minor to moderate noise criterion exceedances to **Tables 4B.22** and **4B.23** under all conditions except inversions. Due to the easterly location of the scrapers, however, major exceedances (5dB or greater) are predicted at R6 and R9 under inversion conditions if a high-level emplacement location is used. The use of a high level emplacement area would be avoided during inversions and SSW winds. Reducing the number of scrapers at ground level from two to one under SSW wind conditions would reduce the exceedances at R5 from 2dB to 1dB.

Table 4B.24
Predicted Year 5 Noise Levels (With tandem scrapers) ((dB(A)$L_{eq(15min)}$)

Location	Meteorological Condition							Criterion dB(A)
	Calm	ENE wind		SSW wind		Inversion		
		Low*	High*	Low	High	Low	High	
R1 “Flodden”	<20	33	33	<20	<20	25	32	35
R2 “Ivanhoe”	<20	29	34	<20	<20	25	30	35
R4 “Illili”	21	22	24	34	35	34	**37**	35
R5 “Ferndale”	23	21	23	**37**	**39**	35	**39**	35
R6 “Plainview”	34	26	28	34	**39**	**36**	**40**	35
R7 “Woodlawn”	25	20	24	26	29	30	**36**	35
R8 “Sugarloaf”	23	<20	22	24	26	29	35	35
R9 “Lilydale”	34	27	31	30	**37**	**36**	**44**	35
R10 “Mulwalla” (1)	<20	29	30	<20	<20	27	31	35
R11 “Mulwalla” (2)	<20	28	28	<20	<20	26	30	35
R12 “Lyndon Park”	<20	20	24	20	21	25	29	35
R13 “Merralong”	<20	20	21	<20	<20	21	27	35
R14 “Skipton”	<20	<20	20	25	28	25	31	35
R15 “Glendower”	23	20	22	33	**36**	31	35	35
R16 “Carramar”	20	<20	<20	29	30	27	33	35
R17 “Crendon”	<20	<20	<20	24	26	25	30	35
R18 “Glenfenzie”	<20	<20	<20	25	28	25	31	35
Source: Spectrum Acoustics (2008) - Table 13								

Table 4B.25
Predicted Year 5 Noise Levels (No scrapers) ((dB(A)$L_{eq(15min)}$)

Location	Meteorological Condition							Criterion dB(A)
	Calm	ENE wind		SSW wind		Inversion		
		Low	High	Low	High	Low	High	
R1 "Flodden"	<20	32	32	<20	<20	24	30	35
R2 "Ivanhoe"	<20	27	33	<20	<20	25	29	35
R4 "Illili"	21	21	23	32	35	33	**36**	35
R5 "Ferndale"	21	<20	21	35	**38**	33	**37**	35
R6 "Plainview"	32	<20	28	27	**37**	35	**38**	35
R7 "Woodlawn"	21	<20	23	<20	<20	30	35	35
R8 "Sugarloaf"	<20	<20	22	24	31	27	29	35
R9 "Lilydale"	25	24	30	26	35	35	**42**	35
R10 "Mulwalla" (1)	<20	29	29	<20	<20	25	30	35
R11 "Mulwalla" (2)	<20	28	27	<20	<20	26	30	35
R12 "Lyndon Park"	<20	<20	<20	<20	<20	24	27	35
R13 "Merralong"	<20	<20	<20	<20	<20	20	25	35
R14 "Skipton"	<20	<20	<20	24	27	24	29	35
R15 "Glendower"	21	<20	21	33	35	30	33	35
R16 "Carramar"	<20	<20	<20	25	27	25	31	35
R17 "Crendon"	<20	<20	<20	23	26	24	28	35
R18 "Glenfenzie"	<20	<20	<20	25	27	24	29	35

Source: Spectrum Acoustics (2008) - Table 14

Since Year 5 is the final proposed year of mining, the proposed noise mitigation measure of making a low in-pit overburden emplacement area available for use during adverse wind conditions from the start of Year 2 would result in noise compliance at all assessed receivers for the life of the mine, except for a minor (2dB) exceedance at R5 when scrapers are operating at an exposed location. Marginal compliance is predicted at R5 and R9 under worst case conditions and these locations would be established as noise monitoring locations.

GeoSpectrum (2008) recommend that since the operational noise (except when operating on the out-of-pit emplacement) can generally be managed to achieve the noise criterion to within 1dB, that the 35dB(A) criterion be applied. Any identified noise criterion exceedances could then be mitigated or managed as required, or negotiated agreement could be reached with the affected receiver(s). The recommended achievable noise criteria for the Sunnyside Coal Project are summarised in **Table 4B.26.**

4B.2.7.3 Road Traffic Noise

Residences within 400m of the haulage route between the Project Site and Whitehaven CHPP and Rail Loading Facility are identified in **Table 4B.27**. The location of these receivers are indicated on Figure 2 of Spectrum (2008). The **Table 4B.27** shows the distance of the residence from the coal transport route, the relevant section of the route, the posted speed limit and the predicted noise level.

Table 4B.26
Recommended Achievable Noise Criteria (dB(A), $L_{eq(15min)}$

Location	Out of Pit Emplacement (up to 6 months)	After completion of Emplacement
R! "Flodden"	35	35
R2 "Ivanhoe"	38	35
R4 "Illili"	39	35
R5 "Ferndale"	39	35
R6 "Plain View"	35	35
R7 "Woodlawn"	35	35
R8 "Sugarloaf"	34	35
R9 "Lilydale"	35	35
R10 "Mulwalla " (1)	35	35
R11 "Mulwalla" (2)	35	35
R12 "Lyndon Park"	35	35
R13 "Merralong"	35	35
R14 "Skipton"	35	35
R15 "Glendower"	36	35
R16 "Carramar"	35	35
R17 "Crendon"	35	35
R18 "Glenfenzie"	35	35
Source Spectrum Acoustics (2008) - Table 15		

Table 4B.27
Representative Receivers adjacent to the Off-site Coal Transport Route and Predicted Levels

Receiver	Section of Coal Transport Route	Distance, m	Speed, km/h	Criterion dB(A),$L_{eq(1hr)}$	Predicted dB(A),$L_{eq(1hr)}$
"Lilydale"	Coocooboonah Lane	200	80	55	34*
"Woodlawn"	Oxley Highway	290	100	60	<50
"Pyramid Hill"	Oxley Highway	360	100	60	<50
"Toryburn"	Oxley Highway	100	100	60	50.5
"Rai Lee"	Oxley Highway	150	100	60	<50
"Roslyn"	Torrens Road	40	60	55	55
"The Dog House"	Quia Rd (rail underpass)	260	60	60	<50
* Worst case predicted level over all years and weather conditions.					
Source: Spectrum Acoustics (2008) - Table 15					

The results in **Table 4B.27** show that predicted truck noise levels may be equal to the criterion at the two Torrens Road residences. A specific Traffic Noise Management Plan would be prepared to address truck noise at these locations. Since the trucks are on-road vehicles, all trucks would undergo acoustic testing to ensure that they comply with the noise requirements of ADR 28/01. Any excessive noise (often due to maintenance issues or degraded muffler

performance) would be highlighted and rectified by the haulage contractor. One of the residences would be nominated as a routine noise monitoring location, with the results used to inform any future actions to be taken, if any, with regard to traffic noise levels at the two residences.

Although Coocooboonah Lane (existing sections and proposed re-alignment) is a public local road subject to a daytime traffic noise criterion of 55dB(A), **Table 4B.27** shows that the worst case predicted noise level from coal transport trucks would be no more than 1dB(A) below the more stringent site noise criterion of 35dB(A).

4B.2.7.4 Non-residential Receivers

In addition to the residential receivers considered in this report, there is a requirement to consider noise impacts on vacant land that could be developed for residential use. Such land is considered noise affected if the noise criterion is exceeded over more than 25% of that land.

The Gunnedah Local Environment Plan (LEP, 1998) shows that the Project Site and surrounding land is zoned either Rural 1(a) or 1(b). Allowable land subdivision sizes and minimum formed road frontages for these zonings are as follows.

Zoning	Description	Minimum size	Minimum road frontage
Rural 1(a)	Agricultural Protection	200ha	400m
Rural 1(b)	Rural General	40ha	400m

4B.2.7.5 Train Noise

Actual train noise measurements were used to calculate the likely impact of train noise.

This was calculated to be 42.2dB(A),$L_{eq(24\ hr)}$ which is almost 15dB below the DECC criterion of 55dB(A),$L_{eq(24\ hr)}$.

The rail line from Gunnedah to the Main Northern Line at Werris Creek currently has the approved train paths to carry up to six coal trains per day. The overall cumulative coal train noise levels are summarised in **Table 4B.28** using the worst case assumption that all six trains (ie. 12 movements) could occur in the day or the night.

Table 4B.28
Noise Impacts from Rail Line at Full Capacity

Period	L_{Aeq} (12 trains movements)	Criterion (EPL 3142)
L_{Aeq} (9 hr) night	57.2dB(A)	60dB(A)
L_{Aeq} (15 hr) day	55.0dB(A)	65dB(A)
Source: Spectrum Acoustics (2008) - Section 6.4		

Table 4B.28 shows that with the line carrying coal trains at full capacity, the resulting noise levels are below the noise goals given in ARTC's EPL 3142.

4B.2.7.6 Blasting

Ground vibration levels are predicted to be below the 5mm/s criterion at all surrounding residences. Blasting design and implementation would ensure the 115dB blast overpressure criterion is also met. Blast monitoring would be undertaken in the vicinity of all residences within 2km of the active blast site.

4B.2.7.7 Heritage Site

An Aboriginal axe-grinding groove, recorded as "Sunnyside AGG1" in the Aboriginal Heritage Assessment, is located on top of the western and of the hill defining the southern limit of mining. This axe-grinding groove is located approximately 150m from the southern side of the open cut area.

A limit of 80 mm/s vertical vibration velocity has been adopted previously and accepted by DECC to protect against damaging such structures within, or atop, sandstone outcrops. The blasting assessment has shown that in order to meet this vertical vibration velocity criteria, large blasts (MIC 1 952kg) would not occur closer than 210m to "Sunnyside" AGG1. Medium sized blasts (MIC 960kg) can be used in the zone between 150m and 210m from the axe-grinding groove.

4B.2.7.8 Impact Assessment Summary

Sections 4B2.7.1 to 4B.2.7.7 discuss the assessment of the potential noise and vibration impacts of the proposed Sunnyside Coal Mine.

The first year of activities on site would see the construction of site roads, excavation of the open cut access ramp, amenity bund formation and the out-of-pit overburden emplacement. These activities would only occur during the daytime.

Minor to moderate (1dB to 4dB) exceedances of the operational noise criterion have been predicted at some receivers during completion of the out-of-pit emplacement. Due to the daytime-only nature of the activities, their relatively short duration in the life of the Project and the difficulty and cost of effectively reducing noise emissions, NMPL seeks to have noise levels up to 4dB above the operational criterion to be set as the noise criteria for this activity. These temporary noise limits would decrease to 35dB(A) after completion of this activity.

Constructing the re-aligned section of Coocooboonah Lane is a genuine off-site construction activity and has been assessed against a construction noise criterion. Exceedances of up to 6dB have been predicted for the short period (approximately 2 weeks)) when construction activities are closest to the residence at "Lilydale" (approximately 200m). Road construction activities

on the northern half of Coocooboonah Lane would comply with the construction noise criterion at all receivers. Site establishment activities are not predicted to result in site noise criterion exceedances at this receiver, with the exception of a brief period when topsoil is being stripped in the southeast corner of the site. A Construction Noise Management Plan would be implemented to minimise the impact of construction noise levels at impacted receivers.

Minor to moderate (1dB to 3dB) exceedances of the operational noise criterion have been predicted at some receivers and a recommendation has been made to include these locations in a noise monitoring program. After the first year of mining, the in-pit area would be progressively back-filled with overburden and two emplacement areas at different elevations within the pit would be available. Utilisation of the low-level emplacement area during adverse weather conditions would result in compliance with the noise criterion at all receivers for the majority of time when there would be either no scrapers on site, or the scrapers would be working below natural ground level. This noise control measure would be formally documented in an Operational Noise Management Plan.

Blasting design and implementation would ensure compliance with the 115dB criterion for blast overpressure at the nearest receiver ("Lilydale"). A blast monitor would be installed near this residence. The accumulated data would give the mine operators a clear picture of blast levels at this residence before the mine advances closer to the residence.

No traffic noise criterion exceedance have been predicted at any receivers, with levels equal to the criterion predicted at the two residences set back from Torrens Road. Recommendations have been made to minimise noise impacts, monitor actual traffic noise levels and communicate with the residents.

No exceedances of noise and vibration criteria for road or rail transportation of coal have been predicted.

Spectrum (2008) concluded that the Project could operate without adversely impacting upon the acoustical amenity of any Non-Project-related residential receiver, after implementation of the noise control and management recommendations in their report and discussed in the above subsections.

4B.2.8 Monitoring

The following subsections describe the noise and vibration monitoring program that would be implemented sufficient to determine compliance with the relevant criteria. Specific details of measurement, analysis and reporting methods would be included in both a Construction and an Operating Noise Management Plan prepared to assist site personnel should development consent be granted.

4B.2.8.1 Noise Monitoring

Construction Noise

When the Coocooboonah Lane re-alignment is being constructed construction noise monitoring would be conducted on at least two occasions at representative locations north of the site and at "Lilydale" .

Operational Noise

Operational noise compliance monitoring would be conducted monthly for the first six months of mining operations (ie. during completion of the out-of-pit emplacement), reverting to quarterly for the remainder of the first year. Subject to noise measurements confirming predicted levels and an absence of noise complaints, the noise monitoring program would be reviewed after the initial 12 months with a view to continuing the quarterly (or less frequent) surveys.

4B.2.8.2 Blast Monitoring

Blast vibration / airblast overpressure monitors would be positioned at all residences within 2km of the active blast site.

4B.3 FAUNA

The fauna assessment was undertaken by Kevin Mills and Associates (Mills). Their assessment is presented in full as Part 3A of the Specialist Consultant Studies Compendium, with the relevant information summarised in the following subsections. As a result of the assessment, a Koala Management Plan was prepared. This Plan is included in full as Part 3B of the Specialist Consultant Studies Compendium.

4B.3.1 Introduction

Based on the environmental risk analysis undertaken for the Project (Section 3.3 and **Table 3.5),** the potential ecological impacts requiring assessment and their unmitigated risk rating are as follows.

- Disturbance to native vegetation / habitat within nominated areas (low risk).
- Disturbance to native vegetation / habitat outside nominated areas (moderate risk).
- Disturbance to threatened flora / fauna and endangered ecological communities (high risk).
- Disturbance leading to local population reduction (high risk).

- Disturbance leading to local extinction(s) (extreme risk).
- Local biodiversity (moderate risk).
- Regional biodiversity (high risk).

The Director-General's requirements issued by the Department of Planning require that the assessment of threatened species and their habitat include a field survey of the site which would be conducted and documented in accordance with the draft *Guidelines for Threatened Species Assessment* (DEC).

The following subsections describe and assess the existing threatened species and their habitat, identify the ecological management issues, proposed controls, safeguards and mitigation measures for the threatened species and their habitat.

The Fauna Assessment contains lists of the fauna recorded in the Gunnedah district, lists of the fauna observed during the current field surveys, discussion of the threatened fauna species listed in the NSW *Threatened Species Conservation Act 1995* (TSC Act) known and likely to occur in the area generally, and on the Project Site particularly. The fauna generally, and the threatened fauna in particular, associated with the woodland remnants in the area are documented. An assessment of the potential of the Sunnyside Coal Project to impact upon threatened species and their habitat is provided in the report relating to both the TSC Act and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The woodland remnants would not be removed by the Project.

4B.3.2 Fauna Habitat

Most of the fauna habitat in the Project Site is exotic grassland, with rock outcrops and small areas of woodland on the southern part of the "Sunnyside" property. There are no wetlands within the Project Site except for a few small farm dams. The main drainage that traverses the Project Site is almost always completely dry.

Four main fauna habitat types have been identified on or adjacent to the Project Site.

(i) Cleared (mainly improved pasture).

(ii) Hills Woodland.

(iii) Plains Woodland.

(iv) Rock Outcrops.

Figure 4B.4 identifies the distribution of these main fauna habitat types.

Most of the Project Site is covered by a mixture of exotic grassland and improved pasture. Native grasses and herbs dominate in some areas, but these are only those native plants hardy enough to survive intensive grazing.

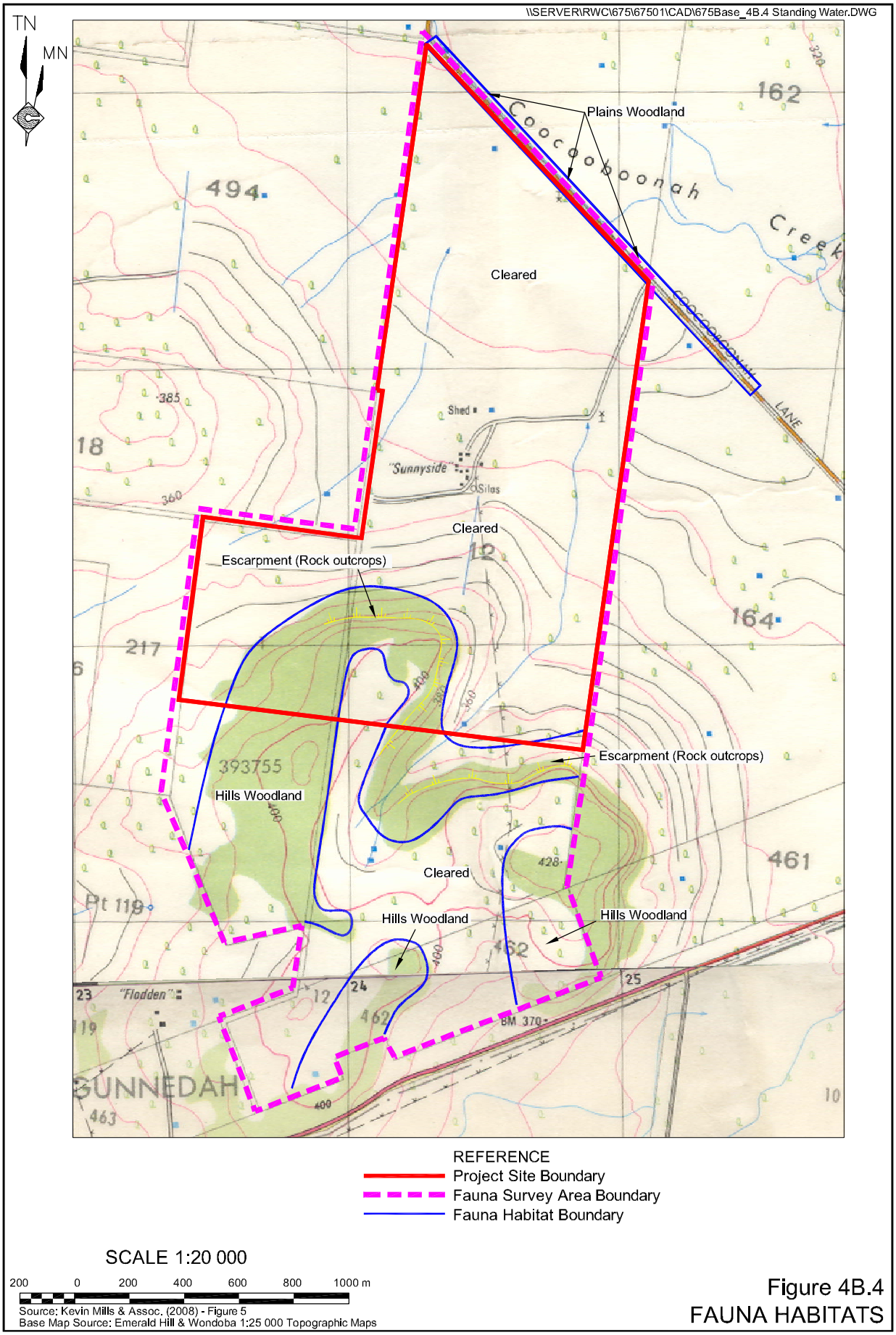

Figure 4B.4
FAUNA HABITATS

The open cut area is covered by a mosaic of improved pasture, exotic grassland, mixed native and exotic grassland, and occasional trees of Wilga and Kurrajong. The area to be mined extends just into the treed area below the rocky escarpment. Here, there are numerous small pollarded trees of Whitewood, heavily pruned during the drought to obtain stock feed. The understorey is a mixture of natives and exotics, and there are only scattered shrubs and no other trees. Around the "Sunnyside" residence, Peppercorn and White Cedar are the most common trees, along with various garden plants.

The habitat value of these cleared parts of the Project Site is low. There is little to attract native animals with the food resource being scant for most species except, perhaps, for kangaroos and other macropods, and there are few shelter sites.

The small rocky escarpment extending from east to west across the southern part of the Project Site supports Hills Woodland. This woodland is dominated by White Box, Tumble-down Red Gum, Motherumbah and White Cypress, with occasional Red Ash, Kurrajong, and Weeping Pittosporum. Various small tree species are also present, including Wilga.

Most of the trees along the escarpment are small and many are multi-stemmed, which may be indicative of past clearing. Few of the trees are large and/or old enough to have developed hollows. The shrubs present include Hop Bush, Pinkwood, Budda, Water Bush and Native Olive. The shrub layer is quite dense in some places. The ground cover is grassy, mostly rather open to sparse.

Much of the Project Site would have originally been covered by Plains Woodland, but most of it was cleared many years ago. The Plains Woodland in the Project Site is now restricted to the road reserve of Coocooboonah Lane, although there is also a narrow and discontinuous example along the lower section of the road reserve on the western boundary of the "Sunnyside" property. The main tree species in this community are White Box, Poplar Box and Yellow Box, and smaller tree species such as Wilga, Yarran, Desert Cassia, Kurrajong and Water Bush. The ground cover is grassy, containing a mix of native species and introduced herbaceous weeds. Some of the trees are large and have hollows, including a few dead trees.

The Rock Outcrops fauna habitat occurs along the escarpment and is characterised by large outcrops of sandstone and conglomerate rock, with many crevices and small overhangs. The habitat value of the rock outcrops is high for the native fauna of the local area, particularly for reptiles. Rock outcrops such as these provide ideal shelter sites for snakes, lizards and other reptiles.

Several Koalas were observed in the trees along the edge of the escarpment. The prime Koala feed tree species, White Box, is common along the escarpment, usually just above and/or just below the rocky area.

Some of the vegetation along the escarpment is quite distinctive because of the presence of plant species with rainforest affinities. These species include Red Ash, Native Olive, Whitewood, Wilga and several species of vine.

The remnant woodland in the southern part of the Project Site and further to the south on the "Sunnyside" property is a valuable area of local habitat. This is especially so if it is considered in a broader context, for much of the Gunnedah landscape has been cleared. The habitat is of particularly good quality, as suggested by the diversity of fauna species recorded during the survey, and it has attributes that attract threatened fauna.

Corridors of habitat promote the movement and interaction (physical and genetic) of fauna across the landscape. Some fauna species do not cross broad areas of cleared land. Hence, these species require continuous corridors of habitat to survive in a rural landscape, or at least strategically located "stepping stones" of habitat.

The Hills Woodland within the Project Site is located on hilly terrain between the Namoi River plains in the east and the Collygra Creek lowlands in the west, where numerous woodland remnants exist. Some of these remnants, such as Wondobah State Forest, are very large compared to the woodland in and adjacent to the Project Site. The woodland remnants are often linked by roadside remnants or scattered smaller remnants that form important "stepping stones" between the larger remnants.

4B.3.3 Fauna of Conservation Significance

Threatened species are listed on schedules under the NSW TSC Act and the Commonwealth EPBC Act. Under the TSC Act, they are classified "endangered" (Schedule 1, Part 1), "vulnerable" (Schedule 2) or "presumed extinct" (Schedule 1, Part 4). Under the EPBC Act, they are classified "extinct", "critically endangered", "endangered", "vulnerable" or "conservation dependent".

Mills (2007) records that a list of all fauna species identified by these Acts was obtained during the preparation of the fauna assessment. Those species not likely to be in the area were not considered further whereas those species that are threatened species recorded in the Project Site, expected to occur in the Project Site or considered reasonably likely to occur there were identified. A summary of their assessment is included in the following paragraphs.

Koala

The Koala is listed as Vulnerable on Schedule 2 of the TSC Act.

Prior to European settlement, Koalas were common in the eucalypt forests and woodlands extending from north Queensland, to New South Wales, Victoria and the south-eastern corner of South Australia. However, the species' distribution has contracted dramatically and abundance has declined.

Koalas inhabit eucalypt forest and woodland, preferring stands on high nutrient soils and containing their preferred food tree species. Koalas now often live in marginal habitat because so much of their prime habitat has been cleared.

The loss of treed corridors hampers the movement of Koalas from one area of habitat to another and stops recolonisation of areas devoid of Koalas.

The Koalas of the Gunnedah district were studied by the National Parks and Wildlife Service and documented in their 1992 report entitled *"Koalas and Land use in Gunnedah Shire"*. The study confirmed the presence of several healthy colonies to the south and west of Gunnedah, where the population as a whole has increased dramatically since the 1970s.

Figure 4B.5 details the locations where Koalas were observed during the field survey. Koalas were observed in the woodland vegetation above the proposed open cut area and in the remnant vegetation along Coocooboonah Lane. Koalas were observed in five tree species, namely White Box, Yellow Box, Tumbledown Gum, Wilga and Red Ash.

Speckled Warbler

This is a bird that is listed as Vulnerable on Schedule 2 of the TSC Act. Its range extends from south-east Queensland, to eastern New South Wales and Victoria. The species has declined in abundance, impacted by the degradation and clearing of woodlands on the tablelands and slopes of New South Wales. It inhabits woodland and occasionally forest, usually where there is an open shrubby understorey and a grassy ground cover.

The Speckled Warbler has been recorded in the large areas of remnant woodland to the south-west of Gunnedah. The species probably occurs in all sizable stands of woodland in this district. It was observed in the woodland in the southern part of the Project Site. At least five pairs appear to be present.

Figure 4B.5 details the locations where Speckled Warbler were observed during their field survey.

Grey-crowned Babbler

This is a bird that is listed as Vulnerable on Schedule 2 of the TSC Act. It once occurred throughout eastern Australia, but the species is now extinct in most near-coastal locations. The species has declined markedly in number across its range and has disappeared from many locations. The size of family groups has been reduced in many areas.

Babblers inhabit woodland dominated by mature eucalypts, with regenerating trees, tall shrubs, and an intact ground cover of grass and forbs.

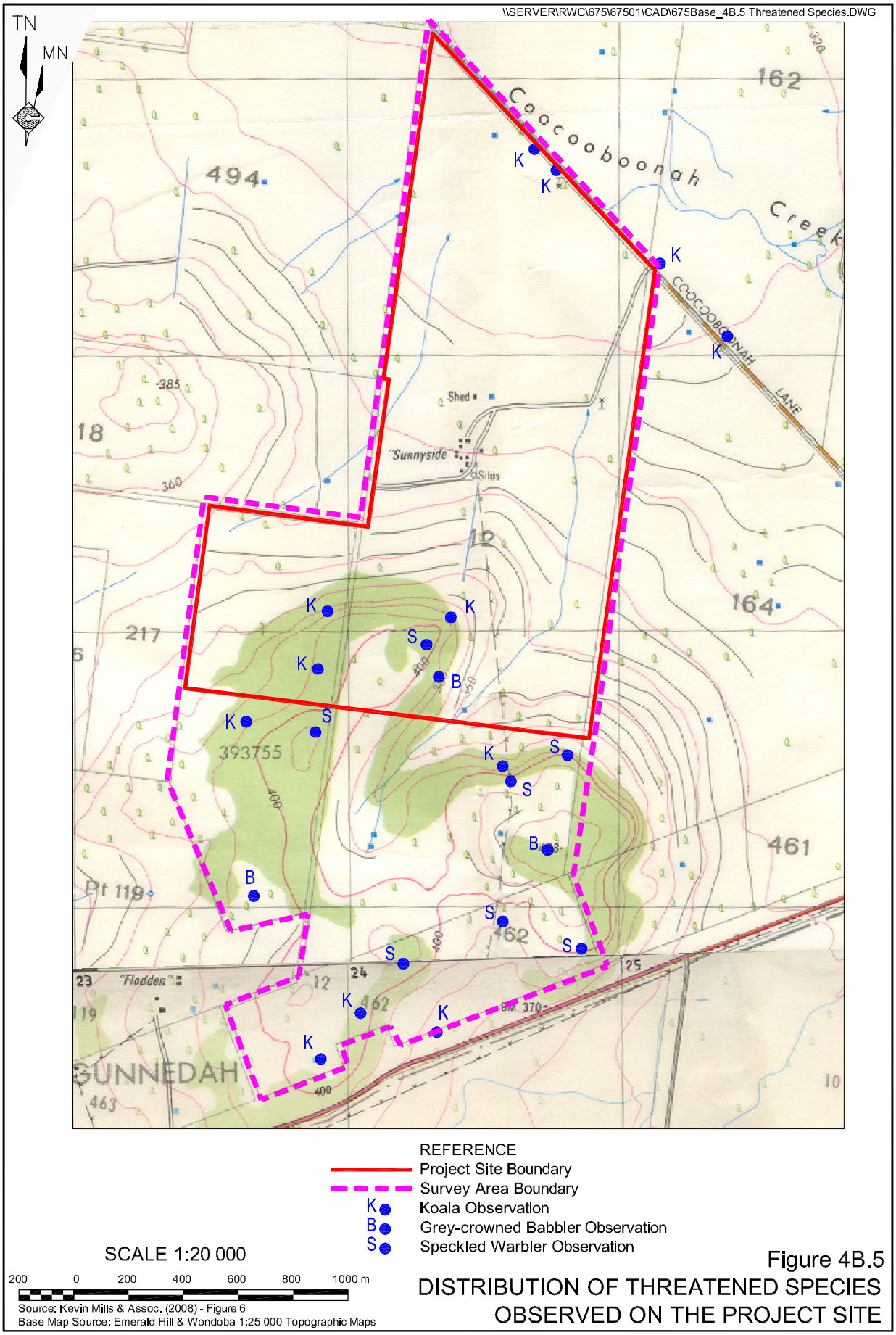

Figure 4B.5
DISTRIBUTION OF THREATENED SPECIES OBSERVED ON THE PROJECT SITE

Figure Prepared by R.W. Corkery & Co. Pty Ltd

oec

The species has been recorded to the north and south of Gunnedah, in or near large stands of woodland. Grey-crowned Babblers were observed in the woodland in the southern part of the Project Site. There appeared to be two or possibly three groups of babblers in this woodland.

Figure 4B.6 details the locations where Grey-crowned Babbler was observed during the field survey.

Brown Treecreeper, Diamond Firetail, and Hooded Robin

These three woodland bird species have declined in abundance as a result of the clearing of vast areas of woodland on the tablelands and slopes of New South Wales. They have been listed as Vulnerable on Schedule 2 of the TSC Act. Although these birds were not recorded during the survey, all three species have been recorded in the Gunnedah district and may well occur in the woodland in the Project Site.

Square-tailed Kite

The NSW Wildlife Atlas has one record of the Square-tailed Kite near Gunnedah. The bird was recorded between the Project Site and Gunnedah. The Kite may well occur in the woodlands in the Project Site, most likely in the warmer months, but this woodland would only be a small part of the species extensive foraging range.

Turquoise Parrot

Turquoise Parrots mainly inhabit the woodlands and forests to the west of the Great Dividing Range, often occurring in valleys and river flats in hilly country. The NSW Wildlife Atlas contains several records from the area to the south-west of Gunnedah, in the vicinity of Black Jack Mountain and Black Jack State Forest where there are large areas of woodland. The Turquoise Parrot may visit the woodland in the Project Site from time to time.

Pale-headed Snake

The Pale-headed Snake, which is primarily a tree-dwelling species, has a patchy distribution in north-eastern New South Wales. In inland areas, it occurs in dry eucalypt forest, eucalypt woodland and cypress woodland, preferably in riparian areas. The NSW Wildlife Atlas contains only one record from the Black Jack Mountain area to the south-west of Gunnedah. Because the species is so rare in this district and there are no riparian areas in the Project Site, the Pale-headed Snake is not expected to occur there. However, its possible presence in the woodland cannot be entirely discounted.

Border Thick-tailed Gecko

This small gecko occurs on the tablelands and slopes of northern New South Wales and southern Queensland with its southern limit in the Tamworth region. This gecko inhabits rocky hills with dry forest and woodland, particularly where there are boulders, rock surfaces and fallen timber and leaf litter. This habitat occurs in the southern part of the Project Site, where the species may well occur. There is one regional record in the NSW Wildlife Atlas for the Black Jack Mountain area to the south-west of Gunnedah. A close relative of this species, the Thick-tailed Gecko was found in rocky areas in several places in the Project Site.

Migratory Species

In addition to threatened species, the EPBC Act allows for the listing of internationally protected migratory species, i.e. species listed under the Japan - Australia Migratory Bird Agreement (JAMBA), the China - Australia Migratory Bird Agreement (CAMBA) and the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

Numerous species recorded in or adjacent to the Project Site are internationally protected migratory species listed under the EPBC Act. These include diurnal birds of prey, such as the Nankeen Kestrel and Brown Falcon, and native ducks such as the Australian Wood Duck and Pacific Black Duck. Many common and widespread Australian bird species have been listed as internationally protected migratory species under the EPBC Act, so other listed species would no doubt occur in the Project Site from time to time.

Endangered Populations

Endangered populations in New South Wales are listed under the TSC Act (Schedule 1, Part 2). There are no provisions under the EPBC Act for the listing of endangered populations. No endangered populations have been declared in or near the Project Site or in the Gunnedah area.

Fisheries Management Act 1994

The *Fisheries Management Act 1994* contains threatened species provisions that are integrated into the *Environmental Planning & Assessment Act 1979*. In a similar way to the TSC Act, the *Fisheries Management Act 1994* lists endangered species, endangered populations, endangered ecological communities and vulnerable species.

The Sunnyside Coal Project is located on land where there are no watercourses, swamps of natural water bodies of any kind. The only wetlands on the property are several small farm dams and none of the listed species, populations or communities would occur on the Project Site.

4B.3.4 Impact Assessment

4B.3.4.1 Vegetation and Habitat

The proposed Sunnyside Coal Mine would result in the complete removal of the habitats over an area of about 90ha. These habitats are almost entirely composed of treeless exotic grassland and sown grassland. There are a few scattered native trees in the area and a stand of Whitewood on the highest part of the proposed open cut area. Therefore, a small number of native trees would be removed, in addition to the exotic plantings around the farm house.

In order to construct the intersection of the mine access road and Coocooboonah Lane in accordance with RTA requirements, approximately three mature trees would need to be removed from the Remnant Plains Woodland vegetation adjacent to the lane.

4B.3.4.2 Threatened Species Populations and Communities

The NSW *Environmental Planning and Assessment Act 1979*, as amended by the TSC Act and *Threatened Species Conservation Amendment Act 2002*, requires that various factors be taken into account when deciding whether a proposed action, development or activity is likely to have a significant effect on threatened species, populations or communities, or their habitats.

Several threatened species were recorded in the vicinity of the Project Site or are expected to occur there from time to time. The factors have been addressed in the following paragraphs, to assist in determining whether the proposed coal mine is likely to have a significant effect on these species.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Koala

The area around the Project Site supports a viable population of the Koala. The woodland habitat utilised by the Koala, would be retained and new woodland areas enhancing and creating corridors would be planted. There is potential for impacting on this species through various activities associated with the proposed coal mine, particularly road killed animals. A Koala Plan of Management has been prepared by Mills (2007b) and is included as Part 3B in the Specialist Consultant Studies Compendium. The Plan addresses the management of the Koala and its habitat in the area, with particular consideration being given to local threats to the Koala population. The implementation of the measures outlined in the Plan of Management would ensure that the local population of the Koala would not be placed at risk of extinction.

Woodland Birds

Two woodland birds were observed on the Project Site and three other species may well occur there. The woodland habitat of these birds would not be impacted by the proposed open cut mine or the access road. This woodland would in fact be expanded through a revegetation program. Under these circumstances, the development proposal is not likely to place any of these woodland birds at risk of extinction.

Other Species

Several other threatened species have been described as potentially occurring in the woodland and escarpment areas of the Project Site. As these areas are being retained, the Project is not likely to place these species at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

The proposed coal mine is not likely to have an adverse effect on the life cycle of any species that constitutes an endangered population. No endangered populations have been declared on, or adjacent to, the Project Site or in the Gunnedah district.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction,*
- *(ii) is likely to substantially and adversely modify the composition of the ecological community such that its occurrence is likely to be placed at risk of extinction*

No fauna endangered ecological communities or critically endangered ecological communities occur in the Project Site or in the Gunnedah district.

(d) in relation to the habitat of a threatened species, population or ecological community:

- *(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,*
- *(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and,*
- *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long term survival of the species, population or ecological community in the locality.*

The known and potential habitat of the threatened species would be retained and indeed expanded as part of the Project. Under these circumstances, the habitat of the species would not be removed, modified or fragmented.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

Critical habitat refers only to those areas of land listed in the Registers of Critical Habitat. No critical habitat has been declared on the Project Site or in the Gunnedah district.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

Recovery Plans

A Draft Koala Recovery Plan has been compiled by the National Parks and Wildlife Service, but has not been finalised. The draft plan identifies several management issues relating to the recovery of the Koala. The proposed coal mine does not involve habitat removal, but may include other potential impacts on Koalas. All relevant issues are dealt with in the Draft Koala Management Plan prepared by Mills (2007b).

Abatement Plans

No relevant Threat Abatement Plans have been prepared.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

To date, the NSW Scientific Committee has listed 30 key threatening processes while seven such processes are listed under the *Fisheries Management Act 1994*. The only identified Key Threatening Processes that would apply with the Sunnyside Coal Project are Anthropogenic Climate Change and Clearing of native vegetation.

Virtually all human activities contribute in some way to anthropogenic climate change. Some clearing of native vegetation would occur, principally understorey species growing in the paddocks. Natural vegetation communities, e.g. woodland, would not be impacted upon.

Mills (2007a) concluded that the development of the proposed coal mine at Sunnyside is not likely to have a significant effect on any threatened fauna species, populations or communities listed under the TSC Act, or their habitats.

4B.3.4.3 Environment Protection and Biodiversity Conservation Act

Of all the threatened Fauna Species identified as occurring within a 15km radius of the Project Site, three species are listed as vulnerable under the EPBC Act. These three species are the Spotted-tail Quoll, Superb Parrot and Border Thick-tailed Gecko.

Mills (2007) concluded that the development of the proposed coal mine at Sunnyside is not likely to have a significant impact on any matter of national environmental significance listed under the EPBC Act. Referral to the Commonwealth Minister for the Environment for assessment and approval is therefore not warranted.

4B.3.4.4 SEPP No. 44 - Koala Habitat Protection

Gunnedah is one of the local government areas listed on Schedule 1 of State Environmental Planning Policy No. 44 - Koala Habitat Protection (SEPP 44). SEPP 44 encourages the conservation and management of natural vegetation that provides habitat for Koalas, to ensure a permanent free-living population over the species' present range and to reverse the current trend of Koala population decline.

Several observations of Koalas were made within the Project Site and across the "Sunnyside" property beyond the Project Site. These observations, the long history of Koalas in the Gunnedah area and the observation of past breeding nearby, lead to the conclusion that there is a resident population of Koalas in and adjacent to the Project Site and that the woodland in the area is core Koala habitat. Clause 9 of SEPP No. 44 requires that a Koala Management Plan must be prepared if development is proposed in "core Koala habitat". A Koala Management Plan is therefore required for this proposed development, a copy of which has been compiled by Mills (2007b).

4B.3.5 Impact Mitigation

4B.3.5.1 Management of Threatened Species

The Sunnyside Koala Management Plan, referred to as Mills (2007b) is included as Part 3B of the *Specialist Consultant Studies Compendium* and addresses the following key requirements for managing the interaction between the Sunnyside Coal Project and the local Koala population.

- Maintaining Koala feed trees on and adjacent to the Project Site.
- Improving the habitat for Koala on the Project Site, particularly habitat corridors.
- Addressing the potential for Koala roadkills.

The Koala Management Plan is a draft document that has been submitted to the Director-General of the Department of Environment and Climate Change (DECC) for their consideration.

The threatened woodland birds present and likely to be present on the "Sunnyside" property would be protected and their habitat enhanced by the measures outlined in the Koala Management Plan. That Plan promotes the protection of all stands of woodland, and planting proposals to link these stands.

4B.3.5.2 Habitat Protection

The following management activities would be undertaken to avoid, minimise and compensate for the impact of the Project on native fauna and fauna habitat. **Figure 2.18** identifies the areas to be managed for Koala habitat and areas where new and enhanced tree plantings would occur.

- The major areas of woodland in the south of the Project Site and beyond would be completely protected. These areas would be delineated and their protection measures discussed in the Vegetation Management Plan and Koala Management Plan.
- The remnant woodland along Coocooboonah Lane is of importance as habitat for the Koala and as an important local movement corridor for this species and other native animals. Clearing of this vegetation should be avoided; this includes trees (alive or dead), understorey plants and timber debris on the ground. The RTA has requested a modified intersection where the mine access road joins Coocooboonah Lane to enable the mine vehicles to give way to local traffic on Coocooboonah Lane. This would require the removal of approximately three trees within the Coocooboonah Lane Reserve at the intersection.
- Immediately prior to their removal, the three trees within the Coocooboonah Lane Reserve would be inspected by a qualified fauna expert. The expert would ensure any Koala has moved out of the tree before trees are removed.
- The removed vegetation would be cut into sections and relocated within the remaining vegetation along Coocooboonah Lane. This treatment would provide shelter habitat for ground animals. As part of their inspection, the fauna expert would recommend methods to relocate suitable tree hollows, should they be present, to nearby retained trees.
- The three mature trees would be removed from the edge of an existing break in the remnant vegetation and their removal is not likely to seriously interrupt the use of the corridor by Koalas or other fauna. The proposal to establish 9.0ha of new Koala habitat, 9.8ha of enriched Koala habitat and the management of 112.0ha of existing native vegetation as Koala habitat (Refer Section 4B.8.9.3 and **Figure 2.17**) would more than offset the removal of three mature trees and improve biodiversity outcomes following completion of the Project.
- The treed corridor along the inside of the western boundary of the Project Site forms another important, albeit interrupted, habitat corridor. There would be no clearing of this corridor.

- Regeneration of treed habitat in the above two areas would improve habitat corridor function. Plantings of local tree species in gaps in the existing trees would progressively strengthen these corridors and act as screening for the proposed coal mine. New plantings within an area near the western edge of the proposed open cut would provide a corridor southwards to provide a link to the existing woodland.
- Planting a new tree corridor along the eastern boundary of the "Sunnyside" property would provide an additional connection between the existing Koala habitat along Coocooboonah Lane and the woodlands on the southern sector of the "Sunnyside" property. This would facilitate Koala movement between the various existing habitats on and adjacent to the "Sunnyside" property.
- The Koala Management Plan would be submitted to the Department of Environment and Climate Change for their consideration.
- In conjunction with the Koala Management Plan, a Vegetation Management Plan would be prepared and consider the following matters.
  - Protecting the existing woodland.
  - Methods for a planting program, including species selection and distribution.
  - Control of noxious and invasive weeds.
  - An appropriate maintenance regime for the plantings.
  - A strategy for monitoring/reporting.

4B.3.6 Koala Management Plan

The Fauna Assessment identified the woodland within and adjacent to the Sunnyside Project Site as core Koala habitat. The presence of this habitat triggered the requirement to prepare the Koala Management Plan.

The hills and plains woodland areas are recognised as Koala habitat. All stands of woodland across the property and on the adjoining road reserves of Coocooboonah Lane and the Oxley Highway, are considered to be part of the core Koala habitat.

4B.3.6.1 Koala Management Plan Objectives and Key Issues

The objectives and subsequent management actions set out in the Koala Management Plan are guided by the two principal objectives of the National Parks and Wildlife Service's Draft Recovery Plan for the Koala. These principal objectives are to conserve Koalas in their existing habitat and to rehabilitate and restore Koala habitat and populations.

The key issues in managing the Koala and its habitat on and around the Sunnyside Project Site are as follows.

Clearing of Koala Habitat

The removal of prime Koala habitat has been the most significant cause of reduction in the population of the Koala across its range. Although clearing has largely halted, habitat is sometimes removed, often incrementally through the clearing of small areas. Many stands of habitat are not managed for conservation and their quality is being decreased by inappropriate land uses.

Roadkill

The death of Koalas by being hit by motor vehicles can be one of the most important impacts on Koala populations. Koalas regularly travel along the ground and are very susceptible to being hit by vehicles, particularly as roadsides often support the only woodland remnants in an area.

Dog Attack

Attack by domestic dogs, and probably feral animals, may represent an important impact on Koalas. Dogs readily kill Koalas, if not immediately, then through causing fatal injuries. Koalas are defenceless against these animals and are often found moving along the ground.

Shooting of Animals

The shooting of Koalas has previously been reported in the Gunnedah district.

Disease (Chlamydiosis)

The Gunnedah population of Koalas is reputed to be free of these diseases. Nothing proposed by NMPL is likely to influence disease in Koalas.

Death from Cattle

Stock have been observed killing Koalas by stomping on them. The prevalence of this is unknown, but is probably not common.

4B.3.6.2 Koala Management Actions

The three key requirements for a Koala population to survive and thrive are availability of suitable feed trees, existence of treed movement corridors and protection from key threatening processes. These key requirements have been incorporated into the Sunnyside Koala Management Plan.

In relation to habitat protection, the remnant woodland in the following areas would be totally protected from any degrading activities, such as clearing, grazing, storing and dumping materials and vehicle incursion not related to management.

- The woodland corridor along Coocooboonah Lane, which is in relatively good condition.
- The treed corridor along the inside of the western boundary of the Project Site which is not presently continuously treed.
- Major areas of woodland in the south of the Project Site and beyond within the "Sunnyside" property.

The above woodland areas would be enhanced through the planting of local tree species to improve their value as Koala habitat as well as their functioning as movement corridors for the Koala and other native fauna.

NMPL Koala Management proposals would protect 112ha of existing Koala habitat, improve corridors by enrichment planting on the western boundary of the site (9.8ha) and new plantings on the eastern boundary (9.0ha). **Figure 2.18** shows the location of these areas. In these areas the corridor would have a minimum width of 40m which is the minimum width recommended by Kevin Mills (pers.comm.).

The Koala habitat areas would be fenced to exclude livestock. This fencing would be a mix of fencing types constructed to ensure that it does not prevent dispersal and movement of Koalas nor constitute a hazard to their wellbeing. For example, barbed wire would not be included in the fence construction. It is proposed to build a Koala proof fence to isolate the mining area. This fence would be cyclone mesh with a loose overhanging top section to prevent Koala access into the mining area. All other corridor fencing would not prevent Koala migration, but would prevent livestock access.

Access to these areas would only be permitted for personnel working on the revegetation program. Gates to the mine and coal transport route would be closed when not in use by company vehicles. A sign at the mine office would explain the importance of the area for Koalas and identify the key restrictions to protect the species locally, including road speed limits and the prohibition of cutting down trees anywhere beyond the approved areas of disturbance.

The planting programs would only utilise local tree species obtained from a local seed source. The following species would be priority species and those with an asterisk (*) are Koala feed tree species.

Kurrajong	*Brachychiton populneus*
Motherumbah	*Acacia cheeli*
Poplar Box	*Eucalyptus populnea* *
Red Ash	*Alphitonia excelsa*

Tumble-down Red Gum	*Eucalyptus dealbata*
White Box	*Eucalyptus albens* *
White Cypress	*Callitris glaucophylla*
Wilga	*Geijera parviflora*.
Yellow Box	*Eucalyptus melliodora* *

These trees would be planted in a manner that results in a tree species mix consistent with SEPP 44 and Circular B35 definitions of Koala habitat. The replanting would ensure there is >15% Koala feed trees in the planting mix. The health and survival of the trees would be monitored and monitoring would also confirm retention of the Koala habitat status. Dead trees would be replaced and the replacement species mix would be compiled to ensure retention of the Koala habitat status.

In order to reduce road kill, the Koala Management Plan commits to a speed limit of 40kph on all roads in the Project Site. NMPL would establish a new and temporary alignment for Coocooboonah Lane for the duration of the Project. This new alignment would not require a 40kph speed limit as it is separate from the current alignment and its associated Koala habitat.

The proposed clean water diversion drain south of the open cut pit would be located in already cleared country and would not affect any Koala habitat trees.

Bushfire would not be used as a woodland management tool unless agreement has been obtained from the DECC. Fires that do start, would be extinguished as soon as practicable.

4B.3.6.3 Regional Biodiversity

The Namoi Catchment Management Board has established targets to be achieved within the Namoi River Catchment with reference to biodiversity (NCMB, 2003). The Project has therefore been assessed against the three following targets.

- *Target B.1 - Existing native vegetation*

  By 2010 a minimum of 15% (6 300km^2) of the catchment would be managed for conservation. The 15% is to be made up from 3 150km^2 public lands (parks, reserves) and 3 150km^2 on private land.

  NMPL's tree planting proposals would contribute 18.8ha of new and enhanced vegetation to the targeted 3 150km^2 of existing native vegetation to be managed on private land for conservation within the catchment.

- *Target B.2* - Distribution *and quality of biodiversity*

  By 2010 maintain and manage the extent of;

  a) *existing (2001) native vegetation communities within each bioregion in the Namoi Catchment by the adoption of management principles that improve condition; and*

  b) *high Conservation Value Vegetation as identified and defined by Regional Vegetation and Water Management Committees.*

  Those areas of existing and proposed native vegetation to be managed for habitat purposes are representative of the native vegetation of the bioregion as well as comprising areas of high conservation value in line with Target B.2.

- *Target B.3 - Additional native vegetation*

  By 2010 support the maintenance of, or improve biodiversity with strategic native re-vegetation of an additional 10 000ha.

  An existing 112ha of native vegetation would be managed for Koala habitat preservation with 18.8ha of disturbed land to be rehabilitated using native trees and shrub species suitable for Koala habitat. This would support Target B.3 for strategic native revegetation of an additional 10 000ha within the catchment.

4B.3.7 Impact Assessment

NMPL have made commitments to avoid and minimise the potential impacts on native fauna, particularly threatened species and their habitat. Special attention would be given to those threatened species recorded on the Project Site, namely the Koala, Speckled Warbler and Grey-crowned Babbler. Mills (2007) concludes that the proposed coal mine is not likely to have a significant effect on threatened fauna.

NMPL have made commitments to protect, manage and improve fauna habitat on the Project Site, particularly for the threatened species.

An assessment of the threatened species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was undertaken as part of the investigation. The Sunnyside Coal Project proposal is not likely to have a significant impact on any matter of national environmental significance.

On the basis of the investigations undertaken, Mills (2007) concludes that the Project is:

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

- unlikely to augment or significantly contribute to any of the Commonwealth or State listed key threatening processes in the long term;
- unlikely to significantly affect any Ramsar wetland or any CAMBA or JAMBA internationally listed species;
- unlikely to significantly affect any core or potential Koala habitat. A Koala Management Plan has been prepared; and
- consistent with ESD principles with regards to fauna and would not adversely affect the local biodiversity irreversibly.

4B.4 SURFACE WATER

The surface water assessment was undertaken by Soil Conservation Service (SCS), a division of the NSW Department of Lands. The full assessment is presented as Part 4 of the Specialist Consultant Studies Compendium, with the relevant information from the assessment summarised in the following subsections.

4B.4.1 Introduction

Based on the environmental risk analysis undertaken for the Project (see Section 3.3 and **Table 3.5**), the potential surface water impacts requiring assessment and their unmitigated risk rating are as follows.

- Erosion of natural drainage lines (moderate to high risk).
- Erosion of rehabilitated final landform (moderate risk).
- Discharge of sediment-laden or turbid water from the Project Site (high risk).
- Reduced flows to downstream agricultural land and native vegetation (low risk).
- Temporary degradation of downstream water quality through minor discharge/spill of dirty or contaminated water (moderate risk).
- Long term contamination of downstream water quality through major or repeated discharge/spill of contaminated or dirty water (high risk).
- Altered flooding patterns and indirect impacts on native vegetation communities and ecosystems (moderate risk).

In addition, the Director-General's requirements issued by the Department of Planning require that the assessment of surface water include a detailed water balance and refer to the *Guidelines for Fresh and Marine Water Quality* (ANZECC), and *Managing Urban Stormwater: Soils & Construction* (Landcom) documents.

The following subsections describe and assess the existing drainage and surface water environment, identify the surface water management issues, proposed surface water controls safeguards and mitigation measures and an assessment of the residual impacts following the implementation of these safeguards and mitigation measures.

4B.4.2 Project Site

4B.4.2.1 Site Description

The "Sunnyside" property is located within a distinct catchment area of approximately 376ha about 15km west of Gunnedah. The majority of the "Sunnyside" property's surface water runoff runs northwards across the Project Site. It then runs into Coocooboonah Creek which flows northwest within a constructed waterway paralleling Coocooboonah Lane. From there it flows into Rock Well Creek then into Native Cat Creek which continues to flow northwest for 6km. It then heads north within Collygra Creek where it flows across a floodplain area before flowing into the Namoi River some 25km north of the Project Site. The remainder of the property's surface water flows south into Coocooboonah Creek ultimately flowing into the Namoi River to the north.

The property can be divided into four separate sub-catchments with these described in **Table 4B.29** and presented on **Figure 4B.6**.

Table 4B.29
Catchments of the Project Site and Surrounds

Catchment No.	Approximate Area (ha)	Description of Catchment
1	170*	This western catchment generally flows northwards within the Project Site then north into Coocooboonah Creek. Includes DW1 and DW2 Catchments.
2	131	This eastern catchment generally flows northwards within the Project Site then north into Coocooboonah Creek.
3	54	This catchment flows southwards across the Oxley Highway into Coocooboonah Creek south of the Project Site.
4	21	This small catchment generally falls westwards and then south into Coocooboonah Creek south of the Project Site.
Total	**376ha**	

* Catchment 1 includes 61ha of clean water catchment and 42ha and 67ha of dirty water catchment in Areas DW1 and DW2 respectively (**Figure 4B.6**).

Source: Modified after Soil Conservation Service (2007) - Table 1

4B.4.2.2 Existing Water Storage and Harvestable Right

Four substantial farm dams occur within the Project Site with their approximate capacity listed in **Table 4B.30**.

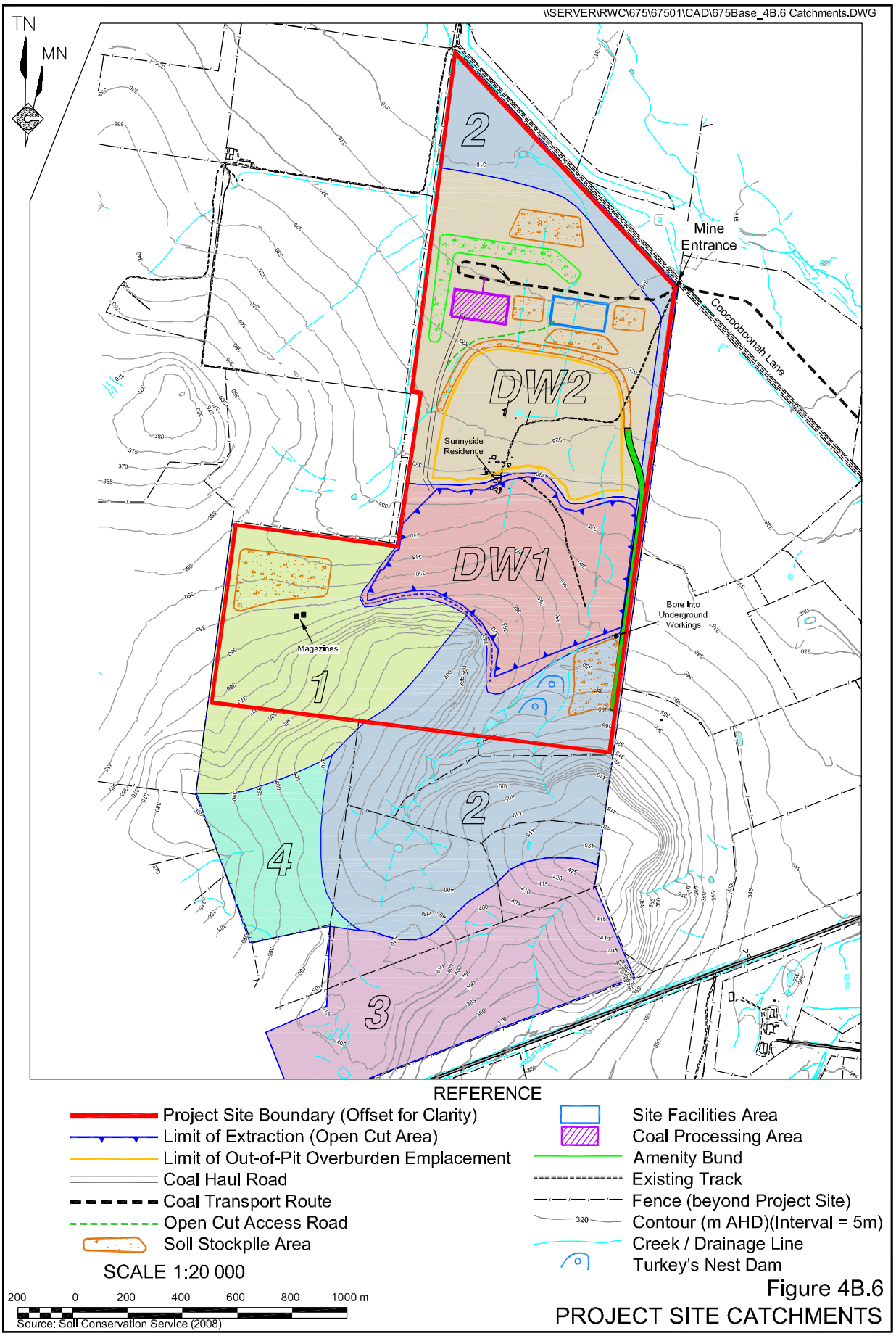

Figure 4B.6
PROJECT SITE CATCHMENTS

Figure Prepared by R.W. Corkery & Co. Pty Ltd

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Table 4B.30
Dam Capacities and Locations

Dam Number	Capacity (m^3)
1	500
2	2 000
3	2 000
4	1 000
Total	**5 500**

The capacity of existing water storages on the Project Site is approximately 5 500m^3. Throughout the life of the Project, one of these dams (2 000m^3) would be removed as it is within the overburden emplacement footprint area. There would be approximately 3 500m^3 or 3.5ML of water storage retained and available for use after both the open cut area and overburden emplacement are at their fullest extents.

The harvestable right capacity for the "Sunnyside" property is 26.32MLpa. The maximum harvestable rights dam capacity (MHRDC) was determined using the DNR publication titled *Rural Production and Water Sharing Landholders Information Package.* The MHRDC is 26.32ML, so there is potential to store, through the construction of additional dams, an additional 22.82ML on the Project Site which can be used for any purpose, ie. 26.32ML to 3.5ML.

The maximum harvestable right does not include storages that are to be used for environmental purposes. For the Sunnyside Project, environmental purposes include the capture of predominantly "dirty" or sediment-laden water. The water within those storages used for environmental purposes can be used for dust suppression and watering rehabilitated areas.

4B.4.2.3 Surface Water Quality

Table 4B.31 lists those field pH and electrical conductivity measurements recorded by GeoTerra (2008).

Table 4B.31
Field Stream Water Chemistry

Site	Date	Electrical Conductivity µS/cm	pH
Coocooboonah Creek "Plain View"	22.10.06	960	6.13
Coocooboonah Creek (after rain)	03.11.06	272	7.64
"Sunnyside" Dam 1	24.01.08	324	8.71
"Sunnyside" Dam 2	24.01.08	330	9.07
"Sunnyside" Dam 3	24.01.08	234	9.06
"Sunnyside" Dam 4	24.01.08	236	9.17
Source: GeoTerra (2008) - Table 5.			

Essentially, the surface water has low salinity levels and above neutral pH values.

4B.4.2.4 Flooding

Water that flows from southeast to northwest along Coocooboonah Creek has potential to interfere with the transportation of coal from the Project Site to the Whitehaven CHPP and Rail Loading Facility. Coocooboonah Creek is ephemeral and, based on anecdotal evidence, only runs after rainfall events and may run for approximately two days after a large rainfall event that occurs over its entire catchment.

NMPL is intending to construct the proposed coal transport route at current ground level and wherever necessary cross any gullies via concrete causeways. This type of gully crossing and road construction would not inhibit the overland flow of water and thus would not impact on localised flooding of the area.

4B.4.3 Water Management

Both quantity and quality of surface water on site can be affected by the following.

- Run-off from any area that has been denuded of vegetation.
- Run-off from stockpiles of topsoil, subsoil, overburden and raw and processed coal and rehabilitated areas.
- Discharge of mine waters.
- Runoff into mining void.
- Run-off from hardstand areas including roads, processing areas, site facilities and load-out facilities.
- Leaking or spillage of hydrocarbon products.

4B.4.3.1 Water Quantity

The Project could potentially increase the amount of runoff leaving the site due to the disturbance of vegetation and increases in hardstand areas. This increase in water quantity could increase the soil erosion of the Project Site and surrounding environment. Project activities could potentially reduce the amount of runoff leaving the site due to the capture of water within the void and other water retention structures. This water would then be unavailable to the surrounding environment and other water users down catchment.

4B.4.3.2 Water Quality

Water quality parameters that may be affected by Project activity include:

- pH;
- suspended solids;
- electrical conductivity;
- heavy metal concentrations; and
- hydrocarbon products (fuel, oil and lubricants).

The current water quality parameters that are appropriate for assessment of activities proposed within the Project Site and their current possible acceptable guidelines are presented in **Table 4B.32**.

Water that has a suspended solids concentration equal to or lower than that specified within **Table 4B.32** is classified as "clean water" and water that has a suspended solids concentration greater than those specified is classified as "dirty water". Water that displays substantial changes in pH, electrical conductivity or contains concentrations of heavy metals or hydrocarbons above nominated levels is referred to as "contaminated water".

Table 4B.32
Possible Discharge Parameter Limits

Parameter	50th Percentile Limit	70th Percentile Limit	100th Percentile Limit
pH	-	-	6.5 to 8.5
Suspended Solids (mg/L)	≤ 20	≤ 35	≤ 50
Grease and Oil (mg/L)	-	-	≤ 10
Source: Soil Conservation Service (2007) – Table 3			

4B.4.3.3 Soil Erosion

Surface water flows can cause sheet, rill and gully erosion. Wind may lead to soil erosion and transportation from its origin. Although erosion is a natural occurrence, its occurrence and severity is accelerated by changes in vegetative cover and concentration of water. Lost soil reduces the productive capacity of the land and in addition changes the environmental characteristics of receiving waters and catchments. The Sunnyside Coal Project would alter the vegetative cover and concentrated flow of water so it could potentially lead to increased erosion. The SCS addressed this issue in their assessment using a variety of mitigation management practices.

4B.4.3.4 Dryland Salinity

Dryland salinity is the accumulation of salts within the soil profile that hinder plant growth and ultimately denude areas and increase the salt concentration in surface water flows into creeks and rivers. The Namoi Catchment Management Board acknowledges dryland salinity as an issue within the Namoi Valley, however, they do not identify the area around Sunnyside as particularly subject to dryland salinity.

Vegetation would be disturbed by the Project although it is recognised that a substantially greater number of trees are to be planted on the Project Site than are to be removed. The management of vegetation would aid in reducing any potential dryland salinity issues that may develop as a result of the Project.

4B.4.4 Surface Water Impact Mitigation Measures

The key principles in managing surface waters to avoid potential impacts are to:

- divert "clean" water away from the disturbed area;
- maintain as much vegetation (particularly grass), on the Project Site as possible; and
- capture "dirty" water and treat it so that it can be discharged to meet accepted guidelines.

These principles have been incorporated into a surface water management plan based on a worst case scenario, with the proposed mine in full operation with the overburden emplacement at its fullest extent and without any vegetative cover. The design criteria, design procedures and data sources are discussed in the following subsections. The specification of dam positions and sizes provided are indicative, these specifications may vary with specific mine management requirements and a desire to capture all dirty water that is generated by the Project.

4B.4.4.1 Project Site Catchment Yields

Based on the harvestable rights for the property, NMPL could capture and use 26.32MLpa of clean surface water.

The water required by the Project is between 75 and 100MLpa depending on the seasonal conditions. The harvestable right of 26.32MLpa could provide part of the water requirement.

Table 4B.33 summarises the catchment yield calculations for the Project Site's clean water catchments. This table confirms that, the maximum harvestable right of 26.32ML/yr could be easily obtained through the construction of appropriately placed storage dams. The remaining maximum water requirement for the Project of 73.68ML (100ML - 26.32ML) could be obtained from a combination of the following three sources.

- Capture of dirty water which flows over exposed surfaces within the Project Site.
- Extraction of groundwater from one or more existing or constructed bores.
- From groundwater and surface water retained within the mine void.

None of these sources has been assessed as part of the Project Site maximum harvestable right.

Table 4B.33
Annual Catchment Yields for the Project Site's Clean Water Catchments*

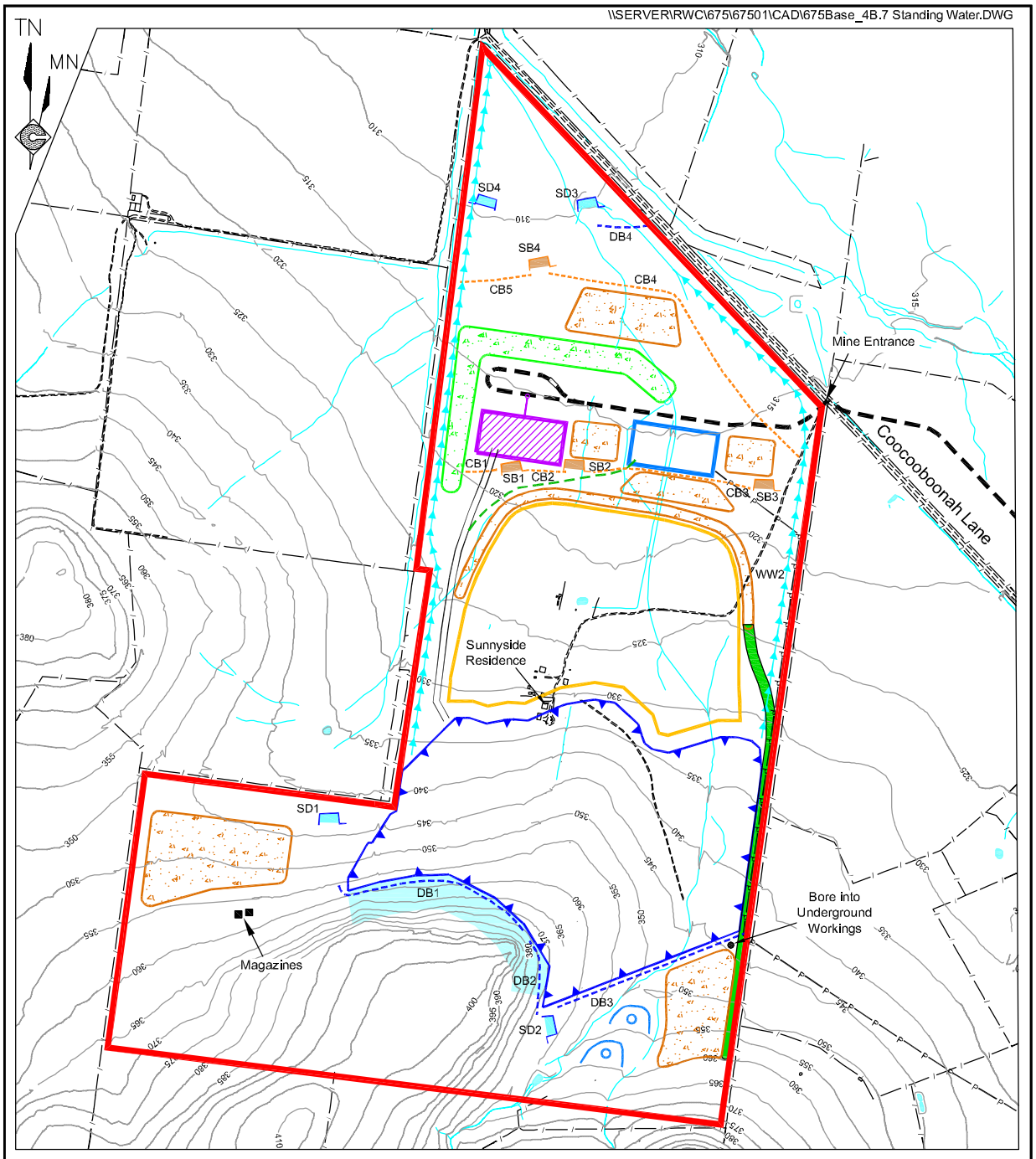
Rainfall Event (mm)	Decile 1 Rainfall (373.6mm)	Mean Rainfall (616.4mm)	Decile 9 Rainfall (843.4mm)
Catchment Area 1 Yield 61ha (ML/year)	22.8	37.6	51.5
Catchment Area 2 Yield 131ha (ML/year)	48.9	80.7	110.5
Catchment Area 3 Yield 54ha (ML/year)	20.2	33.3	45.5
Catchment Area 4 Yield 21ha (ML/year)	7.8	12.9	17.7
TOTAL ML/year	**99.8**	**164.6**	**225.2**
* Based on Gunnedah Pool rainfall figures			
Source: Soil Conservation Service (2007) - Table 4			

Water Balance

A site water balance was prepared to assess:

- whether sufficient surface water is available for capture onsite during dry years for the water requirements outlined; and
- if significant discharge would be required in wet years.

Table 4B.34 outlines the catchment yields under varying rainfall events, the type of water captured and the water storages associated with these catchments. These catchments reflect the surface water management controls proposed by NMPL and presented on **Figure 4B.7**.



REFERENCE

- Project Site Boundary (Offset for Clarity)
- Limit of Extraction (Open Cut Area)
- Limit of Out-of-Pit Overburden Emplacement
- Coal Haul Road
- Coal Transport Route
- Open Cut Access Road
- Soil Stockpile Area
- Potential Auger Mining Area
- Site Facilities Area
- Coal Processing Area
- Amenity Bund
- Existing Track
- Fence (beyond Project Site)
- 320 Contour (m AHD)(Interval = 5m)
- Creek / Drainage Line
- Grassed Waterway
- SD2 SB2 Storage Dam / Sediment Basin
- DB1 CB1 Diversion Bank / Catch Bank
- Turkey's Nest Dam

SCALE 1:15 000

250 0 250 500 750 m

Source: Soil Conservation Service (2008)

Figure 4B.7
SURFACE WATER MANAGEMENT CONTROLS

Figure Prepared by R.W. Corkery & Co. Pty Ltd

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Table 4B.34
Annual Catchment Yields (ML/yr)

Catchment with approximate area	Yield (10^{th} percentile) ML/yr	Yield (50^{th} percentile) ML/yr	Yield (90^{th} percentile) ML/yr	Associated Water Storage and volume ML
"Dirty" Water from around out-of-pit dump and ROM etc (67ha)	37.55	61.95	84.76	13ML
Open Cut Area potential (42ha)	15.69	25.89	35.42	9ML
Groundwater Inflow into Void	Yield Not Considered. Pumped underground. Approximately 374ML/year			
Total Dirty Water	**53.24**	**87.84**	**120.18**	
"Clean" from western and northern fall (192ha)	71.73	118.35	161.93	26.32ML/yr
"Clean" from around the western and southern fall (75ha)	28.02	46.23	63.26	
Total Clean Water	**99.75**	**164.58**	**225.19**	
Totals (Dirty and Clean Water)	**152.99**	**252.42**	**345.37**	**48.32**
Mine Water Requirements	**100**	**88**	**75**	
TOTAL BALANCE	**52.99**	**152.42**	**245.37**	
Source: Soil Conservation Service (2007) - Table 5				

During dry years (10th percentile rainfall), the water available from a combination of dirty water (including the open cut area) void groundwater inflow, and clean water sources would be sufficient to meet operational water requirements. Given the catchment yields also exceed water storage volumes in the median years (50th percentile) and wet years (90th percentile), it is expected that a discharge of surface water may occur.

NMPL propose to obtain the bulk of the mine water supply from pit inflows which are predicted to average 374ML/year. Should these predicted pit inflows occur, there would need to be a discharge of surface water from the Project Site under all types of rainfall years.

SCS did not consider groundwater inflows into the open cut as part of their water balance calculations. Due to the volumes involved and the area available, it would be problematic to manage this volume of water on the surface. This inflow water would be pumped into the Gunnedah Mine N^{o} 5 Entry underground workings. This matter is discussed in Section 4B.1.5.6.

4B.4.4.2 Water Quality Mitigation Measures

Diversion of Clean Water

The diversion of clean waters away from disturbed areas would reduce erosion and its potential for contamination. This would be achieved by constructing diversion banks, waterways and storage dams. The indicative positions of these structures are shown on **Figure 4B.7** and their specifications listed in **Tables 4B.35** and **4B.36**. The clean water catchment area south of the

open cut pit would be directed around the eastern edge of the pit in a purpose built waterway. This would prevent clean runoff water from entering the pit. The grade on banks may vary once final survey is undertaken and some banks may need to be split to achieve start and finish positions.

Table 4B.35
Diversion Bank Specifications

Structure ID	Catchment Area (ha)	Channel Bottom Width (m)	Channel Grade (%)	Bank Height (m)	Sill Width (m)	Slope Below Sill (%)
DB1	15	6	0.5	0.8	14	4
DB2	131	10	0.5	1	20	3
DB3/WW1	10	6	0.5	0.8	12	1
	Waterway Width (m)		**Bank Height (m)**			
WW1	20		1			
WW2	20		1			
Source: Soil Conservation Service (2007) - Table 6						

Table 4B.36
Storage Dam Specifications

Structure ID	Catchment Area (ha)	Volume (m^3)	Depth (m)	Dimensions length x width (mxm)	Outlet Width (m)	Sill Width (m)
SD1	24	1000	3	28x25	6	12
SD2	125	4000	4	37x50	10	20
SD3	150	8900	4	58x60	10	20
SD4	115	8900	4	58x60	10	20
Source: Soil Conservation Service (2007) - Table 7						

The dimensions for each diversion bank are based on the upslope catchment area and topography. Generally the following would be adopted when constructing these banks, namely:

- the channel of the bank is to be trapezoidal;
- bank batters between 1:3 to 1:6 (Vertical : Horizontal);
- channel batters are to be 1:6 (V:H);
- channel grade 1 : 400 (5cm/20m) if channel is bare;
- channel grade 1 : 200 (10cm/20m) if channel is to be kept well grassed;
- level sill outlet to each channel;
- stable grass cover to be maintained below sill outlets; and
- sill width approximately 1.5 x channel base width.

The requirements for each storage dam would consist of:

- excavation and dam bank batters to be at least 1:3 (V:H);
- crest width to be a minimum 3m wide;
- freeboard to be a minimum 1m above top water level up to a wall height of 3m, above that there would be an allowance made of 0.1m/m increase in wall height;
- inlet and outlet channel batters are to be 1:6 (V:H);
- outlet channel grade 1 : 400 (5cm/20m) if channel is bare;
- outlet channel grade 1 : 200 (10cm/20m) if channel is to be kept well grassed;
- level sill outlet to each channel;
- stable grass cover to be maintained below sill outlets; and
- sill width of approximately 1.5 x channel base width.

4B.4.4.3 Capture of Dirty Water

Dirty or sediment-laden water structures would collect water that may have suspended solids concentrations that would be outside the range of those prescribed by DECC guidelines (**Table 4B.32**).

Catch banks/drains would be constructed to divert potentially sediment-laden waters into sediment basins below sites that can potentially generate significant quantities of sediment laden water.

Sediment basins have been design for Type D soils according to the Landcom publication, "Managing Urban Stormwater: Soils and Construction 4th Edition. Accordingly, based on a potential dirty water area of 109ha, there is a requirement to be able to capture 22ML of dirty water.

This quantity of water can be captured in any number of basins of suitable dimensions that totals 22ML capacity. The indicative positions of all of these structures are shown on **Figure 4B.7** and their specifications are listed in **Tables 4B.37** and **4B.38**.

Table 4B.37
Catch Bank / Drain Specifications

Structure ID	Catchment Area (ha)	Channel Bottom Width (m)	Channel Grade (%)	Bank Height (m)	Sill Width (m)	Slope Below Sill (%)
CB1	15	6	0.5	0.7	12	1
CB2	35	6	0.5	0.7	12	1
CB3	15	6	0.5	0.7	12	1
CB4	65	8	0.5	0.7	12	1
CB5	28	6	0.5	0.7	12	1
Source: Soil Conservation Service (2007) - Table 8						

Table 4B.38
Sediment Basin Specifications

Structure ID	Catchment Area Total contributing(ha)	Volume (m^3)	Depth (m)	Dimensions length x width (mxm)	Outlet Width (m)	Sill Width (m)
SB1	20	5000	3	49x50	6	12
SB2	40	6000	3	50x57	6	12
SB3	20	5000	3	49x50	8	16
SB4	70	6000	3	50x57	6	12
Source: Soil Conservation Service (2007) - Table 9						

The dimensions for each catch bank are based on the upslope catchment area and topography. Generally the following would be followed for each bank.

- The channel of the bank is to be trapezoidal.
- Bank batters between 1:3 to 1:6 (V:H).
- Channel batters are to be 1:6 (V:H).
- Channel grade 1 : 400 (5cm/20m) if channel is bare.
- Channel grade 1 : 200 (10cm/20m) if channel is to be kept well grassed.
- Level sill outlet to each channel.
- Stable grass cover to be maintained below sill outlets.
- Sill width approximately 1.5 x channel base width.

The requirements for each sediment basin would consist of the following.

- Excavation and dam bank batters to be at least 1:3 (V:H).
- Crest width to be a minimum 3m wide.
- Freeboard to be a minimum 1m above top water level up to a wall height of 3m above that there would be an allowance made of 0.1m/m increase in wall height.
- Inlet and outlet channel batters are to be 1:6 (V:H).
- Outlet channel grade 1 : 400 (5cm/20m) if channel is bare.
- Outlet channel grade 1 : 200 (10cm/20m) if channel is to be kept well grassed.
- Level sill outlet to each channel.
- Stable grass cover to be maintained below sill outlets.
- Sill width of approximately 1.5 x channel base width.

4B.4.4.4 Mine Access Road Design

The proposed coal transport route from the Project Site to the Oxley Highway would be constructed with a crown. This road would be constructed at ground level with causeways used to cross water flow depressions along the proposed route. The mine access road into the Project Site would be constructed with an infall over its entire length so that any water that falls on the road is directed towards the mine area. This would enable this potentially dirty water to be captured by the sediment basins that capture the water that runs off the overburden emplacement. The infall would be no less then 1% or 1 in 100. In addition, the batters of this road would be topsoiled and seeded to limit erosion.

4B.4.4.5 Hydrocarbon Products

Water that discharges from areas where mine plant, equipment and vehicles may be used or serviced may potentially contain hydrocarbons. These areas on the Project Site would include:

- coal stockpiling area;
- mine facilities area;
- any fuel, oil and grease storage; and
- refuelling bays.

These areas would be managed by the following means.

- All water from these areas would be directed to oil separators and containment systems for subsequent removal.
- Storage tanks would have an impermeable surface and bunding so as to contain at least 110% of its storage capacity of the largest tank.
- All hydrocarbon products would be securely stored.
- There would be designated refuelling, oiling and greasing areas.

4B.4.4.6 Maintenance of Vegetation on the Project Site

The maintenance of vegetation would be a critical factor in the containment, and where possible improvement in water quality. Vegetation reduces soil erosion and also filters suspended solids from water. As a general rule, a ground cover would be maintained on all the land that is not being used for processing facilities, administration / maintenance facilities, roads, mining activities and the overburden emplacements. Ideally, this ground cover would be 70% or better. This value would fluctuate with seasonal conditions but 70% cover would be aimed for.

Vegetation, particularly trees, also reduces the potential for dryland salinity by reducing the depth of the water table relative to the root zone of plants. This lowering of the water table keeps salts within the soil profile further from the surface and reduces the potential for dryland salinity. Maintaining and/or enhancing as much vegetation on the Project Site as possible, particularly trees, would reduce the potential for dryland salinity.

4B.4.4.7 Sewage

Sewage effluent has the potential to contaminate surface water. As a result, a sewage management system would be installed and managed based on the requirements of the Gunnedah Shire Council and DECC.

4B.4.4.8 Contingency Plans

Contingency plans would be implemented for surface water management under the following scenarios.

- If discharges from the various sediment basins exceed the discharge parameter limits in **Table 4B.32**, one or more of the following actions would be implemented.
  - Flocculants would be added to expedite settlement of sediments.
  - Sediment basins would be enlarged or additional ones constructed.
  - Water quality upstream and downstream of the confluence of the discharged waters would be monitored.

- If a major hydrocarbon spill occurred, the following would be implemented.
  - As much hydrocarbon as possible would be recovered at the source by collecting the contaminated ground. This would be put under cover on an impermeable surface to be later remediated and/or transported to an approved waste depot.
  - One or more holes would be excavated within or around the spill site to create a hydraulic gradient so that soil water and the spilled material would congregate within the holes thus enabling pumping out.
  - Groundwater would be monitored for any continued contamination. This water would be treated or utilised on-site provided DECC requirements are met.

4B.4.4.9 Long Term Surface Water Management and Final Landform

The installation of all storage dams, diversion banks, catch banks and sediment basins would occur before any other soil disturbance works are undertaken in the respective catchments. The disturbance of vegetation associated with any works would be limited and staged so that the maximum vegetation cover is retained for as long as possible. The overburden emplacement would be rehabilitated as the mine progresses thus reducing the amount of denuded earth exposed to rainfall and potential erosion.

All water diversion and water storage structures would be in place before the mine becomes operational. These structures would be maintained for the duration of the mine and until the landform is fully revegetated. The sediment basins would be cleaned when their capacity is reduced by 20% and any erosion repaired throughout the life of the mine and subsequent maintenance period.

Water control structures on the overburden emplacement would consist of graded banks directing water to large rock flumes. The graded banks would be equally spaced down the overburden emplacements. The basic specifications for these graded banks are as follows.

- Maximum grade of 0.25% or 1 in 400.
- A channel width of not less than 3m.
- Bank height of not less than 1m.
- Channel is to be trapezoidal in shape.
- Excavation batters are to be at least 1 : 4 (V:H).

Each catchment rock flume would direct water from the top of the emplacement batter down to the original ground level. This water would then be directed into the existing sediment basin system. The flumes would be constructed to have the following minimum specifications.

- Parabolic shape with minimum 1m turn up either side.
- 80% of rock used must be >200mm in diameter.
- Minimum 10m width.

4B.4.5 Impact Assessment

4B.4.5.1 Introduction

Following the adoption of the water management controls discussed above, the impacts on surface water within and beyond the Project Site and proposed coal transport route have been assessed as follows.

4B.4.5.2 Surface Water Catchments

The Project would not result in any diversion between catchments. On completion of the final landform, water from a small catchment of 21ha, would report to the final open cut void. This would reduce the area of the Coocooboonah Catchment available to downstream water users by less than 1%, which is a very minor change to local drainage.

4B.4.5.3 Surface Water Quantity

The Project would be unlikely to significantly impact on surface water available to landholders downstream of the Project Site or environmental flows within local watercourses and the Namoi River because of the implementation of the following water management controls.

- Maximising the use of dirty water.
- Maintaining storage dams with a combined ongoing capacity sufficient only to capture the maximum harvestable right of the Project Site.
- Drawing of supplementary water from the open cut area and groundwater bore.

4B.4.5.4 Surface Water Quality

The water management controls recommended by Soil Conservation Service (2007) and identified on **Figure 4B.8** have been designed to capture all dirty water generated by project-related activities and direct it to sediment basins via catchment banks/drains. The design of the catchment banks/drains and sediment basins would ensure that sufficient time is provided for any suspended sediment to settle out prior to discharge from the Project Site. In the event water quality criteria are exceeded, the adoption of the mitigation measures would ensure any exceedance would be limited to isolated occurrences. As a result, the likely impact of the Project on surface water quality external to the Project Site would be negligible.

The Namoi Catchment Management Board has established targets to be achieved within the Namoi River Catchment with reference to river salinity (NCMB, 2003). The Project has therefore been assessed against the four following targets.

- *Target RS.1 - Water quality*

  By 2010 to have all land managers (including urban) using better management practices throughout the catchment to minimise the mobilisation of salt to rivers.

  The salinity of any water discharge from the Project Site would be comparable with existing water quality provided all potentially saline subsoils are appropriately incorporated in the overburden emplacements. The overburden itself has been characterised to have a low potential for salinity generation.

- *Target RS.2 - Gully control*

  By 2010, halt existing gully erosion and bed lowering within priority salinity sub catchments by constructing 1000 gully control and bed lowering structures to reduce the mobilisation of salt to the river.

  The comprehensive erosion and sediment controls would ensure gully erosion is minimised on the Project Site and therefore provide a positive contribution towards the achievement of this target.

- *Target RS.3 - New development*

  From 2001, new investment requiring a Development Application or requiring approval under Part 5 of EP&A Act, to result in no net increase in the salt load to the river.

  Project Site water discharge would contribute to no net increase in the salt load of the Namoi River as a result of the Project, ie. based upon the observations relating to Target RS.1 above.

- *Target RS.4 - Point sources*

  By 2010 existing point sources of river salinity to have a reduction of 10% on current (2001) salt loads.

  There are no point sources of river salinity associated with the Project.

4B.4.5.5 Erosion and Sedimentation

The construction of the water quality management controls and implementation of mitigation measures, in conjunction with the commitment of NMPL to enhance the vegetation (particularly grass) cover, would reduce the potential for erosion and sedimentation on the Project Site.

4B.4.5.6 Flooding

Flooding is not anticipated to have a major impact on the operation of the Project. Given, there would be minimal alteration to local catchments because of the Project, it is unlikely to alter local flooding patterns.

4B.4.5.7 Dryland Salinity

Native deep-rooted vegetation on the Project Site would be retained beyond the proposed areas of disturbance. This, together with the rehabilitation of part of the final landform with native woodland vegetation, would contribute to the reduction in the potential for short and long term for dryland salinity issues.

The Namoi Catchment Management Board has also established targets to be achieved within the Namoi River Catchment with reference to dryland salinity (NCMB, 2003). The Project has therefore been assessed against the three following targets.

- *Target DS.1 - Use of best management practices*

  By 2010, to have 60% of land managers and an area of 18 600km^2 across the whole of the Namoi catchment managed to minimise the mobilisation of salt to a set of agreed best management practices and in identified hazard areas to increase the adoption rate to 80%.

  Very little deep rooted vegetation would be disturbed by the Sunnyside Coal Project. In addition Koala habitat would be retained and enhanced and would result in an increase in deep-rooted vegetation on the Project Site. The Project would provide a positive impact in achieving this target.

- *Target DS.2 - Cap and pipe the bores*

  By 2010 Cap and Pipe all (25) high flow bores (>5L/s) in the Namoi portion of the Great Australian Basin.

  This target is not applicable to the Project.

- *Target DS.3 - Discharge areas*

  From 2001 retain all vegetation on saline discharging areas and establish an additional 1 000ha of ground cover to be managed at greater than 70% cover.

  Not applicable as the proposed areas of disturbance are not saline discharging areas.

4B.4.6 Monitoring

NMPL would implement a surface water monitoring program to enable appropriate auditing and management. The frequency of monitoring would reflect the parameters to be monitored, the locations to be monitored and the potential for environmental impact. **Table 4B.39** presents the monitoring schedule recommended by SCS that would be implemented.

Table 4B.39
Proposed Surface Water Monitoring

Location	Parameter	Frequency
Selected Storage Dam and Sediment Basins	EC, pH, suspended solids, hydrocarbons	Quarterly or in the event of a significant rain event
Selected Storage Dam and Sediment Basins	EC, pH, suspended solids, hydrocarbons, heavy metals, nutrients.	Annually
Void water	EC, pH, suspended solids, hydrocarbons	Quarterly
Void water	EC, pH, suspended solids, hydrocarbons, heavy metals, nutrients.	Annually
Upstream and downstream of the Projects Sites influence on Coocooboonah Creek.	EC, pH, suspended solids, hydrocarbons, heavy metals, nutrients.	Annually or in the event of a significant rain event
Source: Soil Conservation Service (2007) - Table 10		

The monitoring results would be reviewed on an annual basis and the frequency, locations and/or parameters re-assessed to ensure meaningful data is being collected. All monitoring results would be presented in the relevant AEMR.

Monitoring of soil erosion and vegetative cover would also be undertaken. In the event any soil erosion greater then 300mm deep for a maximum of 10m long is identified, this would be corrected via conservation earthworks and or re-vegetation. If rehabilitated areas with groundcover <70% are identified, these areas would be reseeded, fertilised and watered so that percentage groundcover can be maintained.

4B.5 AIR QUALITY

The air quality assessment was undertaken by Heggies Pty Ltd (Heggies). The full assessment is presented in Part 5 of the Specialist Consultant Studies Compendium, with the relevant information from the assessment summarised in the following subsections.

4B.5.1 Introduction

Based on the environmental risk analysis undertaken for the Project (Section 3.3 and **Table 3.5**), the potential air quality impacts requiring assessment and their unmitigated risk rating are as follows.

- Deposited dust levels attributable to the Project occasionally (for one or two months every year) above DECC guideline, affects only adjacent landholders (moderate risk).

- Deposited dust levels attributable to the Project regularly (>5 months per year) above approved limit, affects landholders some distance from the Project Site (high risk).
- PM_{10} levels attributable to the Project occasionally (once every 1 to 2 years) above the Project goal, affects only adjacent landholders (moderate risk).
- PM_{10} levels attributable to the Project occasionally (>5 times per year) above the Project goal affects landholders some distance from Project Site (high risk).
- Greenhouse gas emissions (high risk).

The Director-General's requirements issued by the Department of Planning require that the assessment of air quality refer to *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (DEC, 2005).

Dust generation would be one of the main air quality issues relevant to the Sunnyside Project. Depending upon the size and concentration of particles in the air and their composition, airborne dust has the potential to affect human health as well as contribute to the general degradation of the environment. The term *"particulate matter"* refers to a category of airborne particles typically less than 50µm in aerodynamic diameter and ranging down to 0.1µm in size. Particles less than 10µm and 2.5µm are referred to in this document as PM_{10} and $PM_{2.5}$ particles respectively. The human respiratory system has a built-in defensive system that prevents PM_{10} particles from reaching sensitive areas of the respiratory system. As particles larger than 10µm can also contribute to environmental degradation, the air quality assessment also considers the total mass of particles suspended in the air, ie. Total Suspended Particulate Matter (TSP). Particles that have an aerodynamic sufficiently large so as not to be suspended in air (typically >35µm) are referred to as deposited dust.

Greenhouse gases would be produced as a consequence of the Project, through:

- the use of fuel to power mobile equipment, in production of explosives for blasting operations (ANFO) and in electricity generators on the Project Site;
- road haulage trucks which transport the coal from the Project Site to the Whitehaven CHPP and Rail Loading Facility;
- fugitive emissions from open cut exposure and extraction of the ROM coal; and
- eventual combustion of the coal to generate energy.

The effects of greenhouse gas emissions on global temperatures, most notably the Greenhouse Effect, are well documented and an assessment of greenhouse gas emissions was included in the assessment of air quality impacts.

The following subsections describe and assess the existing air quality environment, identify the air quality management issues and the proposed air quality controls, safeguards and mitigation measures. Additionally, the assessment of the residual impacts upon the air quality following the implementation of these safeguards and mitigation measures is also presented.

As part of their assessment, Heggies (2007) analysed the existing air quality environment. They also used dust deposition monitoring data from the nearby Whitehaven Coal Mine to derive a dust deposition average for the region surrounding the Sunnyside Project Site.

Ambient concentrations of dust particulates (PM_{10}) were assessed using the air quality monitoring station located at Tamworth maintained by the DECC.

Given the rural setting, it was assumed that the background levels of greenhouse gases are negligible.

Local meteorological conditions were assessed using the Air Pollution Model (TAPM). This Model was used to generate a meteorological data set, using the data assimilation option to incorporate observations from the Bureau of Meteorology's Gunnedah Airport Automatic Weather Station. Weather data recorded at the nearby Whitehaven Coal Mine was also used to provide a wider view of the regional meteorology.

4B.5.2 Existing Air Quality Environment

4B.5.2.1 Introduction

Air quality guidelines and goals refer to levels of "pollutants" in air which include both operational and existing sources. In order to fully assess impacts against all the relevant air quality guidelines and goals, it is therefore necessary to compile information or estimates on existing dust deposition levels and the existing concentrations of airborne particulates.
In the absence of site-specific air quality data, existing background levels are described through reference to monitoring undertaken at nearby locations.

4B.5.2.2 Dust Deposition

Dust deposition monitoring data from the Whitehaven Coal Mine was used to derive a dust deposition average for the region surrounding the Project Site. Monitoring at Whitehaven Coal Mine has been ongoing since early July 2000.

Results of dust deposition monitoring at eight monitoring locations around the Whitehaven Coal Mine, for the period January 2004 to September 2006 are presented in **Table 4B.40**. To ensure that the dust deposition levels used in the assessment were the most representative of background conditions, Heggies (2007) selected the dust deposition sites least influenced by mining activities. These data provide background levels attributable to rural activities and

natural sources together with a small proportion of dust generated by the activities within the Whitehaven Coal Mine. Due to this small proportion of mine-generated dust, the levels listed in **Table 4B.40** are considered to be over-estimates of the background levels for the Project Site.

Table 4B.40
Dust Deposition Monitoring Data
Whitehaven Coal Mine – Average Monthly Deposition – January 2004 – September 2006

Site Location	Monitoring Period	Total Insoluble Solids (Non Filtrable Residue) g/m^2/month	Non Combustible Material (Ash) g/m^2/month
Location WD2 (Merton)	Jan 04 - Sep 2006	2.1	1.1
Location WD5 (Wilga)	Jan 04 - Sep 2006	1.2	0.8
Location WD6 (Bungalow)	Jan 04 - Sep 2006	1.3	0.7
Location WD7 (Wilgai)	Jan 04 - Sep 2006	2.1	1.1
Location WD8 (Gundawarra)	Jan 04 - Sep 2006	2.3	1.6
Location WD12 (Whitehaven)	Jan 04 - Sep 2006	1.7	1.2
Location WD13 (Womboola)	Jan 04 - Sep 2006	1.3	0.8
Location WD14 (Bungalow)	Jan 04 - Sep 2006	2.5	1.0
Average		1.8	1.0
Source: Heggies (2007) - Table 2			

Table 4B.40 shows the average Total Insoluble Solids component of the dust deposition was 1.8g/m^2/month and this is considered to represent background deposition for assessment purposes.

4B.5.2.3 Particulate Matter

Historical monitoring of PM_{10} using a High Volume Air Sampler has been conducted by WCM at two locations in the vicinity of the Tarrawonga Coal Mine. The monitoring has been conducted in accordance with the DECC's one day in six monitoring cycle.

On the days when monitoring was undertaken the 24 hour average PM_{10} was below the DECC goal of 50µg/m^3 . The annual average was 22.1µg/m^3 and 15.9µg/m^3 at each site respectively. Due to the relative closeness of mining activity, Heggies (2007) considered this data to be an over-estimate of the background PM_{10} likely to be experienced at the Sunnyside Project Site.
For their modelling assessment, Heggies (2007) required a continuous PM_{10} dataset rather than one day in every six of the WCM monitoring. The closest site to the Sunnyside Project Site monitoring PM_{10} continuously is the NSW Department of Environment and Climate Change (DECC) site in Tamworth. This is approximately 110km to the east-southeast of the Sunnyside Project Site, but was considered by Heggies (2007) to be able to provide a conservative estimate of background PM_{10} concentrations in the vicinity of the Project Site.

The PM_{10} ambient concentrations were determined by assessing the DECC air quality recorded data which represent real time recordings of ambient particulate matter. Data for 2005 was selected as the most recent validated data set available. The results indicate that the highest 24 hour average PM_{10} concentration at the Tamworth monitoring site during 2005 was 89µg/m^3. This was likely as a result of an anomalous event such as a dust storm or bushfire.

The annual average PM_{10} concentration for 2005, recorded at the DECC's Tamworth monitoring site was 16.5µg/m^3.

The USEPA has observed that the ambient PM_{10} is typically approximately 50% of Total Suspended Particulates (TSP) in the ambient air in regions where road traffic is not the dominant particulate source, such as rural areas. In the absence of monitoring data for TSP, the annual average TSP concentration for the region may therefore be derived by multiplying the annual average PM_{10} concentration (16.5µg/m^3) by a factor of two. Consequently, Heggies (2007) estimated a background TSP concentration at 33µg/m^3.

4B.5.2.4 Greenhouse Gases

The potential for project-related greenhouse gas generation comes from combustion sources including carbon dioxide, carbon monoxide, oxides of nitrogen and non-methane Volatile Organic Compounds (NMVOCs) and the release of coal bed methane during mining and post-mining activities.

Given the rural nature of the area, existing background concentrations of greenhouse gases were assumed to be negligible.

4B.5.2.5 Summary of Existing Air Quality

For each potential pollutant, the maximum background concentration for each relevant averaging period has been assumed in order to provide an estimate of the background air quality. This results in a conservatively high estimate of background concentrations, however, this is consistent the DECC's Approved Methods.

Site-specific background air quality levels adopted for assessment purposes are included in **Table 4B.41**. These levels are based on the data discussed in Sections 4B.5.2.1 to 4B 5.2.4.

Table 4B.41
Background Air Quality Environment for Assessment Purposes

Air Quality Parameter	Averaging Period	Assumed Background Level
TSP	Annual	33µg/m^3
PM_{10}	24-hour	Daily Varying
PM_{10}	Annual	16.5µg/m^3
Dust	Annual	<2g/m^2/month
Greenhouse Gases	All periods	Negligible
Source: Heggies (2007) - Table 3		

4B.5.3 Potential Sources of Air Contaminants

4B.5.3.1 Particulate Emissions

The main sources of dust generated during the development and operation of the proposed mine and use of the proposed coal transport route would include:

- mining activities (including vegetation clearing, soil stripping, overburden ripping and placement, and drilling and blasting activities;
- road and hardstand area construction (on-site);
- road construction and delivery of road construction materials;
- coal processing area activities (crushing / screening plant, front-end loader);
- wind erosion off areas within the open cut area, emplacements and soil stockpiles;
- general movement of heavy vehicles on unsealed roads within the site (haul truck wheel dust); and
- transportation of product coal between the Project Site and the Whitehaven CHPP and Rail Loading Facility.

4B.5.3.2 Greenhouse Gas Emissions

The Project has the potential to generate greenhouse gas emissions from a number of sources, including:

- the combustion of fuel by diesel-powered equipment and vehicles, including front-end loaders, excavators, bulldozers, scrapers, graders, drill rigs, explosives trucks and haul trucks;
- combustion of diesel fuel for on-site power generation for the processing plant, mine facilities, and lighting towers;
- the release of coal bed methane; and
- the use of explosives during blasting.

The product coal sold to predominantly export markets would ultimately be burnt to create energy. This process also produces significant volumes of greenhouse gases which are therefore attributable to the Project.

Although carbon dioxide (CO_2) would be the principal gas produced, greenhouse gases emitted as a result of the Project would also include carbon monoxide (CO), methane (CH_4), oxides of nitrogen (NO_X), SO_2 and non-methane volatile organic compounds (NMVOCs).

4B.5.4 Air Quality Goals

4B.5.4.1 Particulate Matter Goals

Emissions of PM_{10} and $PM_{2.5}$ particles are considered important pollutants due to their ability to penetrate the respiratory system. Potential adverse impacts associated with exposure to these sizes of particles include increased mortality from cardiovascular and respiratory diseases, chronic obstructive pulmonary disease and heart disease and reduced lung capacity in asthmatic children.

The NSW PM_{10} goals as expressed in the DECC Approved Methods are:

- A 24-hour maximum of 50µg/m^3; and
- An annual average of 30µg/m^3.

The 24-hour PM_{10} standard of 50µg/m^3 is numerically identical to the equivalent National Environment Protection Measure (NEPM) reporting standard, except that the NEPM reporting standard allows for 5 exceedances per year. These NEPM goals were developed by the National Environmental Protection Council (NEPC) in 1998 to be achieved within 10 years of commencement.

In July 2003, a variation to the Ambient Air Quality NEPM was made to extend its coverage to $PM_{2.5}$. This document references the following goals for $PM_{2.5}$:

- A 24-hour maximum of 25µg/m^3; and
- An annual average of 8µg/m^3.

4B.5.4.2 Total Suspended Particulates Goals

The National Health and Medical Research Council (NHMRC) have recommended an annual average goal for Total Suspended Particulates (TSP) of 90µg/m^3.

As discussed in Section 4B.5.2.3, the PM_{10} particle size fraction is typically of the order of 50% of the TSP mass in rural areas. Therefore, the NHMRC recommended TSP level of 90µg/m^3 is consistent with an annual average PM_{10} goal of approximately 45µg/m^3. Consequently, the NHMRC goal may be regarded as less stringent than the more recent DECC PM_{10} goal of 30µg/m^3.

Therefore, it was concluded that the annual TSP goal would be achieved for the Sunnyside Project if the annual PM_{10} goal is satisfied.

4B.5.4.3 Dust Emission Goals

Sections 4B.5.4.1 and 4B.5.4.2 addressed goals for health impacts of particulate matter. There is also potential for dust deposition to result in nuisance impacts.

To avoid dust nuisance the DECC has developed assessment goals for dust fallout. These goals specify a maximum increase in deposited dust of $2g/m^2$/month and in any case, not to exceed a maximum total deposited dust level of $4g/m^2$/month.

In Section 4B.5.2.2, the ambient dust deposition level has been assumed to be less than $2g/m^2$/month. Consequently, the maximum increase in deposited dust level ($2g/m^2$/month) would be the governing goal for the Sunnyside Project.

4B.5.4.4 Project Air Quality Goals

In summary, the DECC (EPA) project specific air quality goals are as follows.

PM_{10}: A 24-hour maximum of $50\mu g/m^3$
An annual average of $30\mu g/m^3$

$PM_{2.5}$: A 24-hour maximum of $25\mu g/m^3$
An annual average of $8\mu g/m^3$

Dust: Nuisance expected to impact on surrounding residences when incremental annual average dust deposition levels exceed $2g/m^2$/month

4B.5.5 Operational Air Quality Controls

4B.5.5.1 Introduction

NMPL would apply a wide range of air pollution control measures to ensure air quality standards are not compromised by its activities. These operational controls have been categorised as either dust control measures or controls for other air contaminants.

4B.5.5.2 Dust Control Measures

The proposed controls to the primary dust generation sources identified in Section 4B.5.3.1 are presented as follows.

Vegetation clearing and soil stripping.

- Cleared trees and branches would be retained for use in stabilising slopes identified for rehabilitation with native woodland communities. No burning of vegetation would be permitted.

	• Where practicable, soil stripping would be undertaken at a time when there is sufficient soil moisture to prevent significant dust lift-off. • Whenever possible, NMPL would avoid stripping soil in periods of high winds. • Dust suppression by water application would be used to increase soil moisture should stripping occur during periods of high wind or low soil moisture.
Drilling and blasting activities.	• The drill rig would utilise water injection or alternatively, be fitted with dust collectors. • The use of aggregates for blast hole stemming to prevent venting of explosion gases. • Conducting blasting both before the establishment, and after the break-up of low-level atmospheric temperature inversions which typically occur after 4:00pm and can remain until 8.00am.
Overburden ripping and placement.	• Ripping of softer overburden material would be avoided during periods of high wind.
Coal Mining.	• Low moisture coal would be sprayed with water prior to excavation to raise moisture content to >6%.
Road and hardstand area construction (on-site).	• Clearing ahead of construction activities would be minimised. • Cleared areas would be watered regularly during construction.
Road Construction and delivery of construction materials.	• Clearing ahead of road construction would be minimised. • Active construction areas would be watered regularly. • Truck speeds on roads under construction would be restricted to <50kph.
Crushing and screening.	• Notwithstanding the moist nature of the ROM coal, water would be applied to the coal at the feed hopper, crusher and at all conveyor transfer and discharge points at the rate of approximately 2L/t coal processed.

- Some flexibility would exist to temporarily cease operation in the event of protracted dry periods, high winds, and significant dust generation and dispersal towards the surrounding residences.

Wind erosion of open pit and stockpiles.

- Minimising the extent of clearing/site preparation in advance of mining.
- Clear definition of any access or haul roads and the restriction of vehicles and equipment to those roads.
- Routine application of water with or without chemical dust suppressants. Water would be sprayed onto stockpiles and hardstand areas.
- Progressive rehabilitation of areas of disturbance including topsoil and subsoil stockpiles.
- Installation of bund walls and windbreaks as required.

Internal coal transport and general movement of heavy vehicles within the Project Site.

- Internal haul roads would be regularly watered. The frequency of water application to the various internal haul roads and exposed surfaces would be dependent on climatic factors, in particular wind and temperature, and usage. Generally, water would be applied at a rate of >2L/m^2/application with an estimated 63-88ML to be used each year for the purpose of dust suppression.

Transportation of product coal between the Project Site and the Whitehaven CHPP.

- Coal would not be loaded above the truck body sides, thereby preventing the accidental loss of the coal from the trucks during transportation.
- All trucks carrying product coal from the mine would be covered with approved covers and the tailgates securely fixed to prevent windblown dust emission or spillages.
- The road surface along the entire coal transport route would be sealed.

A Dust Management Plan would be implemented at the Project Site to minimise potential emissions during adverse weather conditions. Adverse weather conditions include moderate wind speeds prevailing from the northwest which would blow towards the nearest Non-Project-related residences. The on-site weather station includes an anemometer, which would enable the instantaneous identification of adverse weather conditions and would assist with appropriate operation of the stockpile water sprays.

4B.5.5.3 Control Measures for Greenhouse Gas Emissions

Greenhouse gases would be emitted as a result of vehicle exhausts and any blasting fumes. The following operational controls would be implemented to reduce the emission of these gases.

Exhausts

Earthmoving equipment and on-site vehicles would be fitted with exhaust controls which satisfy the NSW DECC emission requirements. NMPL would ensure that all equipment is properly maintained to ensure no unacceptable exhaust emissions occur and commit to the removal of any vehicle or item of mobile equipment from on-site activities which is observed not to comply with NSW DECC guidelines. The exhausts of all equipment would be directed upwards or to the side so as not to impinge on the ground and cause dust lift-off.

Blasting Fumes

The following factors which contribute to non-ideal detonation behaviour and higher emission concentrations (principally of NO_2), would be avoided whenever possible.

- Weak overburden which reduces the necessary explosive confinement, would be ripped and excavated in preference to blasting.
- Water infiltration.
- Long explosive columns.
- Explosive pre-compression caused by hole-to-hole shock propagation due to wet overburden and clay veins.

4B.5.5.4 Greenhouse Gas Reduction

Renewable energy sources would be impractical given the relatively short life of the Project (5 to 7 years) and cost associated with establishing larger scale renewable energy sources such as windfarms or multiple solar panels.

In respect to its association with the Federal Government's Greenhouse Challenge Plus Program, NMPL is obligated to the ongoing implementation of practical actions and initiatives that reduce unit emissions by both productivity improvement and fuel efficiency gains.

NMPL would participate in the Federal Government's Greenhouse Challenge Agreement Program and would integrate a range of greenhouse gas reduction strategies into the design and ongoing operation of the Sunnyside Coal Mine. These strategies would include, but not be restricted to:

- selection of most fuel efficient mining and associated equipment;
- design of out-of-pit access ramps and overburden emplacement access haul roads to optimum gradients for maximum fuel efficiency of the mining equipment using them;

- implementation of reduction and control measures to reduce risks of spontaneous combustion in the pit and on the coal stockpile areas;
- optimisation of throw blasting techniques and bulk dozer push operations for in-pit placement of overburden;
- optimisation of in-pit haulage and placement of overburden by the rear haul truck fleet; and
- implementation of key equipment productivity initiatives through pit design and optimised mine development scheduling.

As a member of the Greenhouse Challenge Program, Whitehaven Coal Limited and its subsidiary companies (eg. NMPL) are required to submit annual reports detailing not only emissions accounting data but also an ongoing program of greenhouse emissions reduction actions. Periodic third party audits would be conducted by the Australian Greenhouse Challenge Office for verification purposes.

4B.5.6 Impact Assessment

4B.5.6.1 Introduction

The assessment of impacts of the proposed Sunnyside Coal Project was primarily undertaken through computer modelling to establish likely concentrations of PM_{10}, deposited dust and emissions of greenhouse gases around the Project Site. The modelling undertaken by Heggies (2007) at nine of the closest Non-Project-related residences ("assessment locations") assumes the adoption of operational controls as set out in Section 4B.5.5.2. Specific distances of the assessment locations to Project Site activities are presented in **Table 4A.2**.

In order to assess the level of impact, the predicted concentrations have been compared against the air quality goals established in Section 4B.5.4.

4B.5.6.2 Air Quality Modelling

Computer predictions of fugitive emissions from the Project Site were undertaken using the Ausplume Gaussian Plume Dispersion Model software (Ausplume) developed by EPA (Victoria). Ausplume combines the particulate emission factors for the various Project Site activities, meteorological data and local topography to predict the dispersion of dust and other particulate matter.

Particulate Emission Factors

The inputs to the Ausplume model have been taken primarily from the default emission factors identified in the *Emission Estimation Technique Manual for Mining* (DEH, 2001). Where the moisture content of materials on the Project Site was not adequately reflected within the defaults emission factors, the equations presented within DEH (2001) were used.

Heggies (2007) adopted a total of 32 assumptions to develop the particulate emission factors. It is noted that at the time of modelling, the coal transport route was assumed to be unsealed and consequently, particulate emissions from this source were calculated accordingly. The coal transport route would in fact be fully sealed. Therefore, the predicted results at the surrounding residences are highly conservative, as sealing this route would be expected to significantly reduce the emissions from this activity.

Meteorological Data

The Air Pollution Model (TAPM) software, developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO), was used to simulate the meteorology of the area. Data obtained from the Bureau of Meteorology's (BoM) Gunnedah Airport Automatic Weather Station (AWS) (Station Number 055202), located approximately 25km east of the Project Site. At the time of the assessment, a site weather monitoring station was not available. A weather station has been recently installed at the Sunnyside Project.

The generated meteorological data set was compared with observed wind data from 2001 – 2005 at the Gunnedah Airport Automatic Weather Station (AWS) (Station Number 055202) and a good correlation between the generated and observed wind directions and wind speeds obtained (Heggies, 2007). This good correlation validates the generated data set and therefore increases the level of confidence that can be placed in the predictions from the modelling.

Local Topography

There are no significant topographic features which would impede atmospheric dispersion between the Project Site and adjacent residences. Considering such uncomplicated near field topography, topography has not been considered in the Ausplume dispersion model.

Modelled Scenario

One operational scenario was modelled to reflect a worst case during a mine operational year. The construction activities on site and the road construction activities within the proposed coal transport route have not been modelled given their comparatively short duration in any one area and the recognition that adoption of dust controls are standard activities for such works.

The chosen modelling scenario was for operational Year 4. This incorporates site operations including drilling, blasting, and removal of topsoil and overburden, extraction of coal at the pit area by bulldozer and excavator, ROM plant operations and ROM and product coal haulage.

4B.5.6.3 Dust Deposition

Table 4B.42 shows the results of the dust deposition modelling. The results show the mean average monthly dust deposition predicted at the residences surrounding the Project Site over a one year time frame. **Figure 4B.8** shows a contour plot of the modelled incremental increase in dust deposition attributable to the Sunnyside Project.

Table 4B.42
Incremental Dust Deposition at Nearest Non-project Residences
(Dust – Annual Average in g/m^2/month)

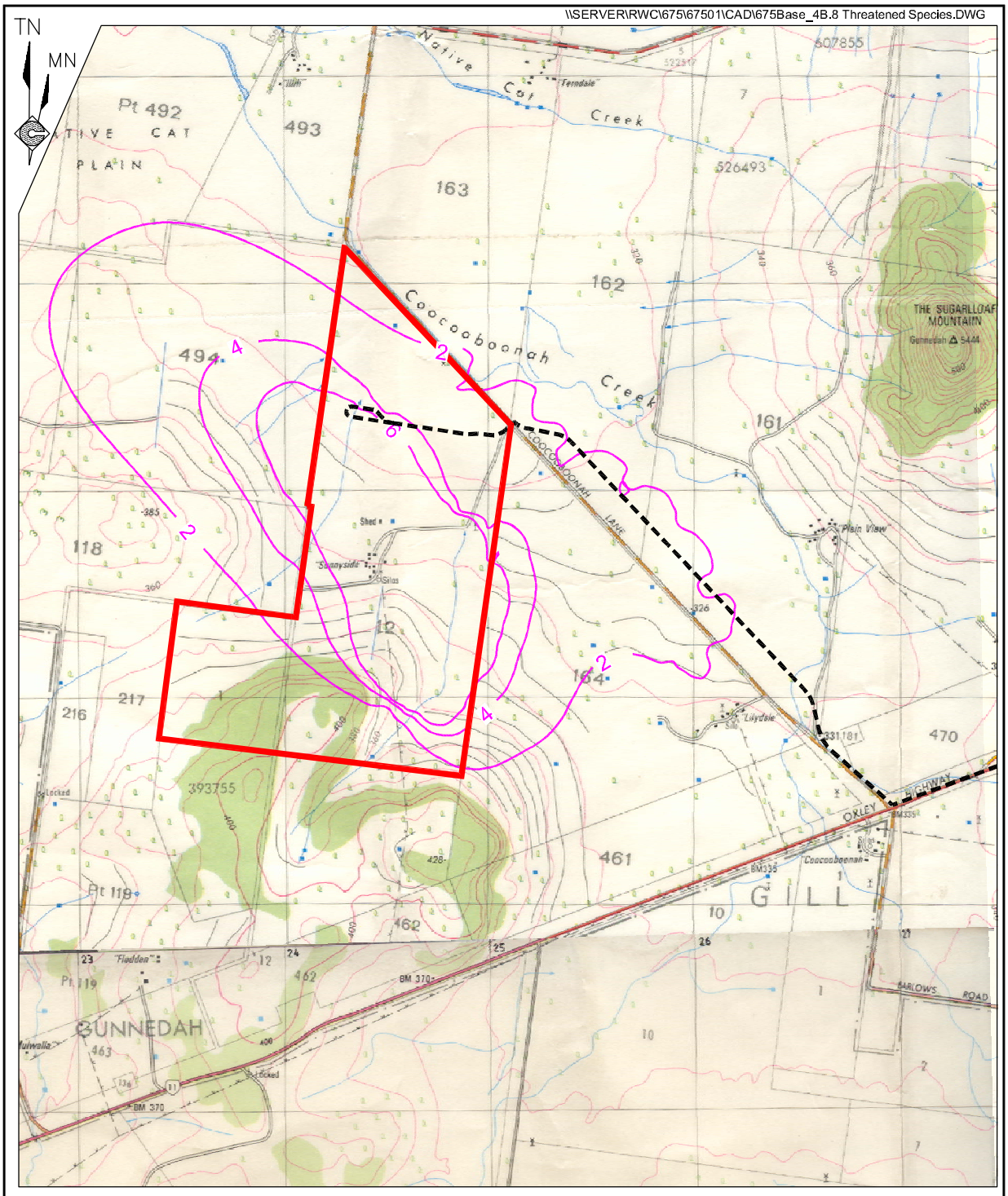
Residence	Incremental Increase attributable to the Project	Project Goal
"Flodden"	0.1	2.0
"Ivanhoe"	0.5	2.0
"lllllli"	0.5	2.0
"Ferndale"	0.2	2.0
"Plain View"	0.9	2.0
"Woodlawn"	0.5	2.0
"Sugarloaf"	0.4	2.0
"Lilydale"	1.9	2.0
Source: Heggies (2007) - Table 6		

Table 4B.42 shows the predicted incremental annual average dust deposition associated with the Sunnyside Project is predicted to be less than 1.9g/m^2/month at all the nearest Non-Project-related residences. As such, levels of dust deposition are predicted to satisfy the Project goal as determined in Section 4B.5.2.5, which is an incremental increase of less than 2.0g/m^2/month at all residences.

4B.5.6.4 PM_{10} (24-hour Average)

Table 4B.43 presents the results of modelling predictions for 24-hour PM_{10} concentrations. As discussed in Section 4B.5.2.3, existing monitoring data showed that background levels of PM_{10} vary on a daily basis and that on two occasions, the levels were above the impact assessment criteria. These two events were excluded from the background data for the assessment. Accordingly, the results presented in **Table 4B.43** present the maximum (background plus increment) 24-hour average concentration of PM_{10} predicted at the residences surrounding the Sunnyside Project Site, excluding the two days when background already exceeded the DECC impact assessment criterion.

Table 4B.43 also shows the maximum predicted increment at each of the surrounding residences for the modelling period. The maximum predicted 24-hour average increment of PM_{10} occurs at the "Lilydale" residence with a concentration of 31.9µg/m^3.



REFERENCE
- Project Site Boundary
- Coal Transport Route
- 4 — Dust Deposition Contour (g/m ^{2}/month)

Note: The dust deposition levels in the vicinity of the re-aligned Coocooboonah Lane were predicted assuming the road was unsealed and regularly watered. The road would in fact be sealed which would noticeably reduce deposited dust levels surrounding the route.

SCALE 1:30 000

500 0 500 1000 1500 m

Source: Heggies (2007) - Appendix 7
Base Map Source: Emerald Hill & Wondoba 1:25 000 Topographic Maps

Figure Prepared by R.W. Corkery & Co. Pty Ltd

Figure 4B.8
AVERAGE MONTHLY DUST DEPOSITION

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Table 4B.43
Background and Incremental PM_{10} Concentration at Nearest Residences
(24-hour Average in µg/m^3)

Residence	Background	Increment attributable to Project	Background + increment	Project Goal	Maximum Predicted Increment
"Flodden"	39.5	0.5	40.0	50	10.2
"Ivanhoe"	39.5	2.0	41.5	50	10.7
"Illili"	39.5	0.0	39.5	50	11.9
"Ferndale"	39.5	0.0	39.5	50	10.3
"Plain View"	27.4	18.8	46.2	50	23.0
"Woodlawn"	39.5	1.2	40.7	50	10.6
"Sugarloaf"	39.5	2.0	41.5	50	9.9
"Lilydale"	32.2	17.3	49.5	50	31.9
Source: Modified after Heggies (2007) - Tables 7 and 8					

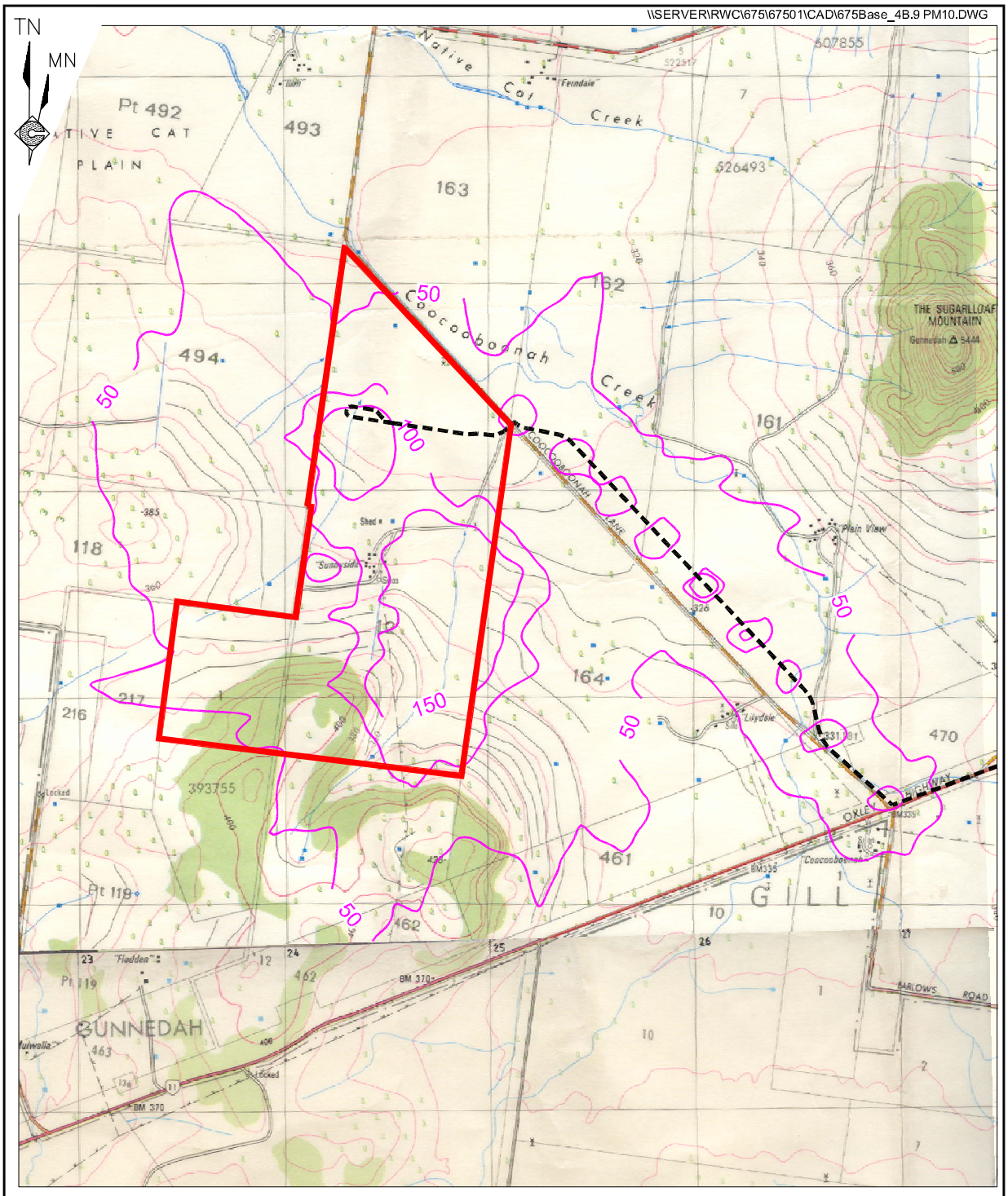
Figure 4B.9 is a contour plot of the predicted 24-hour PM_{10} concentration (background plus increment) attributable to the Project on the third highest predicted day. When the two days on which the background level already exceeds the Project goal are rejected, this day becomes the highest PM_{10} concentration day.

4B.5.6.5 PM_{10} Annual Average

Table 4B.44 presents the results of the Ausplume predictions for annual average PM_{10}. The annual average background PM_{10} at the nearest residences incorporated into the model was 16.5µg/m^3.

Table 4B.44
Background and Incremental Annual PM_{10} Concentrations at Nearest Residences
(Annual average in µg/m^3)

Residence	Background	Increment attributable to the Project	Background + Increment	Project Goal
"Flodden"	16.5	0.6	17.1	30
"Ivanhoe"	16.5	1.2	17.7	30
"Illili"	16.5	0.9	17.4	30
"Ferndale"	16.5	0.6	17.1	30
"Plain View"	16.5	1.7	18.2	30
"Woodlawn"	16.5	0.9	17.4	30
"Sugarloaf"	16.5	0.7	17.2	30
"Lilydale"	16.5	5.6	22.1	30
Source: Heggies (2007) Table 9				



REFERENCE
- Project Site Boundary
- Coal Transport Route
- 50 — PM_{10} Contour (µg/m^3)

Note: The PM_{10} levels in the vicinity of the re-aligned Coocooboonah Lane were predicted assuming the road was unsealed and regularly watered. The road would in fact be sealed which would noticeably reduce PM_{10} levels surrounding the route.

SCALE 1:30 000

500 0 500 1000 1500 m

Source: Heggies (2007) - Appendix 8
Base Map Source: Emerald Hill & Wondoba 1:25 000 Topographic Maps

Figure 4B.9
MAXIMUM PREDICTED 24-HOUR AVERAGE PM_{10} CONCENTRATION

Figure Prepared by R.W. Corkery & Co. Pty Ltd

oec

Figure 4B.10 shows a contour plot of the modelled annual average PM_{10} concentrations (background plus incremental) attributable to the Sunnyside Project.

The results show that the annual concentrations of PM_{10} at the nearest residences attributable to the Project are predicted to be less than 22.1µg/m^3 and consequently satisfy the Project goal of 30µg/m^3.

4B.5.6.6 $PM_{2.5}$

There is little data available regarding $PM_{2.5}$ emission factors and it was not quantitatively assessed using the Ausplume model. However, a semi-quantitative assessment of likely $PM_{2.5}$ concentrations attributable to the Project was determined based on the predicted PM_{10} levels derived from the modelling.

Heggies (2007) estimated that, inclusive of Project activities:

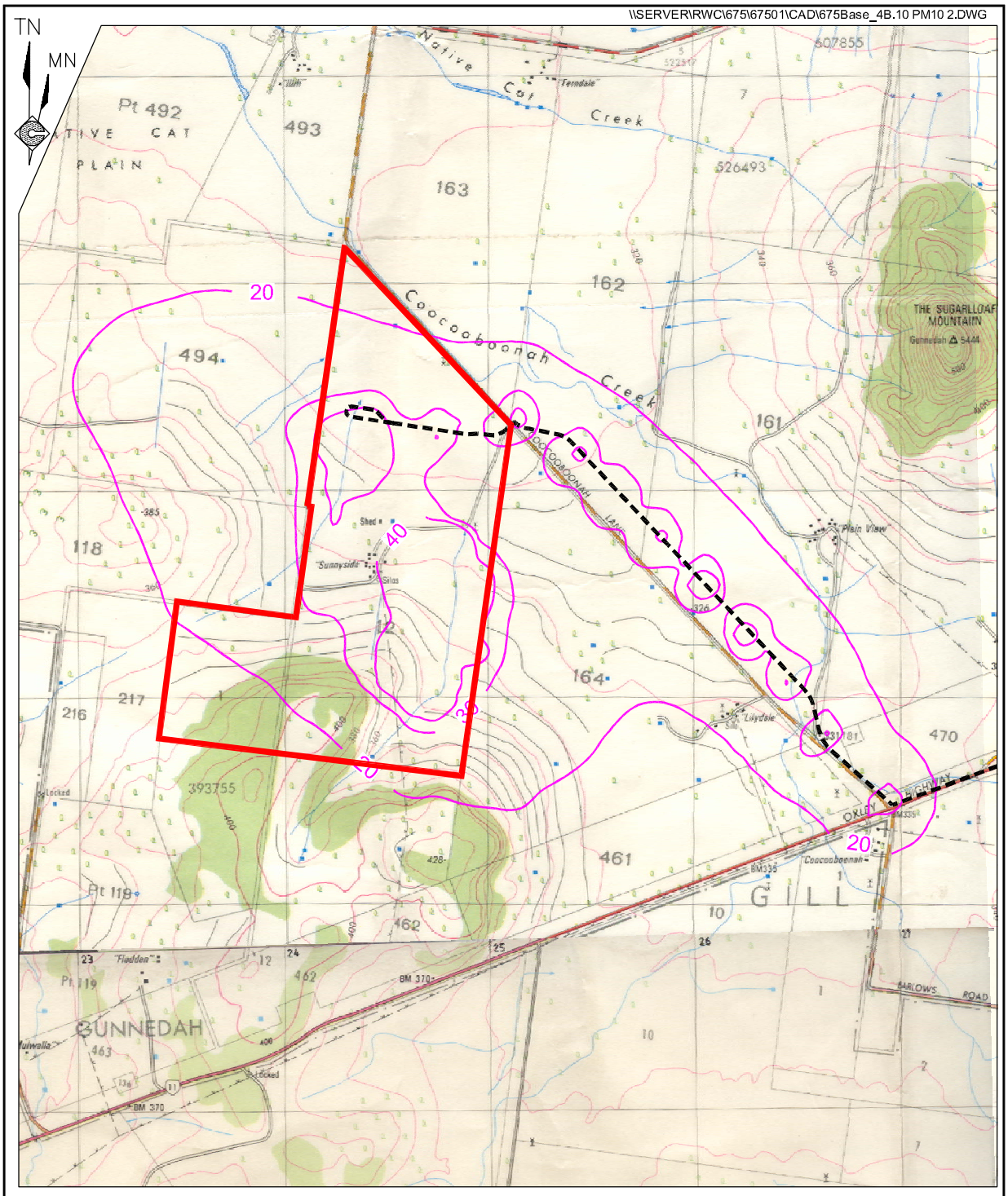
- 24-hour average $PM_{2.5}$ are predicted to be of the order of 13.7µg/m^3, thus satisfying the 24-hour average goal for $PM_{2.5}$ of 25µg/m^3; and
- Annual average $PM_{2.5}$ levels are predicted to be of the order of 6.1µg/m^3, thus satisfying the annual average goal for $PM_{2.5}$ of 8µg/m^3.

4B.5.7 Greenhouse Gas Assessment

Mining operations at the proposed Sunnyside Project have the potential to generate greenhouse gas emissions from a number of sources. These sources include the following.

- The combustion of fuel by diesel-powered equipment and vehicles.
- The release of coal bed methane during excavation and post-excavation activities.
- Use of explosives for blasting.
- Distribution of produced materials.
- End use of produced materials.

A full life cycle assessment of worst case annual greenhouse gas emissions from the Project was conducted by Heggies (2007). The results of this assessment indicate that the maximum annual emissions of CO_2-Equivalent as a result of the operations at the Sunnyside Project are predicted to be of the order of 3.0Mt of CO_2-Equivalent per annum.



REFERENCE
Project Site Boundary
Coal Transport Route
30 — PM_{10} Contour (µg/m^3)

Note: The PM_{10} levels in the vicinity of the re-aligned Coocooboonah Lane were predicted assuming the road was unsealed and regularly watered. The road would in fact be sealed which would noticeably reduce PM_{10} levels surrounding the route.

SCALE 1:30 000

500 0 500 1000 1500 m

Source: Heggles (2007) - Appendix 9
Base Map Source: Emerald Hill & Wondoba 1:25 000 Topographic Maps

Figure Prepared by R.W. Corkery & Co. Pty Ltd

Figure 4B.10
MAXIMUM PREDICTED ANNUAL AVERAGE PM_{10} CONCENTRATION

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The potential maximum emissions from the Project Site for combined Scope 1 and 2, Scope 3 and Total CO_2-Equivalent emissions are presented in **Table 4B.45**. The three emission scopes are defined as follows.

- Scope 1 emissions are those which result from activities under a company's control or from sources which they own. (eg on-site generation of electricity, on-site transportation emissions).
- Scope 2 emissions are those which relate to the generation of purchased electricity consumed in its owned or controlled equipment or operations.
- Scope 3 emissions are defined as those which do not result from the activities of a company although arise from sources not owned or controlled by the company. (eg off-site transportation of purchased fuels, the use of sold products and services).

Table 4B.45
Comparison of Project Emissions of Greenhouse Gases with Australian and International Emissions

Emissions Estimation Period	Scope 1 & 2 Emissions CO_2-e (%-age Comparison with Australian 1990 emissions[1])	Scope 3 Emissions CO_2-e (%-age Comparison with International 2000 emissions[2])	Total Project Emissions CO_2-e (%-age Comparison with International 2000 emissions[2])
Worst Case Year (1Mtpa production)	73kt (0.013%)	2.9Mt (0.009%)	3.0Mt (0.009%)
1: From AGO (2006), National Greenhouse Inventory 2004 *2: From WRI (2005),* Navigating the Numbers – Greenhouse Gas Data and International Climate Policy			
Source: Heggies (2007) - Table 11			

Additionally, greenhouse gas emissions for each Scope breakdown are compared against estimated total Australian and International emissions of CO_2-equivalent, where relevant. Total Australian emissions for 1990 and International emissions for 2000, estimated to be 551.9Mt CO_2-equivalent (AGO, 2006) and 33,666Mt CO_2-equivalent (WRI, 2005) respectively, have been used in this comparison.

4B.5.8 Air Quality Monitoring

Monitoring would be undertaken to demonstrate compliance with the Project air quality goals. NMPL would undertake an annual review of monitoring. All monitoring would be conducted in accordance with the following Australian Standards.

- Approved Methods for Sampling and Analysis of Air Pollutants in NSW (DECC 2005b).
- AS 2922-1987 Ambient Air- Guide for the Siting of Sampling Units.

- AS 3580.10.1-2003 Methods for Sampling and Analysis of Ambient Air – Determination of Particulates – Deposited matter – Gravimetric Method.
- AS 3580.10.1-2003 Particulate Matter – PM_{10} – high volume sampler with size-selective inlet.

Monthly monitoring of dust deposition would be undertaken at four locations throughout the operational life of the Project. Dust gauges have already been located on the following properties in accordance with recommendations of Heggies (2007).

- DDG1: "Lilydale".
- DDG2: "Plain View".
- DDG3: "Ivanhoe".
- DDG4: "Illili".

Subject to agreement from property owners, monitoring of PM_{10} would be conducted at a nearby residence. This is likely to be either "Lilydale" or "Plain View".

4B.6 TRAFFIC AND TRANSPORT

The traffic assessment was undertaken by Constructive Solutions Pty Ltd (CSPL). The full assessment is presented as Part 6 of the Specialist Consultant Studies Compendium, with the relevant information from the assessment summarised in the following subsections.

4B.6.1 Introduction

Based on the environmental risk analysis undertaken for the Project (Section 3.3 and **Table 3.5**), the potential traffic impacts requiring assessment and their unmitigated risk rating are as follows.

- Increased traffic congestion (moderate risk).
- Road pavement deterioration (high risk).
- Elevated risk of minor accident with no injury (moderate risk)
- Elevated risk of minor accident with minor injury(moderate risk)
- Elevated risk of minor accident with moderate injuries requiring hospitalisation (high risk).
- Elevated risk of severe accident with sever injuries or death (high risk).

In addition, the Director-General's requirements issued by the Department of Planning require the assessment of traffic in accordance with the RTA's Guide to Traffic Generating Developments, RTA Road Design Guide and relevant AUSTROADS Standards.

This section commences with a review of the existing traffic volumes and existing road standards along the proposed coal transport route. Potential future traffic levels are predicted together with the likely traffic generated as a result of the Sunnyside Project. This enables the likely traffic impacts to be predicted. Recommendations for road and intersection upgrades to reduce the likely impacts are then described.

4B.6.2 Proposed Coal Transport Route

The location of the coal transport route and the various intersections is shown on **Figure 4B.11**.

The nominated route for haulage is along a re-aligned Coocooboonah Lane, the Oxley Highway, Blackjack Road, Quia Road and Torrens Road.

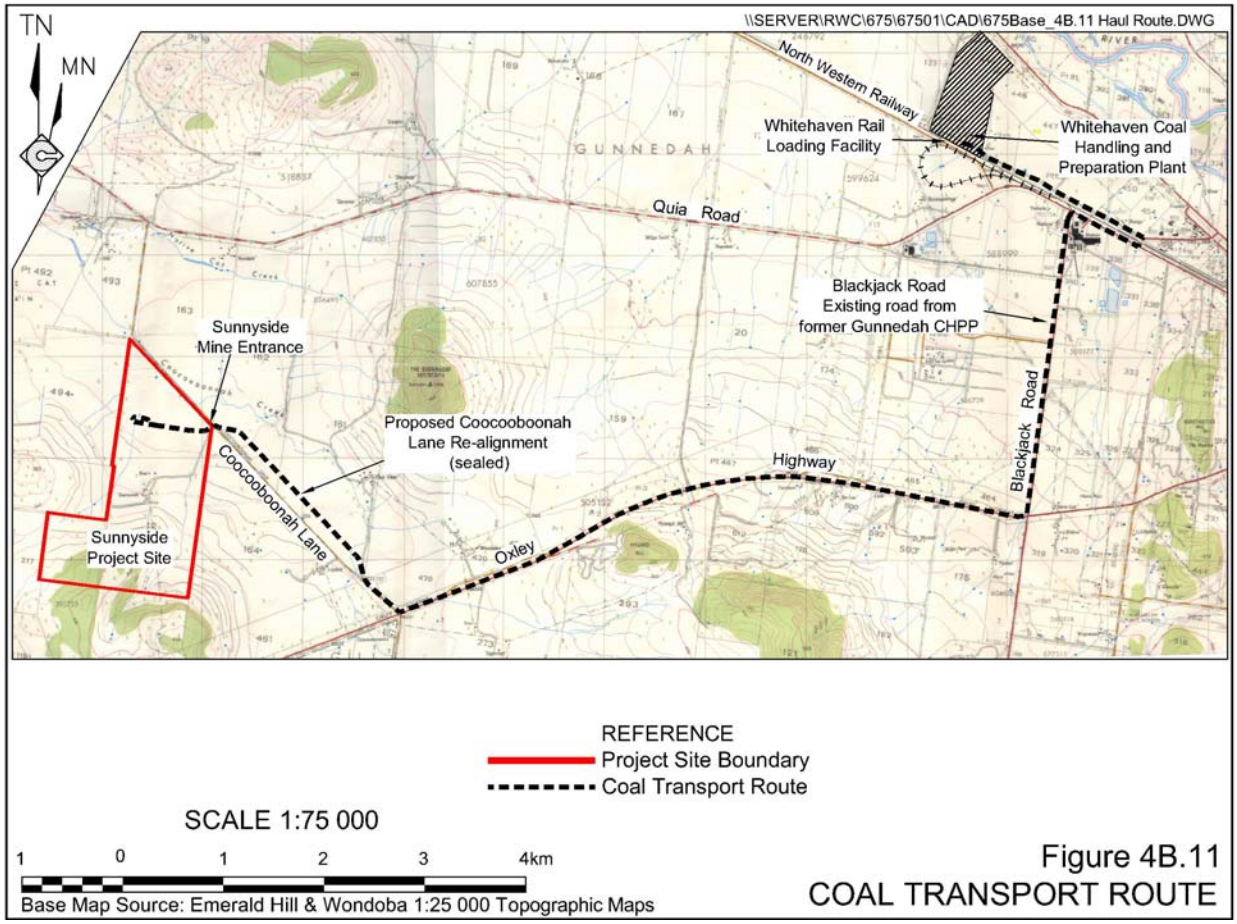

Figure 4B.11
COAL TRANSPORT ROUTE

This route was chosen over other alternatives routes on the basis that:

- it provides good site access to the Oxley Highway;
- it avoids potential Koala habitat in the vicinity of the Project Site;
- the section aligned adjacent to and along Coocooboonah Lane is relatively flat which improves transport efficiency; and
- it has the least disturbance to the surrounding area as it predominantly utilises, or is aligned to existing road infrastructure.

The roads and their corresponding lengths in the coal transport route are included in **Table 4B.46.**

Table 4B.46
Road Lengths Affected by Coal Transport Route

Road name	Length (km)
Coocooboonah Lane	2.7
Oxley Highway	6.7
Blackjack Road	3.0
Quia Road	0.8
Torrens Road	0.6
Torrens Road Access Way*	1.3
TOTAL	**15.1**
* Private Road on Whitehaven Property	
Source: Constructive Solutions (2007) - Table 1	

4B.6.3 Existing Traffic Volumes

Table 4B.47 shows the traffic counts available from Gunnedah Shire Council as well as information supplied by the RTA for the respective roads.

Table 4B.47
Existing Traffic Counts

Location	AADT	Light Vehicles (%)	Heavy Vehicles (%)
Oxley Highway west of Blackjack Road intersection	1654 (2001). Current estimate 1721	Not available Estimated 70-75	Not available Estimated 25-30
Blackjack Road opposite AgQuip Site	275	73.1	26.9
Quia Road east of Blackjack Road Intersection	930	78.7	21.3
Quia Road west of Blackjack Intersection	304	78.2	21.8

No counts were available for Coocooboonah Lane, however, Gunnedah Shire Council representatives estimated that traffic volumes along the route are likely to be less than 15 AADT with 20% heavy vehicles primarily associated with agricultural production resulting in variable heavy traffic volumes.

4B.6.4 Existing Road Standards

4B.6.4.1 Coocooboonah Lane

Coocooboonah Lane is a local road which primarily services the existing properties along its length. The lane services the property 'Plain View' to the right approximately 450m in from the Oxley Highway and 'Lilydale' to the left which is approximately 750m from the Highway as well as others beyond the mine site access.

The lane is a low trafficked road that consists of gravel pavement approximately 6m in width between the table drains. The road accommodates two way traffic in one travelling lane with enough width between the table drains to allow passing.

Gunnedah Shire Council is the road authority for the lane and it is maintained by the Council.

4B.6.4.2 Coocooboonah Lane – Oxley Highway Intersection (see Plate 2.3)

At present, the Coocooboonah Lane intersection with the Oxley Highway is unformed and is controlled by a give way sign on Coocooboonah Lane.

Barlow Road intersects with the Oxley Highway on its southern side approximately 50m on the eastern side of Coocooboonah Lane. Although traffic counts are not available for this lane, it is probable that the traffic volumes are less than Coocooboonah Lane. Sight distance for vehicles approaching the highway from this lane is good in both directions.

4B.6.4.3 Oxley Highway

The section of the Oxley Highway from Gunnedah to Coonabarabran provides a strategic link between the two centres and beyond. The section of the highway between Coocooboonah Lane and Blackjack Road is approximately 6.7km in length and has an estimated traffic volume of 1 448 vehicles per day at the Coocooboonah Lane end. It is likely that the traffic volumes are slightly higher on the highway in the vicinity of the Blackjack Road intersection. Council has estimated the current volumes to be closer to 1 721 vehicles per day.

It is likely that the percentage of commercial vehicles on this road is in the vicinity of 25 to 30%.

The formation consists of two lanes between 3.25m and 3.5m wide with some sealed shoulder of variable width. The alignment is generally good.

The Oxley Highway is maintained on behalf of the RTA by Gunnedah Shire Council through a single invitation maintenance contract.

4B.6.4.4 Oxley Highway – Blackjack Road Intersection (see Plate 2.4)

The Blackjack Road intersection with the Oxley Highway has moderate traffic volumes for most of the year. Larger volumes are experienced before, during and after AgQuip which is held in August of each year.

The intersection is a modified rural treatment with tapers on all turning manoeuvres on and off the Oxley Highway to assist turning articulated vehicles.

The site distance is good approaching from Gunnedah along the Oxley Highway and is reasonable approaching from Coonabarabran.

4B.6.4.5 Blackjack Road

Blackjack Road is a local road which links the Oxley Highway with Quia Road past the AgQuip site. The road is straight, is approximately 3km long and has an approximate seal width of 6.5m to 7m.

The road is primarily used by through traffic except during AgQuip. The traffic volumes provided by Gunnedah Shire Council for this road are 275 vehicles per day with 26.9% heavy vehicles. The traffic volumes during AgQuip on Blackjack Road and other linked roads would be significantly greater before, during and after AgQuip.

At present, there is a large scale industrial subdivision proposed along Blackjack Road which, if realised, would increase traffic volumes. The extent of the increase would be dependent on the staging of the development.

Blackjack Road is currently an approved B-Double route which enables large stock carrying vehicles to access the Gunnedah Saleyards, without the need to pass through the central business area.

4B.6.4.6 Blackjack Road – Quia Road Intersection

The Northwestern end of Blackjack Road terminates when it meets Quia Road at a T intersection. The general geometry of the intersection is considered to be acceptable for the existing traffic volumes on the respective roads. From the traffic counts, it appears as though the predominant flow of traffic is to and from Quia Road onto Blackjack Road.

Guardrail has been placed on the inside corner turning left onto Quia Road. The area behind the guardrail is being utilised as a school bus stop although there are no corresponding school bus stop signs.

4B.6.4.7 Quia Road

Quia Road is a local road located to the west of Gunnedah. The road runs from the Kamilaroi Highway under the rail line where it meets Farrar Road and continues parallel to the rail line before heading west.

The road consists of two sealed lanes with minimal sealed shoulder. The estimated seal width is between 6.5m and 7.0m. Pavement age and quality is variable.

At present, there are 930 vehicle movements a day (21.8% CVs (Commercial Vehicles)) to the east of the Blackjack Road intersection which decreases to 304 (21.3% CVs) to the west of the intersection.

4B.6.4.8 Underpass and Adjoining Intersections (see Plate 2.5)

The haulage route leaves Quia Road via the intersection adjoining the underpass. Torrens Road joins Quia Road just to the north of the underpass.

The Quia Road - Farrar Road intersection has been aligned to accommodate the restraints of the underpass and the associated drainage.

The Farrar Road – Torrens Road intersection is also constrained by the underpass and associated drainage as well as other utilities. The left turn manoeuvre onto Torrens Road from the underpass has a tight radius of curvature. The pavement in this intersection is failing due to the quantity of haulage vehicles, the grade and tight radius turning left into Torrens Road.

The pavement adjacent to the underpass is concrete. The remaining pavement area is presumed to be constructed of unbound granular pavement with the exception of the Torrens Road intersection which is constructed of asphalt.

4B.6.4.9 Torrens Road

Torrens Road is predominantly used for light vehicle access and deliveries to the Whitehaven CHPP and Rail Loading Facility. The pavement consists of unbound granular pavement.

The initial section of pavement is too narrow and is on the verge of failing. Beyond this the pavement is relatively new. Torrens Road is a no through road to the public.

4B.6.4.10 Torrens Road Access Way

The pavement and alignment of Torrens Road Access Way is sufficient for the proposed coal transportation.

4B.6.5 Traffic Generation

4B.6.5.1 Future Traffic Volumes

Future traffic volumes in and around the vicinity of the haulage route are likely to remain fairly similar with the exception of Blackjack and Quia Road. There is a proposed subdivision to the North East of Blackjack Road for the creation of an industrial precinct in and around the former abattoir site. This is likely to increase traffic volumes in and around this area and on adjoining roads if the development proceeds.

The proposed Gunnedah ethanol plant would also result in a significant increase in traffic volumes, however there is no current development application before Council for the Project.

4B.6.5.2 Traffic Generation from the Proposed Development

The proposed development would generate traffic from various activities occurring at the site through the various stages of the development. The volumes of traffic likely to be experienced during the construction and operation of the mine are estimated in the following sections.

Construction Traffic Volumes

Mine site construction and the construction of the intersections would occur prior to the haulage of coal from the site. During this phase of the Project traffic generated by the construction would vary in number and composition depending on the phase, location and type of construction.

Haulage Traffic Volumes

Coal haulage is proposed to be undertaken using a standard articulated truck configuration with an assumed payload of 28 tonne. Based on this payload the estimated truck movements would include 125 loads per day over a 12 hour shift 5 days a week. Consideration would be given to using B-Double configuration vehicles with a 40t load capacity. Based on this payload, the estimated truck movements would be 88 per day over a 12 hour shift, 5 days a week. Some haulage may be undertaken on Saturdays depending on production and rail stockpile capacity at the CHPP and rail loading facility as well as Port demands.

The ratio of haulage vehicles as a percentage of the current number of commercial vehicles per day is shown in the **Table 4B.48.**

Table 4B.48
Estimated Increase in Commercial Vehicles

Road	Estimated Existing Commercial Vehicles	Haulage Vehicles		Percentage Increase	
		28t Cap.	40t Cap	28t Cap.	40t Cap
Coocooboonah Lane	3	250	176	8400%	5867%
Oxley Highway	500	250	176	50%	35%
Blackjack	74	250	176	341%	238%
Quia	198	250	176	127%	89%
Source: Constructive Solutions (2007) - Table 2					

The increase in commercial vehicles as a result of the coal transportation is significant on all roads.

It is probable that increased traffic and increased commercial vehicles would occur on the Oxley Highway, Quia and Blackjack Roads as a result of other developments proposed in the vicinity of this area over the life of the Project.

Workforce Traffic Volumes

The workforce travelling to and from the mine site has been estimated to be approximately 24 full time employees a day. There could be up to 7 part time employees per day also accessing the mine, resulting in the maximum number of 31 persons attending the mine on any one day. Workers residing in Gunnedah would approach the Project Site along the Oxley Highway. Realistically, the workforce would contribute up to 20 light vehicle return trips each day.

It is assumed that the majority of the workforce would reside in or in the immediate vicinity of Gunnedah and travel to and from work via the Oxley Highway. It is estimated that less than 25% of the workforce would reside in a location whereby they access the Project Site along an alternative route either to the west of the Oxley Highway – Coocooboonah Lane intersection or to the northwest of the Project Site along Coocooboonah Lane.

Other Traffic

Other traffic accessing the mine site would include site deliveries, intermittent visits by site staff and other regulatory authorities. Overall it is presumed that other traffic would be relatively low at around 10 vehicles per day with 20% commercial vehicles.

4B.6.6 Site Specific Traffic Impacts and Proposed Improvements

4B.6.6.1 Coal Transportation

Both standard articulated vehicles and B-Doubles would be used to transport coal from the Sunnyside mine site to the Whitehaven CHPP. Both configurations are used extensively in the Gunnedah region.

All proposed road and intersection upgrades have been designed to accommodate B-Double use. The proposed intersection upgrades would provide simplified traffic interaction and also provide appropriate warning relating to the increased volume of truck traffic. "Truck Entering" signs would be placed approaching all intersections.

Speeding and other related driving behaviours would be managed by implementation of a suitable code of conduct incorporating infringement arrangements. WCM has similar codes in place at its other coal operations. In addition, all truck drivers would be subject to existing road rules and regulations.

All coal transport vehicles would be fitted with automated tarpaulins in order to control spillage. Should spillage occur, it would be picked up as soon as it is noticed. Coal haulage contractors on other WCM operations have contracts in place for rapid clean up of any coal spillage.

4B.6.6.2 Coocooboonah Lane

The section of Coocooboonah Lane from the mine site access to the Oxley Highway would experience a significant increase in traffic volumes. The road would form part of the haulage route as well as providing general site access for employees, site deliveries and other associated traffic.

In order to achieve NMPL's commitment to avoid removal of existing Koala habitat, haulage would be undertaken on a new section of road oriented parallel to the existing lane before re-joining the lane approximately 450m north of the Oxley Highway. This new section would also serve as the public road. The existing section of Coocooboonah Lane between the mine site access and the point where the haul road re-aligns with the Lane would be decommissioned whilst the haul road is in service. The proposed re-aligned section of the lane is shown in **Figure 4B.12**.

Figures 4B.13 and **4B.14** show the proposed improvements to the various parts of the haulage route.

The intersection between the coal transport route leaving the Project Site and the re-aligned Coocooboonah Lane where the existing lane meets the new haulage road would incorporate a basic left turn (BAL) treatment as shown in Inset A on **Figure 4B.14** with a sealed approach along Coocooboonah Lane. Vehicles entering from the Project Site would be required to give way to local traffic using Coocooboonah Lane.

The re-aligned Coocooboonah Lane would be constructed through the existing cultivation paddock and would consist of two lanes 3.5m wide. The road would have sealed shoulders 0.5m wide on both sides.

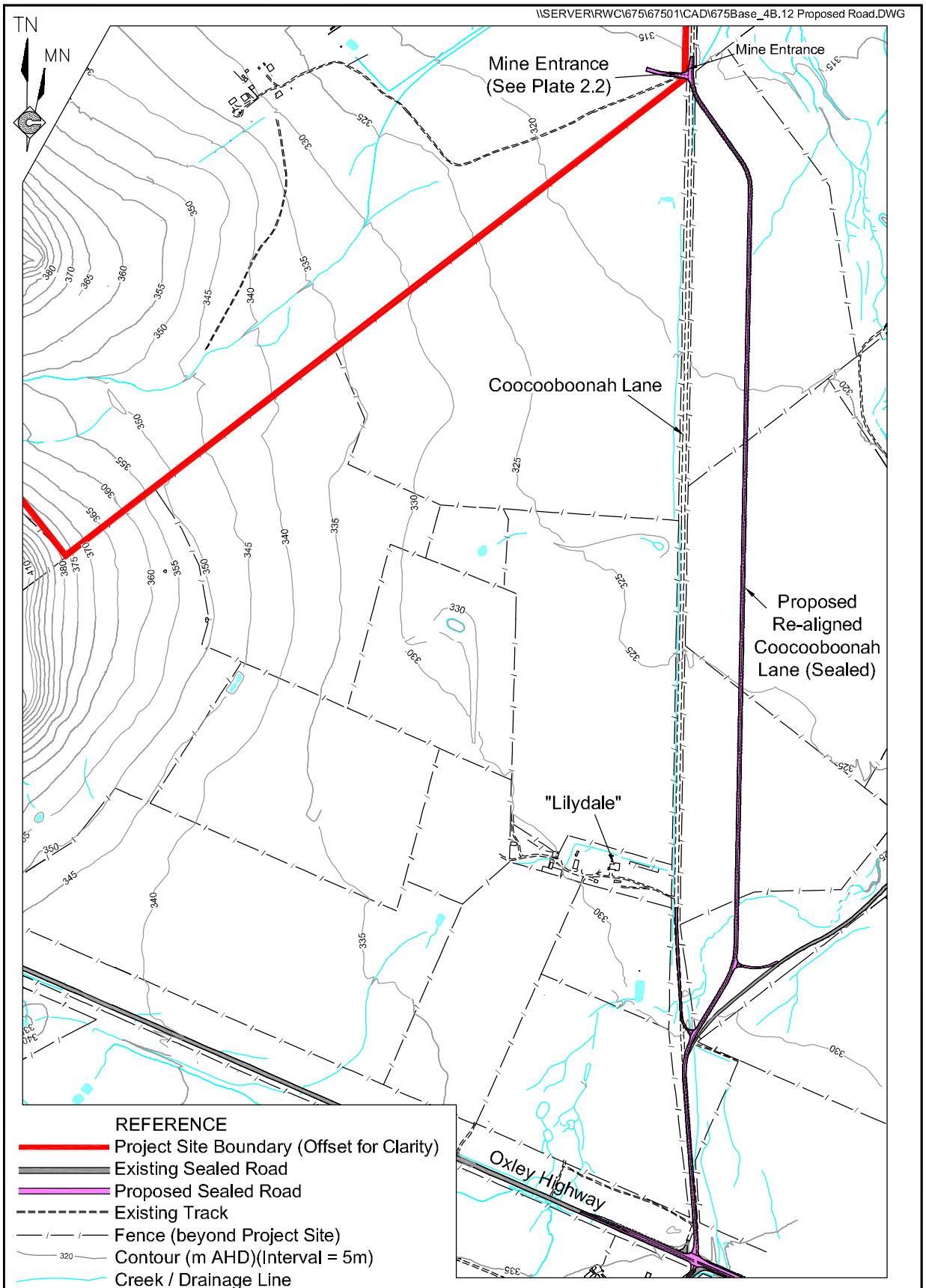

Figure 4B.12
PROPOSED COOCOOBOONAH LANE RE-ALIGNMENT

Figure Prepared by R.W. Corkery & Co. Pty Ltd

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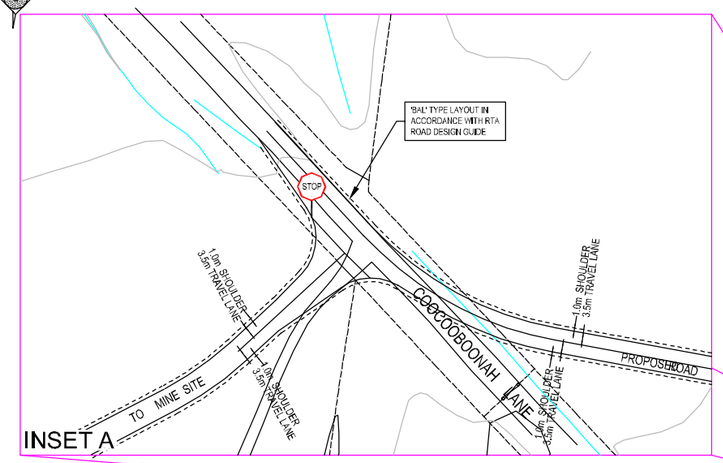
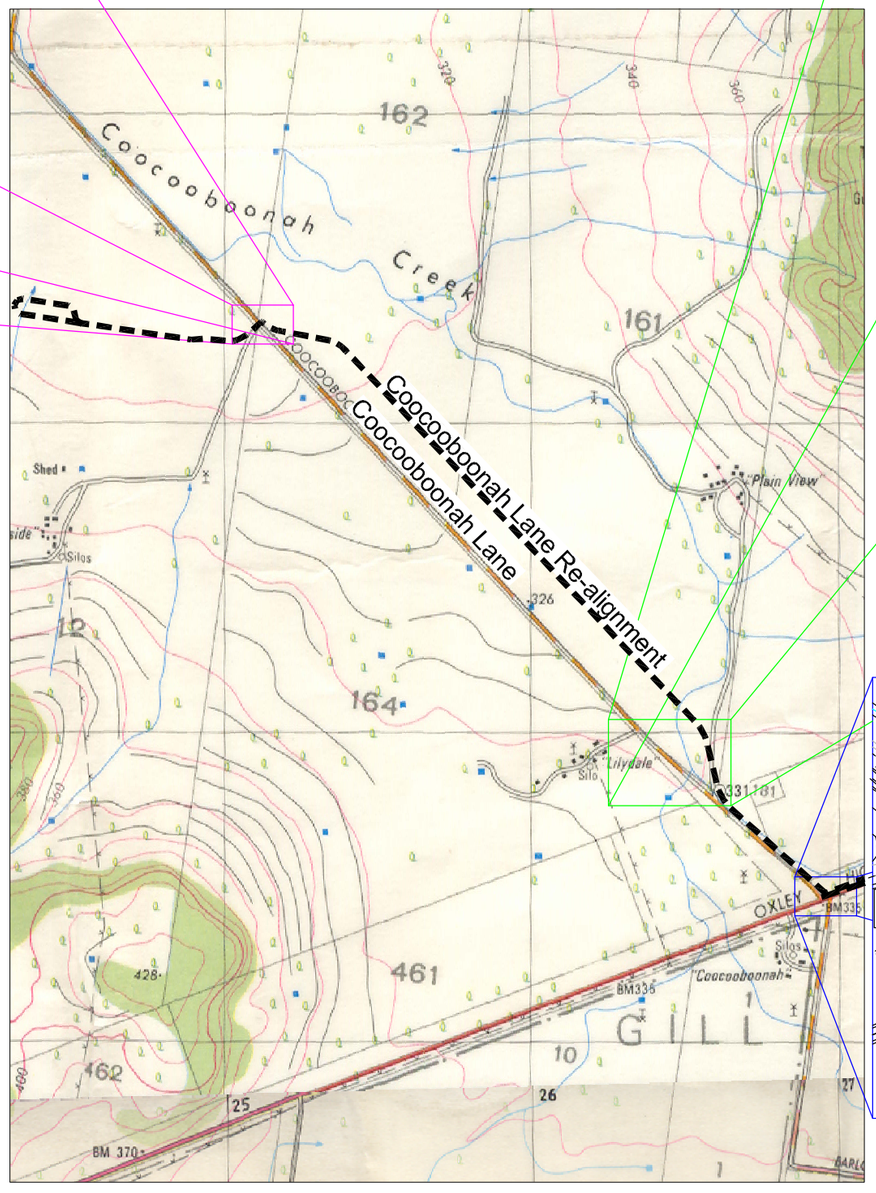
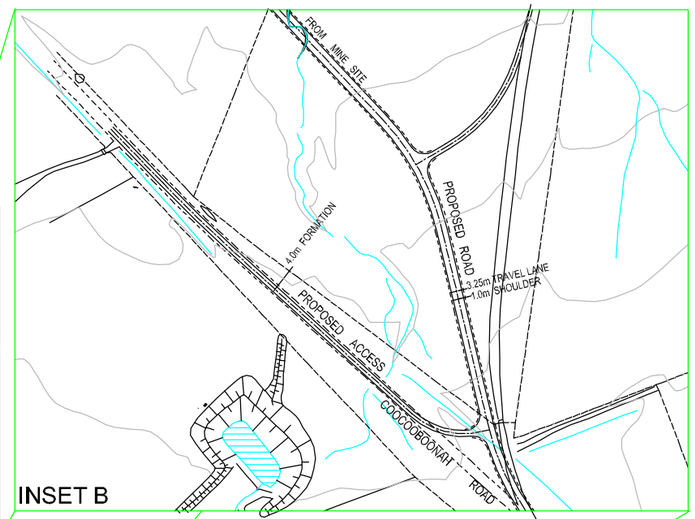
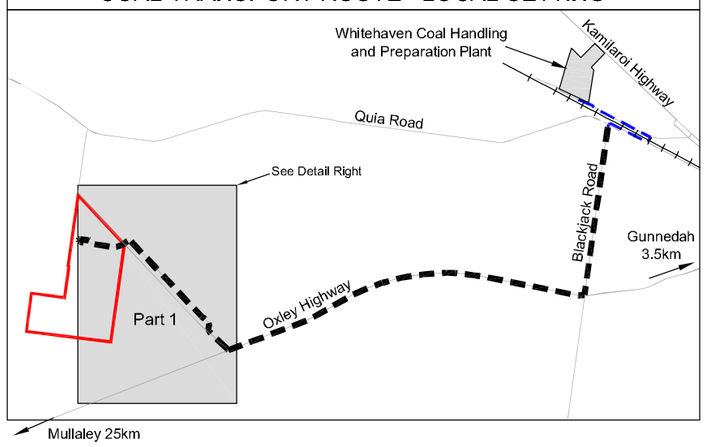


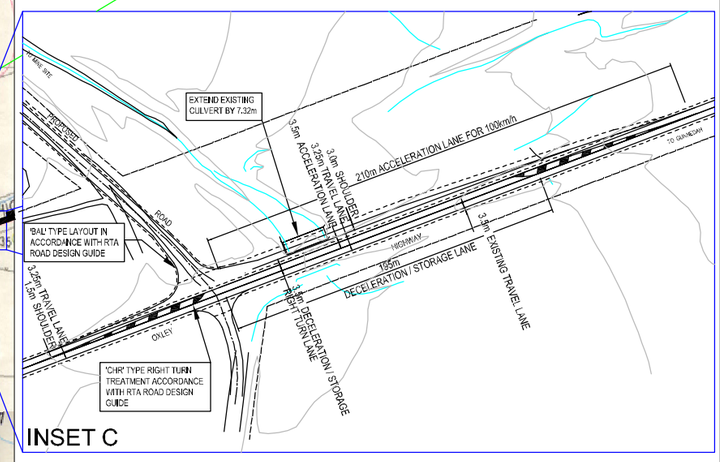




COAL TRANSPORT ROUTE - LOCAL SETTING



REFERENCE
Project Site Boundary
Coal Transport Route



SCALE 1:20 000

200 0 200 400 600 800 1000 m

Base Map Source: Emerald Hill & Wondoba 1:25 000 Topographic Maps
Intersection Designs by: Constructive Solutions Pty Ltd

Figure Prepared by R.W. Corkery & Co. Pty Ltd

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Figure 4B.13
COAL TRANSPORT ROUTE - PART 1

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COAL TRANSPORT ROUTE - LOCAL SETTING

Whitehaven Coal Handling and Preparation Plant
Kamilaroi Highway
See Detail Below
Quia Road
Part 2
Blackjack Road
Gunnedah 3.5km
Oxley Highway
Mullaley 25km

INSET E

INSET F

See Plate 2.5

See Figure 2-7 (Appendix 2) in Traffic Assessment

Whitehaven Rail Loading Facility
Whitehaven Coal Handling and Preparation Plant
Torrens Road Access Way
Torrens Road
Quia Road
Blackjack Road
Oxley Highway

INSET D

REFERENCE
Project Site Boundary
Coal Transport Route

SCALE 1:25 000

250 0 250 500 750 1000 1250 m

Base Map Source: Emerald Hill & Wondoba 1:25 000 Topographic Maps
Intersection Designs by: Constructive Solutions Pty Ltd

Figure Prepared by R.W. Corkery & Co. Pty Ltd

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Figure 4B.14
COAL TRANSPORT ROUTE - PART 2

The two accesses from the "Lilydale" and "Plain View" properties that join the existing Coocooboonah Lane would be re-aligned to provide adequate sight distance for each access and approaching vehicles where they join the re-aligned Coocooboonah Lane. The proposed property access layouts are included in Inset B on **Figure 4B.14**. Sealed access would be provided to the respective property boundaries.

Unbroken double centre lines would be incorporated along this section of the haul road due to the number of commercial vehicles using the road and the limited overtaking opportunities.

4B.6.6.3 Coocooboonah Lane – Oxley Highway Intersection

The Coocooboonah Lane – Oxley Highway intersection would require a significant upgrade. The new intersection would be located in the vicinity of the existing intersection which is located along a straight section of the Highway at a low point between two crests. The sight distance in both directions is very good due to the general topography surrounding the site and is well in excess of 250m.

Notwithstanding that laden coal trucks turning left onto the Oxley Highway towards Gunnedah through the intersection would have good sight distance to merge into the existing traffic, an acceleration lane is proposed turning left (BAL treatment) for the laden vehicles to maintain and develop a reasonable speed on the gentle uphill climb thus making a smoother merge into existing traffic.

A protected deceleration lane is also proposed for the unladen vehicles returning to the Sunnyside mine site to decrease their speed without hindering through west-bound traffic.

The alignments of Coocooboonah Lane and Barlow Road have both previously been modified to make the intersection a four way intersection to simplify traffic interaction an to avoid potential for confusion. An opposing right turn lane for Barlow Road would also be installed. The proposed layout of the intersection is shown in Inset C of **Figure 4B.13**.

The existing alternative accesses from the southern sector of the Project Site to the Oxley Highway would be closed to ensure all access is via the nominated coal transport route.

4B.6.6.4 Oxley Highway

The section of the Oxley Highway between Coocooboonah Lane and Blackjack Road varies considerably in condition. Significant sections of the Highway have been 'heavy patched'.

The increase in heavy vehicles is likely to exacerbate pavement failure and edge break especially in the lane heading towards Gunnedah where the haulage vehicles are laden. As the shoulders vary in width the impact of edge break would be variable, however, it would be undesirable to have a sealed shoulder less than 500mm.

Significant amounts of edge break would reduce effective pavement width and create hazardous conditions for lighter vehicles and vehicles with smaller tyres. Shoulder maintenance techniques would be negotiated with Gunnedah Shire Council as part of the overall maintenance agreement. In some areas, shoulder reconstruction would be required.

As there would be between 88 and 125 one-way truck movements per day along the coal transport route, more rigorous maintenance inspections and intervals would be required particularly in wet weather when pavement failures could become extensive failures in a short period of time.

Although no signs indicating the location of school bus stops were identified during the site inspection if any are located along this section of the Oxley Highway an assessment would be required to ensure the bus and other vehicles have suitable sight distance and that the buses are entirely off the road at pick up and drop off points.

NMPL proposes to enter into a maintenance agreement with Gunnedah Shire Council. This agreement would detail the inspection and maintenance regime agreed by both parties.

4B.6.6.5 Oxley Highway – Blackjack Road Intersection

The existing modified rural treatment at this intersection has assisted in achieving the dimensional capacity to improve semi-trailer and B-Double manoeuvres into Blackjack Road from the Oxley Highway.

Although the existing intersection could accommodate the proposed haulage a left turn deceleration lane (AUL) and opposing right turn lanes would be included to reduce the impact on through traffic. This is shown in Inset D on **Figure 4B.14**.

The existing width of the road pavement at the mouth of Blackjack Road when approaching Oxley Highway from the north provides sub-standard left and right turn lanes onto the highway. It is recommended that the designated left and right turning lanes be created for south-bound traffic approaching the intersection to enable turning movements onto the highway to be made safely.

At least 250m sight distance is provided in both directions along the Highway. However, based on the final layout of the intersection, consideration would be given to relocating some signage.

4B.6.6.6 Blackjack Road

The increase in traffic on Blackjack Road would be predominantly associated with coal transportation rather than commuting workers or other traffic generated by the development.

The pavement is generally in good condition, however, the coal transportation would exacerbate the rate of deterioration particularly in the north-bound lane which would carry the laden trucks.

The existing sealed pavement width is considered inadequate. Two 3.5m wide lanes with 0.5m sealed shoulder on both sides would be provided for the full length of Blackjack Road along the coal transport route.

Line marking, including edge lines, would be established to define travelling lanes and to keep the outer wheel path of heavy vehicles off the shoulder.

4B.6.6.7 Blackjack Road – Quia Road Intersection

The traffic level through this intersection would increase significantly. If traffic volumes remain the same over the period that haulage is undertaken, an auxiliary right turn lane would be constructed.

Gunnedah Council has advised that as a result of development applications for activity in the vicinity of this intersection, and potential land use rezonings being considered, it is probable that traffic volumes through this intersection would increase considerably in the short term (1 to 5 years). In light of the potential traffic increases a roundabout has been proposed by Gunnedah Shire Council. NMPL proposes to continue discussions with Gunnedah Shire Council regarding capital contributions toward construction of a roundabout. Should it be agreed that a roundabout is required, it would be constructed as shown in Inset E on **Figure 4B.14**.

4B.6.6.8 Quia Road

Quia Road already has a significant volume of commercial vehicles which from the last traffic count was 198 per day to the east of the Blackjack Road intersection.

As with Blackjack Road, haulage would exacerbate the rate of deterioration of the unbound pavement especially in the east-bound lane. Edge break would also be prevalent due to the lack of a sealed shoulder.

The existing sealed pavement width is considered inadequate. Two 3.5m lanes with 0.5m sealed shoulders both sides would be provided.

Line marking, including edge lines, would be established to define travelling lanes and to keep the outer wheel path of heavy vehicles off the shoulder.

4B.6.6.9 Underpass and Adjoining Intersections

The existing underpass and adjoining intersections are constructed to a reasonable standard which, with the exception of the pavement in the Torrens Road intersection, appear to be functioning satisfactorily for existing traffic.

Traffic counts on the network in the vicinity of the underpass were not available, however it is understood that the primary traffic flow at present is from Quia Road to Farrar Road which continues to run parallel to the rail line. The proposed coal transportation would change the primary traffic flow north of the underpass.

The existing T intersection between Quia and Farrar Roads is considered inadequate in its current form as it does not provide the dimensional capacity for B-Doubles to undertake both turning manoeuvres.

The creation of an industrial precinct on the land contained within the old abattoir site is likely to result in an upgrade to this intersection as one of the proposed accesses is via a roundabout at this intersection.

Based on the traffic impacts associated with the Project alone, the recommended treatment for the Quia Road-Farrar Road intersection is a basic left hand turn with allowance for deceleration. A typical seagull treatment constructed in accordance with RTA guidelines would accommodate empty trucks turning left through the intersection. A basic layout of the proposed treatment is shown on **Figure 4B.14** pending further developments warranting alternative treatments.

The underpass provides two 3.5m lanes with approximately 0.25m shoulders which are bound by concrete piers for the underpass on both sides. This width is adequate for B-Double vehicles. Alterations to the Quia and Farrar Road intersection would be achieved primarily by widening the intersection to the south.

The Torrens Road intersection with Quia Road requires upgrading as it has insufficient dimensional capacity to accommodate turning articulated vehicles without crossing the centreline of the existing road. A power pole that was on the inside of the corner turning left into Torrens Road has been relocated enabling a suitable turning radius for B-double use.

A heavy duty pavement such as a concrete pavement would be required.

4B.6.6.10 Torrens Road

The initial section of Torrens Road is on the verge of failing due to continued heavy vehicle use. This section is not suitable for the proposed haulage and would need to be fully rehabilitated.

The rehabilitated pavement would consist of two 3.5m lanes with 0.5m sealed shoulders on both sides.

4B.6.7 School Bus Routes

School bus routes are located along the proposed coal transport route. Council indicated that they do not have designated pick up and drop off points along the school bus routes as pick up and drop off locations vary depending on the number of children and their location.

Hawkins Coach Lines operate three school bus services Monday to Friday on school days only.

1. Gunnedah – Mullaley - Tambar Springs.

   In the morning, this school bus service would be operating in the section of the Oxley Highway proposed for the coal transport route between approximately 8.00am and 8.15am. In the afternoon it would be in the same section of Highway between approximately 3.35pm and 3.50pm.

2. Gunnedah – Goolhi.

   In the morning, this school bus service would be on the section of the Quia Road proposed for the coal transport route between approximately 8.10am and 8.15am. In the afternoon it would be in the same section of Highway between approximately 3.35pm and 3.40pm.

3. Gunnedah – Blackjack Road – Mary's Mount.

   In the morning, the school bus service would be on the section of the Oxley Highway proposed for the coal transport route between approximately 8.00am and 8.05am. In the afternoon it would be in the same section of Highway between approximately 3.55pm and 4.00pm.

Hope's Bus Service operate a Gunnedah – "Cincinatti" property school bus service Mondays to Fridays on school days only. In the morning, it would be on the section of Quia Road proposed for coal transport between approximately 8.20am to 8.25am. In the afternoons, it would be on that section of road between approximately 3.35pm and 3.40pm.

NMPL would ensure all employees and transport drivers are aware of the periods when school buses would be on the proposed coal transport route.

Pick-up and drop-off points along the coal transport route would be confirmed in consultation with school bus proprietors and other stakeholders. This would enable all users to be aware of these points and would help to prevent ad-hoc use of areas that may be unsuitable.

4B.6.8 Pedestrian and Cycling Activity

There is very limited pedestrian or cycling activity along the coal transport route and these activities would not be impacted by the coal transportation activities.

4B.6.9 Road Upgrade Recommendations Summary

The Project would generate significant traffic volumes between the Sunnyside Coal Mine and the Whitehaven CHPP and Rail Loading Facility as well as on adjoining parts of the road network.

The existing roads included along the coal transport route range in classification, function and condition. The majority of the route traverses local roads with the exception of the Oxley Highway which is a State Highway.

As a result of the increase in traffic, extensive road upgrades are proposed. An inventory of the upgrades are included in **Table 4B.49**.

As traffic increases on and around Blackjack Road are significant during AgQuip, no coal transportation would be undertaken during that three day period.

4B.7 ARCHAEOLOGY

The Aboriginal heritage assessment was undertaken by Archaeological Surveys and Reports Pty Ltd (ASR). The full assessment is presented in Part 7 of the Specialist Consultant Studies Compendium, with the relevant information from the assessment summarised in the following subsections.

4B.7.1 Introduction

Based on the environmental risk analysis undertaken for the Sunnyside Coal Project (Section 3.3 and **Table 3.5**), the potential environmental impacts related to Aboriginal heritage requiring assessment and their unmitigated risk rating are as follows.

- Disturbance or destruction of identified sites and/or artefacts of Aboriginal cultural heritage without the permission of LALC or DECC (extreme risk).
- Disturbance or destruction of currently unidentified sites and/or artefacts of Aboriginal cultural heritage without the permission of LALC or DECC (high risk).

Table 4B.49
Summary of Proposed Road Upgrading Activities

Road Section	Road Upgrade Actions
General	• Complete all relevant intersection upgrades to AUSTROADs and Gunnedah Shire Council standards. • "Truck Entering" signs would be erected approaching all intersections where relevant.
Coocooboonah Lane	• Proposed re-alignment is shown in Overall Plan for Coocooboonah Lane in **Figure 4B.12.** • Construct new section of road parallel to existing road. • Merge road back with Coocooboonah Lane 450m north of highway and reconstruct 450m section of Coocooboonah Lane. • Re-align and reconstruct property accesses as shown in **Figure 4B.13 (Inset B)**.
Coocooboonah Lane – Oxley Highway Intersection	• Upgrade existing intersection. **Figure 4B.13** (**Inset C**).
Oxley Highway	• Negotiate shoulder maintenance strategy with Council. • Close all alternative accesses between the project Site and the Highway.
Oxley Highway – Blackjack Road Intersection	• Upgrade existing intersection to include a deceleration lane turning left into Blackjack Road as shown in **Figure 4B.13 (Inset D)**.
Blackjack Road	• Widen Blackjack Road to provide two 3.5m lanes with 0.5m sealed shoulder both sides.
Blackjack Road – Quia Road Intersection	• Intersection upgrade would suffice, however, roundabout proposed to accommodate other traffic generating developments. • If required, a roundabout would be constructed in accordance with **Figure 4B.14 (Inset E).**
Quia Road	• Widen Quia Road to provide 2 x 3.5m wide lanes with 0.5m wide sealed shoulders both sides.
Underpass and Adjoining Intersections	• Upgrade to Quia Road – Farrar Road negotiated with Gunnedah Shire Council, however, minimum provision of two opposing right turn lanes and a left turn lane for laden haulage vehicles. • Quia Road – Torrens Road intersection requires upgrade in accordance with **Figure 4B.14 (Inset F)**.
Torrens Road	• Reconstruction of the initial failed section. Two 3.5m lanes with 0.5m sealed shoulder both sides.
Source: Constructive Solutions (2007) - Table 3	

In addition, the Director-General's requirements issued by DoP require that the assessment of Aboriginal heritage refer to the draft *Guidelines of Aboriginal Cultural Heritage Assessment and Community Consultation* (Department of Environment and Climate Change).

The following subsections present the method of assessment, review the results of an Aboriginal survey undertaken, provide the proposed management of identified sites and assess the significance of any impact on these.

During their assessment ASR (2007) engaged the assistance of a representative/s of the Red Chief Local Aboriginal Land Council (LALC) and Bigundi Biame Gunnedarr Traditional People (Bigundi Biame).

4B.7.2 The Archaeological Record

ASR (2007) searched the Aboriginal Sites Register (Aboriginal Heritage Information Management System – AHIMS) and found that no sites had previously been recorded within the 100km^2 search area around the "Sunnyside" property.

ASR (2007) emphasises that the absence of sites, however, would not be seen as being indicative of the typical distribution and density of sites in the region, but merely indicates that no previous archaeological investigations have taken place in the area.

4B.7.3 Predictive Archaeological Model

As part of the assessment a predictive model for site location was developed to establish a basis for testing, comparing and reasoning the survey results.

The model took into account various factors associated with determining where Aboriginal people are most likely to have been, where they left evidence of their activities and the degree to which that evidence is observable in the present record.

The main items of the ASR (2007) model were:

- isolated artefacts may be present and visible in erosion features;
- low-density artefact scatters may be present and visible in erosion features, but it is unlikely that any debitage would be visible;
- there is a potential for trees more than 150 years old to exhibit scarred surfaces;
- there is a potential for any trees more than 150 years old to exhibit carved surfaces;
- there is a low potential for shelters and associated occupation deposits to exist;
- there is a potential for engravings, and/or grinding grooves to occur wherever there is suitable outcropping sandstone;
- there is some potential for potential archaeological deposits to occur;
- there is little potential for art sites to occur as the conglomerates provide poor surfaces on which to paint or draw;
- there would be no obvious stone quarries primarily because the loose stone can be collected from the surface as pebbles;

- there would be no shell middens;
- there would be no visible evidence of burials;
- there would be no surviving Bora rings;
- there would be no surviving stone arrangements; and
- there are no known cultural associations with the area.

4B.7.4 Archaeological Survey and Results

Four sites were recorded during the field survey, including an axe-grinding groove (AGG1), two isolated artefacts (ISO1 and ISO2) and an artefact scatter (OS1). Their locations are shown on **Figure 4B.15**.

4B.7.5 Significance Assessment

ASR (2007) notes that while each of the sites recorded during their investigation has added to archaeological knowledge of site types, distribution and content in the Gunnedah area, none of the information is of sufficient potential for providing further additional new information that warrants research funding or commitment. Consequently, they assessed the sites to have low research potential.

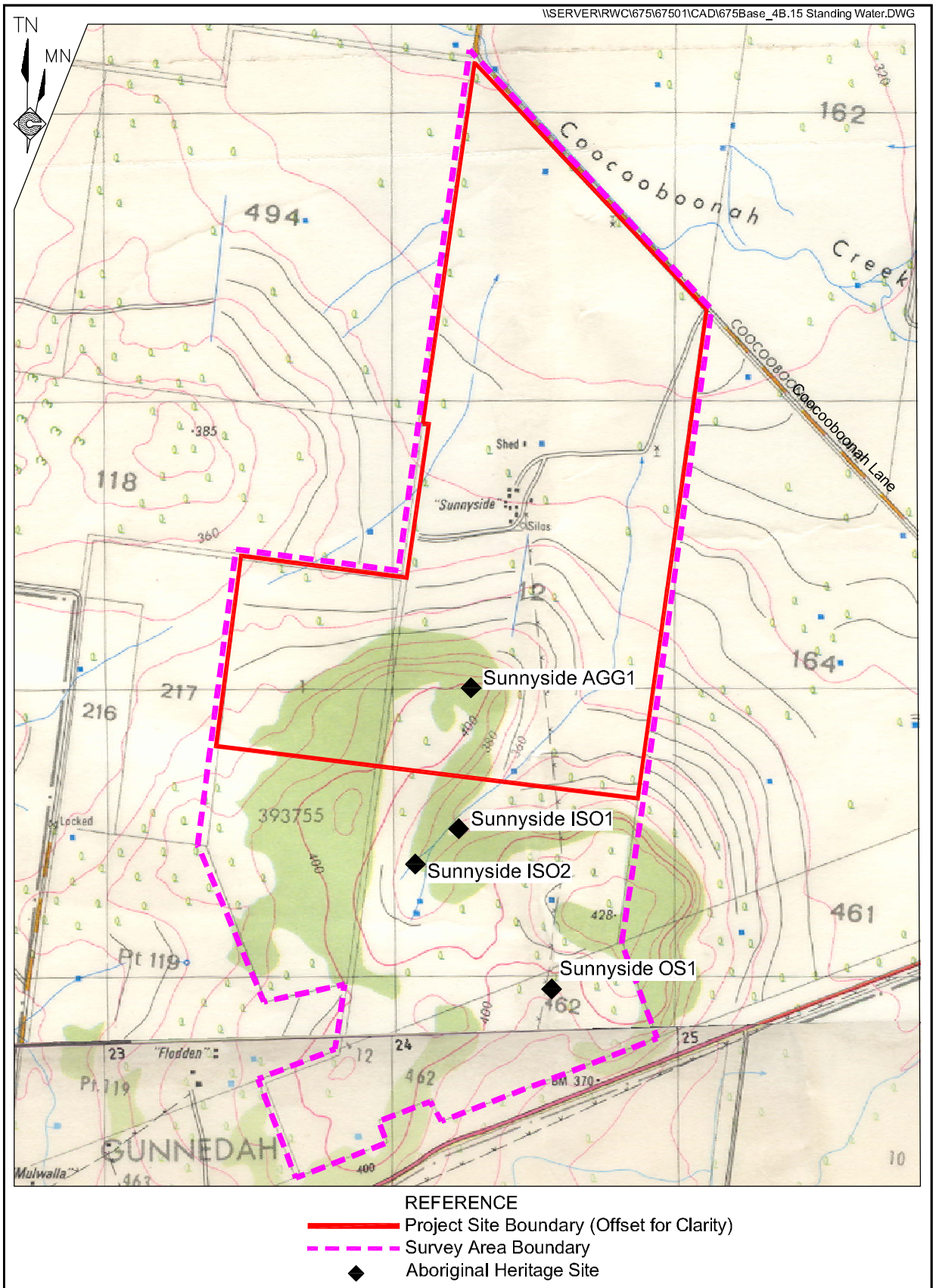
ASR (2007) concludes that because none of the sites recorded during this investigation would require Section 87 or 90 Consents there is no cumulative impact to consider. Unless proposals are changed in such a way that any of the four sites are impacted upon, there is no requirement for an assessment of potential cumulative impacts.

4B.7.6 Management and Mitigation Measures

None of the four identified sites would be directly impacted upon by the proposed mine and support facilities.

Neither the isolated artefacts nor the artefact scatter site are within 500m of the nearest impacts from the proposed coal mine. Therefore, no protective measures are necessary for these sites.

The axe-grinding groove is approximately 150m away from the proposed open cut area, however, there is some potential for it to be damaged by fly-rock (from blasting), or by vibration or shock from blasting within the open cut pit.



Source: Archealoglcal Surveys & Reports Pty Ltd (2007) - Figure 2
Base Map Source: Emerald Hill & Wondoba 1:25 000 Topographic Maps

Figure Prepared by R.W. Corkery & Co. Pty Ltd

Figure 4B.15
ABORIGINAL HERITAGE SITES

Discussions regarding the geotechnical stability of the axe grinding groove (AGG1) were held with the Consultant Archaeologist (ASR) and the Red Chief Local Aboriginal Land Council. ASR advised that there had been an incident at the Werris Creek Coal Mine involving an axe grinding groove being subject to slippage as a result of strata movement associated with the open cut pit at that mine. ASR advised that the situation at Werris Creek was totally different to that at Sunnyside and the concerns expressed in their report about stability of the axe grinding groove at Sunnyside relate only to destabilisation by blast vibration or undermining and not to slippage.

Analysis of the impact of vibration blasting is addressed in Section 4B.2.7.6. Selection of blast size would be used to avoid damage to the axe grinding groove site.

The proposed auger mining would extract only a limited amount of coal and surface subsidence is not predicted to result. Stability of the axe grinding groove would not be affected by the auger mining proposal.

On 8 September 2007, the axe grinding groove was re-inspected with Gary Griffiths, Sites Officer from the Red Chief Local Aboriginal Land Council. It was recognised that the axe grinding groove rock is unlikely to slip as a result of the proposed mining activity. The rock is separated from the base rock, however, it is sitting on the remnant base rock. The rock is stable, is located in a flat area and is not located on a slope or cliff face. The base rock is extensive and would not be subject to slippage as a result of the proposed mining activity.

Protection of the axe grinding groove from fly-rock during the operation of the mine could be achieved simply by way of a straw-bale 'blanket' placed over the site. The potential for damage as a result of blasting vibration has been addressed by managing the size of blasts within specified distances of the axe grinding groove. Section 4B.2.6 contains a detailed description of the Project to manage potential ground vibration impacts on the axe grinding groove.

NMPL has committed to both Red Chief LALC and Bigundi Biame to invite their nominated representatives to monitor all turf stripping activities on site.

In addition to these measures, there are obligations and provisions imposed by the *National Parks and Wildlife Act 1974*. NMPL would implement induction and management processes to ensure that these requirements and obligations are met. The Act requires NMPL to observe the following.

- The owners, and their employees, earthmoving contractors, subcontractors, machine operators and their representatives, whether working in the survey area or elsewhere, would be instructed that in the event of any bone or stone artefacts, or discrete distributions of shell, or any objects of cultural association, being unearthed during earthmoving, work would cease immediately in the area of the find.

- In the event that any bone cannot be clearly identified by a qualified archaeologist as being of animal remains the police are to be informed of its discovery, and officials and/or their representatives of the Red Chief Local Aboriginal Land Council, Bigundi Biame, and the Cultural Heritage Division, Western Directorate DECC, advised that the bone is subject to police investigation.
- Work would not recommence in the area of the find, until both the police (if bone has been found) and those officials or representatives have given their permission to do so. Those failing to report a discovery and those responsible for the damage or destruction occasioned by unauthorised removal or alteration to a site or to archaeological material may be prosecuted under the *National Parks and Wildlife Act 1974*, as amended.

4B.8 FLORA

The flora assessment was undertaken by Geoff Cunningham Natural Resource Consultants Pty Ltd (Cunningham). The assessment is presented in full as Part 8 of the Specialist Consultant Studies Compendium, with the relevant information from each summarised in the following subsections.

4B.8.1 Introduction

Based on the environmental risk analysis undertaken for the Project (Section 3.3 and **Table 3.5**), the potential ecological impacts requiring assessment and their unmitigated risk rating are as follows.

- Disturbance to native vegetation / habitat within nominated areas (low risk).
- Disturbance to native vegetation / habitat outside nominated areas (moderate risk).
- Disturbance to threatened flora / fauna and endangered ecological communities (high risk).
- Disturbance leading to local population reduction (high risk).
- Disturbance leading to local extinction(s) (extreme risk).
- Local biodiversity (moderate risk).
- Regional biodiversity (high risk).

The Director-General's requirements issued by the Department of Planning require that the assessment of threatened species and their habitat include a field survey of the site which would be conducted and documented in accordance with the draft *Guidelines for Threatened Species Assessment* (DECC).

The following subsections describe and assess the existing threatened species and their habitat, identify the ecological management issues, proposed controls, safeguards and mitigation measures for the threatened species and their habitat.

Much of the area has been cleared in the past and most of the cleared land has been cultivated. The vegetation on the cleared areas is relatively heavily invaded by introduced plants.

The land in and adjacent to the northern part of the Project Site comprises open, cleared, gently sloping to almost level country. Almost all of this area has been or is presently being used for cropping and pasture. The southern sector of the area comprises rocky scarp leading to a more hilly area that slopes to the south. This section comprises a mosaic of remnant native vegetation, cleared land that is regenerating to native trees and shrubs and a bare eroded area that appears to have been used as a gravel quarry or for some similar purpose in the past.

4B.8.2 Methodology

The assessment was based on stereoscopic interpretation of 1:25 000 scale colour aerial photographs prior to and during field survey to determine vegetation community features and boundaries. The different landforms and vegetation communities identified through stereoscope interpretation were then sampled in the field to ascertain variation in species density and composition within these communities. There were 46 sample sites at which species composition was recorded and 40m x 40m quadrats were examined to record the occurrence of all ground cover species present.

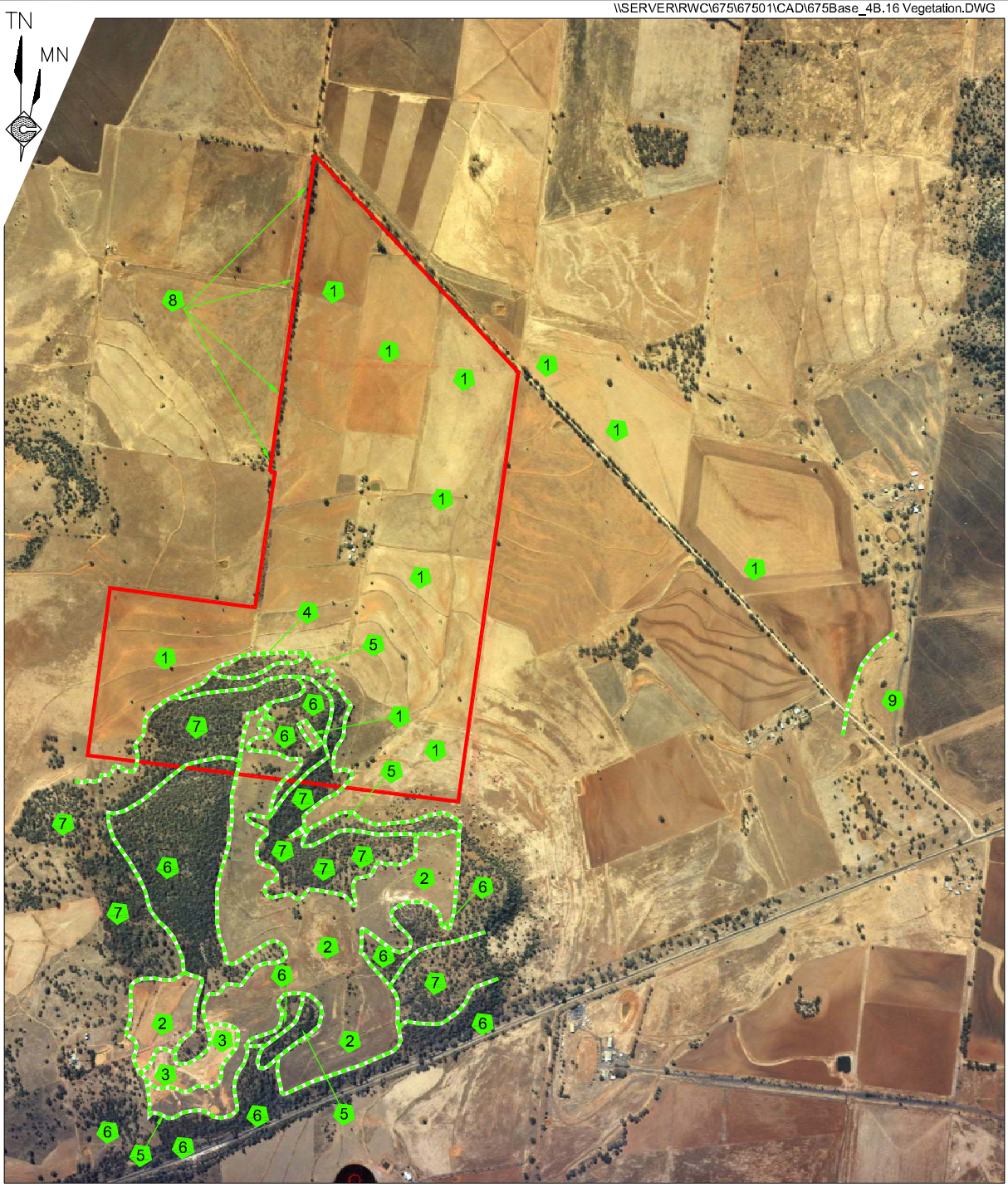
Cunningham (2007) also reviewed existing vegetation information in the Soil Conservation Service Gunnedah District Technical Manual and Mapping by the Department of Land and Water Conservation (now Department of Natural Resources).

4B.8.3 Vegetation Present

The field study identified nine separate vegetation communities within the flora Study Area. The boundaries of each of these communities are shown on **Figure 4B.16**.

The nine vegetation communities are identified as:

- Community 1 – Cleared Cropland and Pastureland;
- Community 2 – Regenerating Grasslands;
- Community 3 – Bare Disturbed Land with Minimal Vegetation Cover;
- Community 4 – Whitewood Community;
- Community 5 – Dry Scrub Community of the Rocky Scarp;



REFERENCE
Project Site Boundary
Vegetation Community Boundary
1 Vegetation Community Reference

VEGETATION COMMUNITIES
Community 1 - Cleared Cropland and Pastureland Community
Community 2 - Regenerating Grasslands Community
Community 3 - Bare Disturbed Land with Minimal Vegetation Cover
Community 4 - Whitewood Community
Community 5 - Dry Scrub Community of the Rocky Scarp
Community 6 - Tumbledown Gum - Wilga - White Cypress Pine Community
Community 7 - White Box Community
Community 8 - Bimble Box - Yellow Box -White Box Woodland Community
Community 9 - Plains Grass Grassland

SCALE 1:25 000

250 0 250 500 750 1000 1250 m

Source: GCNRC (2007) - Figure 5

Figure Prepared by R.W. Corkery & Co. Pty Ltd

Figure 4B.16
VEGETATION COMMUNITIES

- Community 6 – Tumbledown Gum, Wilga and White Cypress Pine Community;
- Community 7 – White Box Community;
- Community 8 – Bimble Box Yellow Box and White Box Woodland Community; and
- Community 9 – Degraded Plains Grass Grassland.

Community 1 identified as Cleared Cropland and Pastureland is almost completely cleared of trees and shrubs and has been cropped in the past.

The Regenerating Grasslands included in Community 2 comprises land that has been cleared for grazing and cropping in the past and which is presently supporting a cover of regenerating native trees and shrub species.

Community 3 appears to have been used as a gravel source in the past and is almost completely bare.

The Whitewood Community identified as Community 4 is confined to a single elongated area below the rocky scarp in the central section of the "Sunnyside" property. Community 5, the Dry Scrub Community of the Rocky Scarp, is confined to the rocky escarpment immediately above Community 4.

The Tumbledown Gum, Wilga and White Cypress Community identified as Community 6 occurs generally on ridge tops with rock outcrops and shallow soils although a variation occurs on a mid-slope area near the Oxley Highway south of "Sunnyside".

Community 7 is the White Box Community. This Community differs from the White Box Yellow Box Blakely's Red Gum Woodland endangered ecological community in that it has a relatively dense shrub layer present rather than having an understorey characterised generally by grass and herbaceous species with shrubs being much less prevalent.

Community 8 is the Bimble Box Yellow Box White Box Woodland Community. It occurs along what appears to be a reserved road that is currently being used as a waterway to dispose of runoff water. This Community is considered to be representative of the White Box Yellow Box Blakely's Red Gum Woodland identified in the NSW *Threatened Species Conservation Act 1995* as an endangered ecological community. The community is also considered to be representative of the White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community listed as Critically Endangered in the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*

Community 9 is the Degraded Plains Grass Community and it occurs in a drainage depression on the eastern end of the proposed coal transport route in the "Plain View" property. This Community is considered to be representative of the Native Vegetation on Cracking Clay Soils of the Liverpool Plains endangered ecological community.

4B.8.4 Threatened Species Issues

The then Department of Environment and Conservation advised of one threatened flora species within the 400km^2 area around the Project Site listed on their Conservation Atlas of NSW Wildlife database. This species is *Cadellia pentastylis*. The Department also provided the following list of species likely to occur in the region.

- *Cadellia pentastylis.*
- *Calotis glandulosa.*
- *Dichantium setosum.*
- *Goodenia macrobarronii.*
- *Philotheca ericifolia.*
- *Hakea pulvinifera.*
- *Homoranthus darwinoides.*
- *Swainsona murrayana.*
- *Thesium australe.*

The then Department of Environment and Conservation also included *Bothriocloa biloba* in the list of species predicted to occur. However, this species has had its listing as a threatened species revoked and was not considered further.

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* online database lists eight plant species as threatened species under the Act that were likely to occur within a 20km radius of the Sunnyside Project Site. The species likely to occur are:

- *Diuris sheaffiana* (now *Diuris tricolour*);
- *Digitaria porrecta;*
- *Goodenia macrobarronii;*
- *Philotheca ericifolia;*
- *Pterostylis cobarensis;*
- *Swainsona murrayana;*
- *Thesium australe;* and
- *Tylophora linearis.*

None of these species identified by the NSW and Commonwealth agencies were present within the Sunnyside Project Site. The threatened plant species were targeted in the field survey, however, none were recorded.

The original condition and habitat values of a large section of the Project Site and surrounds have been modified. The modification has occurred as a consequence of a range of agricultural activities ranging from tree thinning to complete clearing of vegetation cover. However, areas of remnant vegetation do occur around the site.

There is no suitable habitat present at the site for many of the threatened flora species likely or predicted to occur there. Field observations failed to record any threatened flora species and there are no past records of any such species at the site.

The assessment and field survey observations resulted in the conclusion that none of the threatened flora species recorded or predicted to occur in the wider region around Gunnedah occurs at the site.

4B.8.5 Endangered Ecological Communities and Populations

The then Department of Environment and Conservation advised that the following nine potential Endangered Ecological Communities may occur within the Project Site.

- Myall Woodland.
- Fuzzy Box Woodland.
- Coolibah-Black Box Woodland.
- Brigalow.
- Howell Shrublands.
- McKies Stringybark/Blackbutt Open Forest.
- Semi-evergreen Vine Thicket.
- Native vegetation on Cracking Clay Soils of the Liverpool Plains.
- White Box Yellow Box Blakely's Red Gum Woodland.

The Commonwealth advised of only one threatened ecological community listed on the *Environment Protection and Biodiversity Conservation Act 1999* as likely to occur within the Project Site. This community is the critically endangered White Box-Yellow Box-Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands.

The assessment determined that there have been no endangered flora populations recorded in the area in the past and none were recorded during the field survey.

There are remnants of the White Box Yellow Box Blakely's Red Gum Woodland which is listed as an endangered ecological community on the NSW *Threatened Species Conservation Act 1995* and as a critically endangered ecological community on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. This community was recorded on the western boundary of the "Sunnyside" property and along Coocooboonah Lane.

Another community dominated by White Box was also present. However, this community differs from the White Box Yellow Box Blakely's Red Gum Woodland that is listed as both an endangered ecological community and a critically endangered ecological community. The significant difference is the predominance of shrubs rather than grasses and herbs in this other White Box dominated community. The predominance of shrubs specifically excludes this community from the NSW and Commonwealth listings.

A small area of the Native Vegetation on Cracking Clay Soils of the Liverpool Plains endangered ecological community was recorded on the eastern extremity of the proposed re-alignment of Coocooboonah Lane. This area is located on the "Plain View" property near where the re-aligned route re-joins Coocooboonah Lane close to the Oxley Highway.

4B.8.6 Seven-Part Test

A 7 Part Test as defined in the *Environmental Planning and Assessment Act 1979* prescribes the issues that must be taken into account when deciding whether there is likely to be significant effect on threatened species, populations, ecological communities or their habitats.

The following subsections describe these issues and the conclusions reached by Cunningham (2007) in their assessment:

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction:

No threatened flora species have been recorded from the Study Area in the past and none were recorded during field survey. Consequently it is concluded that there would be no adverse effect from the proposed development on the life cycle of any threatened flora species such that a viable local population of the species is likely to be placed at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction:

No endangered flora populations have been recorded in and adjacent to the Project Site in the past and none were recorded during field survey. Consequently it is concluded that there would be no adverse effect from the proposed development on the life cycle of any flora species that constitutes an endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

The Study Area contains remnants of the White Box Yellow Box Blakely's Red Gum Woodland endangered ecological community (NSW TSC Act) and the critically endangered White Box-Yellow Box-Blakely's Red Gum Grassy Woodlands and Derived Native Grassland (Commonwealth EPBC Act) ecological community. This community was recorded on the western boundary of "Sunnyside" property and is present along Coocooboonah Lane.

A small area of the Native Vegetation on Cracking Clay Soils of the Liverpool Plains endangered ecological community was recorded on the eastern extremity of the proposed coal transport route, on Plain View property near where the route joins Coocooboonah Lane close to the Oxley Highway.

The proposed development would not impact in any significant manner on the White Box, Yellow Box, Blakely's Red Gum Woodland endangered ecological community (NSW TSC Act) / critically endangered White Box-Yellow Box-Blakely's Red Gum Grassy Woodlands and Derived Native Grassland (Commonwealth EPBC Act) ecological community as the areas supporting these communities would not be disturbed.

The small area of the Native Vegetation on Cracking Clay Soils of the Liverpool Plains endangered ecological community that is present along a small section of the proposed coal transport route would be temporarily disturbed by the construction of the road. However, only the topsoil would be removed from this area. This topsoil that contains seeds of the species that form this community would be stockpiled separately and then respread after the roadbase material is removed at the cessation of mining.

This temporary disturbance would not constitute a significant impact on this endangered ecological community as it is already degraded and with sympathetic management after the rehabilitation works are complete, including resowing of the dominant groundcover species (if required), its post mining condition would be enhanced.

Consequently it is considered that the proposed development:

- is not likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; nor
- is it likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which the habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The proposed development would not impact in any significant manner on the White Box Yellow Box Blakely's Red Gum Woodland endangered ecological community (NSW TSC Act) / critically endangered White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Commonwealth EPBC Act) ecological community as the areas supporting these communities would not be disturbed.

The area of the Native Vegetation on Cracking Clay Soils of the Liverpool Plains endangered ecological community that is present along a small section of the proposed coal transport route (approximately 1ha) would be temporarily disturbed by the construction of the road. However, only the topsoil would be removed from this area. This topsoil that contains seeds of the species that form this community would be stockpiled separately and then respread after the roadbase material is removed at the cessation of mining.

It is considered that this temporary disturbance would not:

- constitute a significant long term modification of this endangered ecological community or its habitat;
- result in the fragmentation of this habitat in the long term; nor
- have any significant detrimental impact on the long term survival of the endangered ecological community.

In fact, with sympathetic management after the rehabilitation works are complete, including resowing of the dominant groundcover species (if required), its post mining condition would be enhanced.

(e) whether the action proposed is likely to have an effect on critical habitat (either directly or indirectly).

No critical habitat is present within the Study Area. Consequently, it is concluded that the proposed development would not have any effect on any critical habitat.

(f) whether the action proposed is consistent with the objectives or actions of a species recovery plan or threat abatement plan.

There is no species recovery plan in existence for the Native Vegetation on Cracking Clay Soils of the Liverpool Plains endangered ecological community and there are no threat abatement plans that have been finalised and that are relevant to the Study Area.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The temporary removal of the topsoil within the area of the area occupied by the Native Vegetation on Cracking Clay Soils of the Liverpool Plains endangered ecological community would be regarded as clearing of Native Vegetation (NSW TSC Act) and Land Clearance (Commonwealth EPBC Act) because of the presence, in particular, of the native *Austrostipa aristiglumis* (Plains Grass). However, it is not envisaged that any trees would be removed and the native groundcover species would be replaced, and enhanced, on the cessation of mining during the rehabilitation process.

Consequently while a key threatening process would have a temporary impact, the long term view is one of the key threatening process ceasing to exist and of endangered ecological community enhancement.

4B.8.7 Introduced Plant Species and Noxious Weeds

Of a total of 140 plant species recorded within or adjacent to the Project Site, thirty seven (37) are introduced. The percentage of introduced plants is 26.4% of the total plant number, however, many these plants are very numerous – particularly on the open crop and grazing land.

Of the 104 ground cover (pasture) species recorded, 37 (or 35.6%) are introduced. The proportion of the cover provided by introduced species is quite significant.

Two species recorded are listed as Noxious Weeds for Gunnedah Shire. These species are Paterson's Curse and Prickly Pear. Both these weed species are defined as Class 4 locally controlled weeds which pose a threat to primary production, the environment or human health, are widely distributed in an area and are likely to spread in the area or to another area.

These weeds would require continuous monitoring of infestations and control of any plants that appear with appropriate herbicides.

4B.8.8 Koala Habitat

Potential Koala habitat as described in State Environmental Planning Policy No. 44 occurs on and adjacent to the Project Site.

The presence of Koalas have been described in the Fauna Survey Assessment undertaken by Kevin Mills & Associates Pty Ltd. A copy of their Report is included as Part 3A of the *Specialist Consultant Studies Compendium*. Part 3B of the Specialist Consultant Studies Compendium is a Koala Management Plan prepared by Kevin Mills & Associates Pty Ltd.

4B.8.9 Mitigation Measures

The Project is located in an area extensively cleared for agriculture and does not affect major areas of native vegetation.

Notwithstanding, NMPL has incorporated flora management aspects into the planning of the Project and these aspects are discussed in the following subsections.

4B.8.9.1 Design Features

In order to minimise impact on areas of remnant native vegetation, the following design principles were incorporated into the Project.

- All activities on the Project Site were located in areas previously disturbed for agricultural use.
- One of the major considerations for selection of the proposed coal transport route was the avoidance of Koala habitat. It was on this basis that the option to transport coal from a southern access road on the "Sunnyside" property was rejected and the construction of a re-aligned section of Coocooboonah Lane proposed.
- Revegetation species selected incorporate a significant component of Koala feed trees.
- Revegetation of the small section of Coocooboonah Lane re-alignment supporting the vegetation community identified as a remnant of the Native Vegetation on Cracking Clay soils of the Liverpool Plains may require reseeding of the dominant grass species.

4B.8.9.2 Operational Safeguards

NMPL proposes to adopt the following operational safeguards in order to minimise any potential adverse impacts on the local flora within the Project Site. These safeguards are of a general nature and have been developed in consultation with GCNRC.

- The extent of clearing undertaken would be minimised and consistent with operational requirements.
- All areas to be cleared would be clearly defined.
- All clearing and topsoil stripping would be undertaken in campaigns on an as-needed basis.

- Soil material and biomass removed beyond the first 18 to 24 months of mining would be directly transferred to an active rehabilitation area, where practicable.
- Progressive rehabilitation of all disturbed surfaces would be undertaken in accordance with procedures described in Section 2.11.6.
- Noxious weeds would be controlled at all times.

4B.8.9.3 Habitat Establishment

The majority of the area to be affected by the proposed development is already cleared and farmed land that would for the most part be returned to grazing/farming land use. NMPL would operate the Project whilst recognising the presence of a healthy Koala population on and adjacent to the Project Site.

NMPL would implement the Koala Management Plan (Mills 2007b). In addition, rehabilitation commitments include:

- management of 112ha of existing native vegetation for Koala habitat;
- planting and maintenance 9.0ha of new vegetation of Koala feed trees to create Koala corridors; and
- planting 9.8ha of Koala feed trees to enhance existing Koala corridors.

NMPL proposes to rehabilitate the Project Site in a way that establishes new and enhances existing Koala habitat and travel corridors to promote the linkage of remnant areas of native vegetation. The proposed rehabilitation plan is shown on **Figure 2.17**. NMPL recognises the importance of vegetation-linked habitats and these revegetated areas would also provide habitat for other fauna.

Livestock would be excluded from the Koala habitat/movement corridors, although the corridor trees and other vegetation would provide windbreaks and sun shade for nearby grazing animals. The increase in trees would also have a positive effect in reducing or preventing ground water table rise and related soil salinity issues. They would also add to the visual amenity of the Project Site.

4B.8.10 Cumulative Impacts

As there would be no permanent impact of the proposed development on threatened flora species, populations, endangered or critically endangered ecological communities or critical habitat, there would be no permanent cumulative impact on remnant native vegetation resulting from undertaking the proposed development.

4B.9 VISIBILITY

4B.9.1 Introduction

Based on the environmental risk analysis undertaken for the Project (Section 3.3 and **Table 3.5**), the potential environmental impacts on visual amenity requiring assessment and their unmitigated risk rating are as follows.

- Reduced amenity of the altered Project Site landform as a result of:
  - temporary disturbance to the landform (high risk);
  - marginally identifiable changes to landscape (high risk); and
  - highly identifiable changes to the landscape (high risk).
- Reduced effectiveness of the Siding Springs Observatory as a result of night time lighting (low risk).

The following subsections assess the existing visual amenity of the local setting, identify operational safeguards and mitigation measures and provide an assessment of the residual impacts following the implementation of these safeguards and mitigation measures.

4B.9.2 Existing Visual Amenity

4B.9.2.1 Introduction

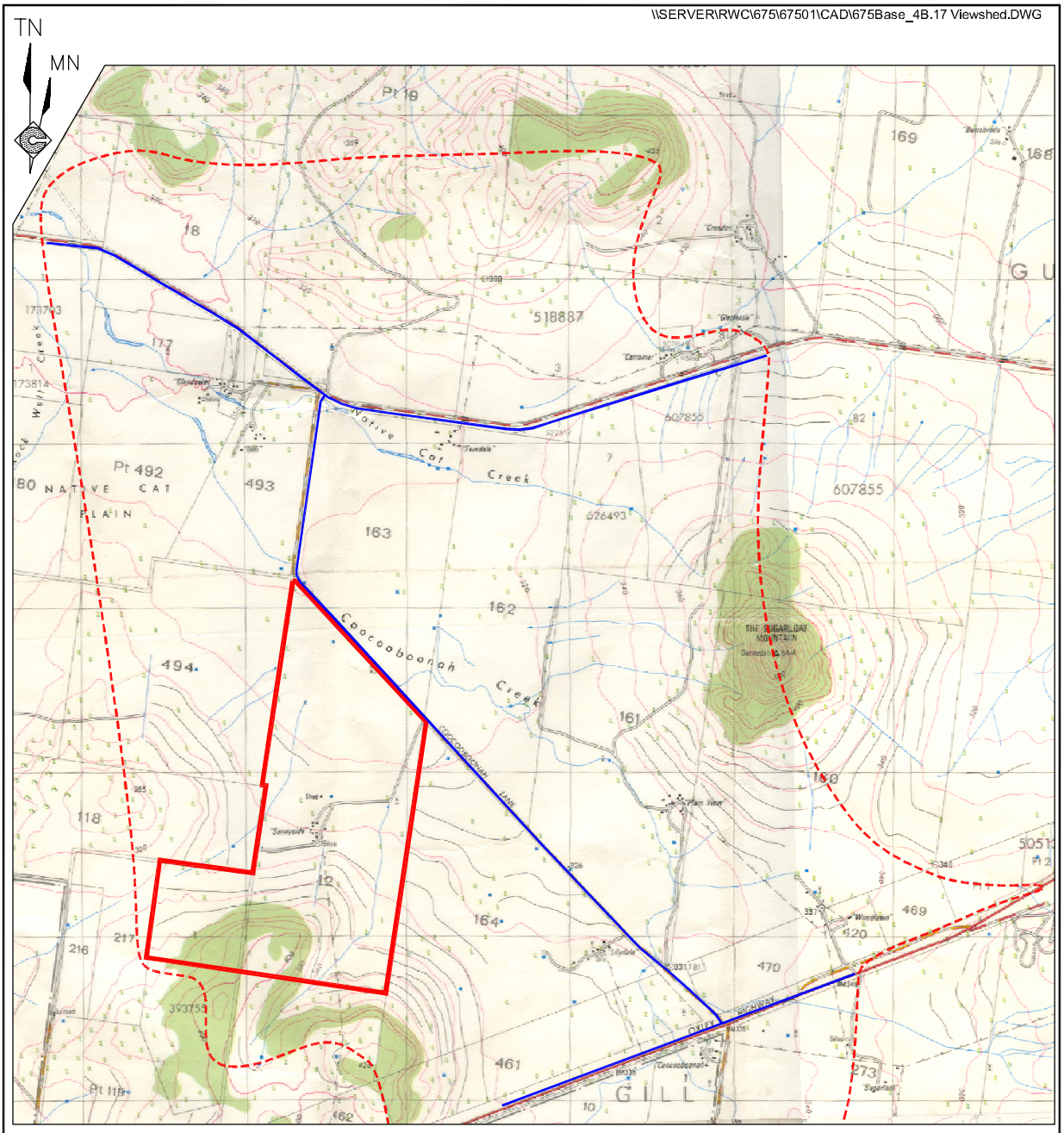
Existing visual amenity is considered in relation to views of the Project Site. The potential to view the site from local roads was determined together with a potential view shed boundary. The view shed boundary defines an area from which views of the Project Site are possible. The proposed coal transport route outside the vicinity of the Project Site would be along existing roads and consequently, has not been assessed for visual impact.

Figure 4B.17 presents the approximate view shed boundary for the Project Site and indicates the location on local roads from which the Project Site can be seen.

4B.9.2.2 Views of the Project Site

The existing topography of the local area, together with patches of trees tends to provide screening of close views of the Project Site. Clear views of the Project Site can be had from distances ranging from 500m to 5km. Beyond that distance, the views of the site tend to be obscured by topography or distance effects.

\\SERVER\RWC\675\67501\CAD\675Base_4B.17 Viewshed.DWG



REFERENCE
Project Site Boundary
Approximate Viewshed Boundary
Sunnyside Project Site Visible from these road Locations

SCALE 1:40 000

0.5 0 0.5 1.0 1.5 2.0 km

Base Map Source: Emerald Hill & Wondoba 1:25 000 Topographic Maps

Figure 4B.17
SUNNYSIDE VIEWSHED

Figure Prepared by R.W. Corkery & Co. Pty Ltd

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When travelling from Gunnedah on the Oxley Highway, the Project site is clearly visible from a section of the Highway adjacent to the Pyramid Hill approximately 5km to the east. The view is then screened by thick vegetation along the side of the highway until the access road into the "Woodlawn" property from where quite clear views of the Project Site occur. The Project Site can then be clearly seen until a ridge on the Lilydale property screens the view. This occurs approximately 1.4km west of the intersection with Coocooboonah Lane.

Due to the directional alignment of the Highway relative to the Project Site, the views of the Project Site would be less obvious for people travelling from Coonabarabran.

The Project Site is visible from all sections of Coocoobooonah Lane, although significant screening is provided by the remnant vegetation along the edge of the Lane.

Vehicles travelling from Gunnedah along Quia Road would be unable to see the Project Site until topping the ridge near the "Crendon" property to the northeast. The Project Site is clearly visible from Quia Road between this ridge and just beyond the Native Cat Creek crossing. Around the intersection of Coocooboonah Lane and Quia Road, views of the Project Site are screened by remnant vegetation and only occasional and filtered views can be had.

4B.9.3 Visual Controls

The remnant vegetation along local road easements offers natural screening of the proposed activities on the Project Site.

The following additional controls would be implemented.

- The Project Site would be progressively rehabilitated such that cleared or non-vegetated areas would be minimised. In particular, non-persistent cover crops would be sown immediately over areas to be rehabilitated prior to the establishment of the designated vegetation type.
- The overburden emplacement has been designed to replicate existing topographic features as much as possible. **Figure 2.6** illustrates the final landform of the emplacement.
- An amenity bund would be constructed around the coal processing area. This would provide visual and acoustic screening of the area. The location of the bund is shown on **Figure 2.1** with more detail on **Figure 2.11**.

The height of the 100t bin in the coal processing area has been restricted to ensure it is screened by the amenity bund.

Other more general safeguards and controls to be implemented would include:

- minimising the extent of land disturbance / clearing in advance of mining;
- progressive rehabilitation of all disturbed areas within the Project Site;
- implementation of air quality controls as identified in Section 4B.5; and
- maintaining the mine and associated areas of disturbance in a clean and tidy condition at all times.

Consideration has been given by NMPL to night-time light emissions which may affect surrounding residents and/or the Siding Spring Observatory at Coonabarabran. A maximum of four lighting plants would be used for night-time activities, ie. until 10:00pm, and would have a combined illumination of 2 320 000 lumens. This level of illumination would be unlikely to have any impact on the Observatory viewing conditions. The site lighting would have no impact on the Culgoora Observatory near Narrabri.

Floodlights would be positioned and directed to minimise emissions, with lighting not required at any given time not used. Where the use of floodlights is required in the open cut, on the overburden emplacement or within the coal handling and processing area, they would be directed downwards and away from the nearest Non-Project-related residences and public roads.

4B.9.4 Assessment of Impacts

It is acknowledged that occupants of residences within the Project Site view shed would have views of activities or disturbance on the Project Site. The views would range from clear to obstructed. It is also noted, however, that the Project Site lies within a rural landscape where areas of land are disturbed seasonally for agriculture-related purposes. Given NMPL's proposal to minimise the extent of surface disturbance in advance of mining and to implement progressive rehabilitation, together with the design features of the overburden emplacements to blend with the existing landform, the likely visual impact of the Project is assessed to be acceptable.

Notwithstanding the likely extent of visual impact, NMPL would maintain regular communications with those residents whose visual amenity is affected by the Project and implement any reasonable additional controls to further reduce the impact on their visual amenity.

The Project Site is located approximately 104km from the Siding Spring Observatory, and night time lighting would be limited to no more than four lighting plants, vehicle lights and building lighting. In addition, mining activity would no occur after 10:00pm, although maintenance work could occur around the clock as required. Consequently, the impact on the viewing conditions of the Observatory would be negligible and almost certainly immeasurable.

4B.10 SOILS AND LAND CAPABILITY

The soils and land capability assessment were undertaken by Geoff Cunningham Natural Resource Consultants (Cunningham). The full assessment is presented in Part 9 of the Specialist Consultant Studies Compendium, with the relevant information from the assessment summarised in the following subsections.

4B.10.1 Introduction

Based on the environmental risk analysis undertaken for the Project (Section 3.3 and **Table 3.5**), the potential soil impacts and changes to land capability and agricultural land suitability requiring assessment and their unmitigated risk ratings were as follows.

- Insufficient soil quantities for rehabilitation (medium risk).
- Temporary disturbance to soil (moderate risk).
- Degradation of soil quality (moderate risk).
- Elevated erosion or erosion potential (moderate risk).
- Decreased land and agricultural capability of the final landform (high risk).

The Director-General's requirements issued by the DoP require that the assessment of soils and land capability / agricultural land capability would refer to *Managing Urban Stormwater: Soils and Construction* (Landcom, 2004).

The assessment also provided sufficient detail to satisfy the Department of Primary Industries - Mineral Resources Mining Operations Plan guidelines and to satisfy the requirements of the Department of Natural Resources' specifications for soil surveys associated with proposed mining operations. The Project Site soils were characterised based upon 15 representative soil profiles as well as laboratory analyses of a selection of representative profiles and land capability of the "Sunnyside" property.

4B.10.2 Assessment Methodology

The Gunnedah District Soil Conservation Service Technical Manual shows three soil groups occurring in the area. These soils are Clay Loams with Red Clay Subsoils, Duplex and "Gravely" Soils; and Skeletal Soils.

The Clay Loams with Red Clay Subsoils are generally associated with Tertiary volcanics and gently undulating slopes. They are highly structured soils with a lower clay content in the surface horizons, weak horizon differentiation and a neutral to slightly alkaline reaction trend. Soil pH increases from about 6.5 at the surface to 7.5 deep in the subsoil. Occasional pH readings of 8.0 can be found at the base of the profile and a little carbonate may occur.

Duplex and "Gravely" Soils are associated with the ridges on Pilliga and Narrabeen Sandstones and the slopes of Middle Carboniferous sedimentary formations. The duplex soils exhibit a strong texture differentiation with an abrupt boundary between the A and B horizons. Normally a well developed bleached A2 horizon is present in the profile. The B horizon is usually blocky but may be columnar in structure. The A horizon is usually neutral to slightly acid in reaction while the B horizon is alkaline to strongly alkaline.

"Gravely" Soils are characterized by the presence of small rounded pebbles and gravely material throughout the profile. The surface soil is usually moderately thick and mildly acid to neutral in pH while the B horizons are alkaline with occasional carbonate nodules present.

Skeletal Soils are associated with steep topography. They lack horizon development apart from the presence of an A1 horizon. Their texture is usually related to the rock on which they are developed.

4B.10.3 Site Soils Information

Three Soil Mapping Units (SMU) were identified on and adjacent to the Project Site.

- SMU1 – occurs on upper slopes areas below the rocky scarp in the southern section of the proposed area to be mined.
- SMU2 – occurs on the mid- and lower slopes over the remainder or northern section of the Study Area.
- SMU3 – is associated with a small occurrence of endangered ecological community – Native Vegetation on Cracking Clay Soils of the Liverpool Plains - located on the eastern end of the proposed coal transport route on the "Plain View" property.

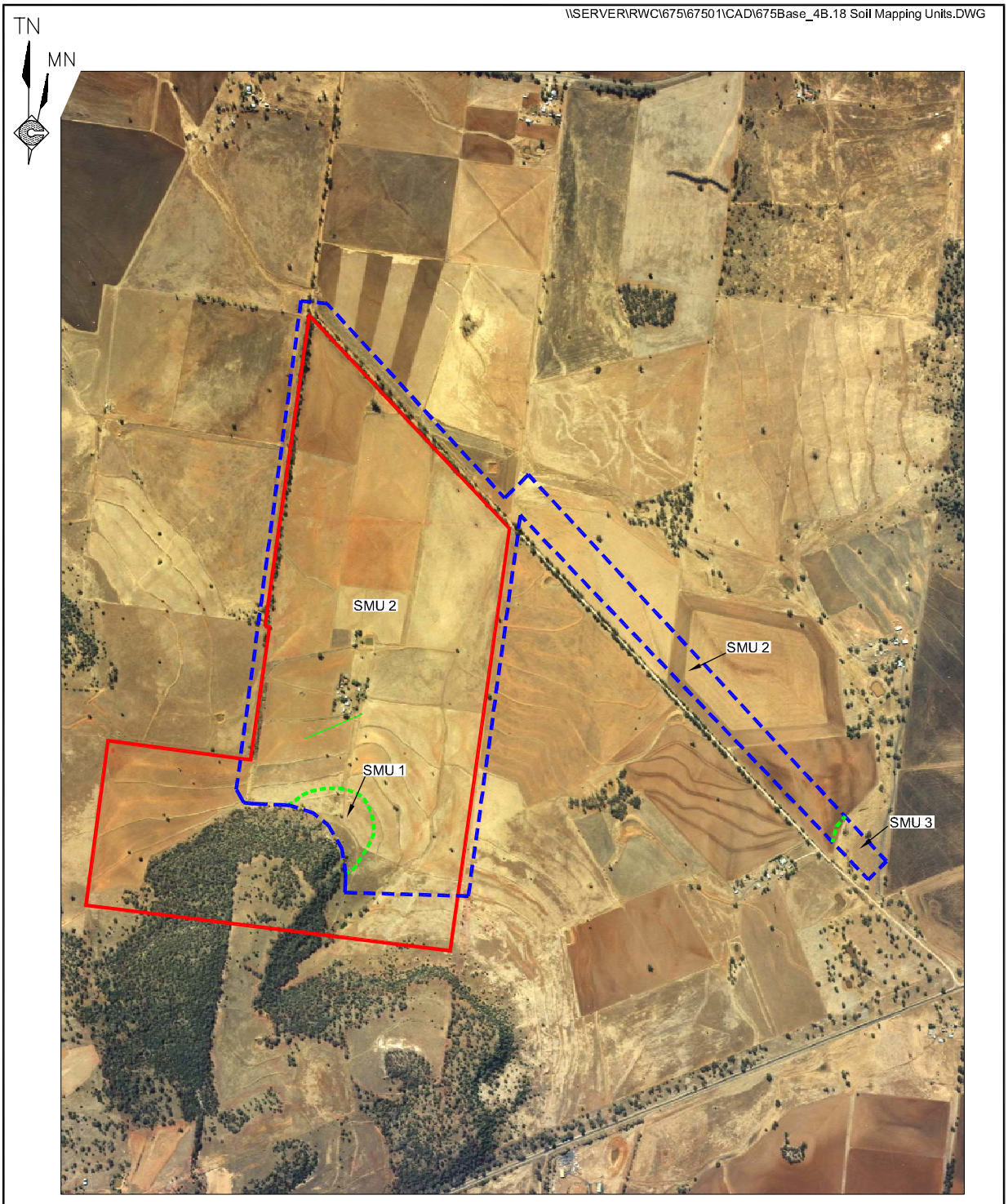
The locations of the boundaries of the three SMUs are shown in **Figure 4B.18**).

4B.10.3.1 Soil Physical Analyses

Table 4B.50 shows the results obtained from laboratory analysis of the samples from Pits 2, 7, 9 and 12.

The three tests (Particle Size Analysis, Dispersion %, Emerson Aggregate Test) carried out on samples from each of the horizons provide a good indication of the soil's likely behaviour in relation to the erosive forces.

\\SERVER\RWC\675\67501\CAD\675Base_4B.18 Soil Mapping Units.DWG



SCALE 1:25 000

250 0 250 500 750 1000 1250 m

Source: Geoff Cunningham Natural Resource Consultants (2007) - Figure 4

Figure 4B.18
SOIL MAPPING UNITS

Figure Prepared by R.W. Corkery & Co. Pty Ltd

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Table 4B.50
Physical Laboratory Analysis Data for Selected Soil Profiles
(Whole Soil Particle Size Analysis)

SMU / Pit No.	Layer	Texture (Fine Earth)#	Depth (Cm)	PSA % Clay	PSA % Silt	PSA % Fine Sand	PSA% Coarse Sand	PSA % Total Sand	PSA % Gravel
SMU 1 PIT 2	**1**	**loam**	**0-21**	13	11	37	23	60	16
	2	**clay**	**21-65**	33	6	11	17	28	33
	3	**loamy sand**	**65-145**	4	5	17	18	35	66
SMU 1 PIT 7	**1**	**loam**	**0-13**	19	18	42	17	59	4
	2	**clay**	**13-56**	47	13	28	12	40	<1
SMU 2 PIT 9	**1**	**loamy sand**	**0-18**	7	9	52	26	78	6
	2	**sandy clay loam**	**18-58**	17	4	28	15	43	36
	3	**clay**	**58-85**	42	9	37	11	48	1
	4	**clay loam**	**85-150**	29	9	44	12	56	6
	5	**clay loam**	**150-250**	21	12	30	12	42	25
SMU 2 PIT 12	**1**	**sandy loam**	**0-16**	20	10	50	20	70	<1
	2	**clay loam**	**16-80**	26	11	44	18	62	1
	3	**clay**	**80-170**	52	8	30	9	39	1
	4	**clay loam**	**170-250**	29	17	38	13	51	3

Note: PSA = Particle Size Analysis # texture based on laboratory measurements

Source: Geoff Cunningham Natural Resource Consultants Pty Ltd (2007) - Table 1

Particle Size Analysis

The Particle Size Analysis (PSA) test shows the amounts of gravel, clay, silt, fine sand and coarse sand contained within each sample. From **Table 4B.50**, it is evident that the topsoils in both SMUs contain relatively low levels of gravel and consequently the material is suitable for use in rehabilitation works.

The subsoils exhibited variable gravel contents with those from SMU 1 containing generally more gravel. Despite this higher gravel content, the subsoils are suitable for use in rehabilitation.

The texture class of each soil layer is determined by analysis of the material (fine earth fraction) that is less than 2mm in size – ie. the sample from each tested horizon with the gravel removed. The calculated texture of the fine earth fraction of each of the layers tested in the laboratory is shown in **Table 4B.51**.

Dispersion Percentage

The Dispersion Percentage (D%) test indicates the proportion of the soil material less than 0.005mm in size that would disperse on wetting. The D% values shown in **Table 4B.51** indicate that all of the topsoils analysed (both SMU 1 and SMU 2) showed a slight dispersibility.

Table 4B.51
Physical Laboratory Analysis Data for Selected Soil Profiles
(Whole Soil Particle Size Analysis)

SMU / Pit No.	Layer	Texture (Fine Earth)#	Depth (cm)	D%	D% Level of Dispersion	EAT	EAT Level of Dispersion
SMU 1 PIT 2	**1**	**loam**	**0-21**	10	slight	3(1)	Slight
	2	**clay**	**21-65**	20	slight	3(2)	Slight
	3	**loamy sand**	**65-145**	19	slight	3(1)	Slight
SMU 1 PIT 7	**1**	**loam**	**0-13**	14	slight	3(1)	Slight
	2	**clay**	**13-56**	12	slight	5	Slight
SMU 2 PIT 9	**1**	**loamy sand**	**0-18**	14	slight	3(1)	Slight
	2	**sandy clay loam**	**18-58**	21	slight	3(2)	Slight
	3	**clay**	**58-85**	13	slight	3(2)	Slight
	4	**clay loam**	**85-150**	34	moderate	2(1)	high to moderate
	5	**clay loam**	**150-250**	19	slight	2(1)	high to moderate
SMU 2 PIT 12	**1**	**sandy loam**	**0-16**	16	slight	3(2)	Slight
	2	**clay loam**	**16-80**	13	slight	3(2)	Slight
	3	**clay**	**80-170**	8	slight	3(2)	Slight
	4	**clay loam**	**170-250**	36	moderate	3(2)	Slight

Notes: D = Dispersion EAT = Emerson Aggregate Test # texture based on laboratory measurements

Source: Geoff Cunningham Natural Resource Consultants Pty Ltd (2007) - Table 1

The subsoil D% values for both SMUs were, for the most part, also in the slight dispersibility category. The exceptions were moderate values for the lower horizons in both profiles from SMU 2. This is material that would not have to be stripped to any degree and stockpiled for use in rehabilitation.

While the measured dispersibility values for both the topsoil and subsoil in both SMUs are low there is still a need for appropriate measures to be taken to protect the stockpiles of stripped soil. The stockpiled material, when respread, would be afforded rapid protection from soil erosion in the form of vegetative cover.

Emerson Aggregate Test

The Emerson Aggregate Test (EAT) provides a measure of the coherence of soil aggregates when they are immersed in water. The degree of soil aggregate stability increases from Class 1 through to Class 8. Classes 2 and 3 have a number of subclasses based on the degree of dispersion.

The EAT values shown in **Table 4B.51** indicate that all of the topsoils analysed from both SMU1 and SMU2 showed EAT values in the slight class. This indicates general soil stability.

The subsoil EAT values for both SMUs, with the exception of the two lowest horizons in Profile 9 (SMU2) were in the slight category. The high to moderate values for the two lower horizons in Profile 9 indicate considerably less stability. Given the depth at which this material occurs there should not be a need for it to be stripped to any degree and stockpiled for use in rehabilitation.

The measured EAT values for both the topsoil and subsoil in both SMUs are generally low. Nevertheless appropriate protective measures are required to ensure the protection of stockpile surfaces and areas where the material is respread to ensure that soil erosion does not occur.

4B.10.3.2 Soil Chemical Analyses

The results of the laboratory analyses and the field pH measurements are contained in **Table 4B.52**.

Table 4B.52
Physical Laboratory Analysis Data for Selected Soil Profiles

SMU / Pit No.	Layer	Texture (Fine Earth)#	Depth (cm)	pH *	EC (dS/m)#
SMU 1 PIT 2	**1**	**loam**	**0-21**	6.5	0.10
	2	**clay**	**21-65**	8.0	0.05
	3	**loamy sand**	**65-145**	8.5	0.06
SMU 1 PIT 7	**1**	**loam**	**0-13**	6.0	0.10
	2	**clay**	**13-56**	8.0	0.11
SMU 2 PIT 9	**1**	**loamy sand**	**0-18**	6.0	0.01
	2	**sandy clay loam**	**18-58**	6.0	<0.01
	3	**clay**	**58-85**	8.0	0.03
	4	**clay loam**	**85-150**	8.0	0.03
	5	**clay loam**	**150-250**	8.0	0.03
SMU 2 PIT 12	1	**sandy loam**	**0-16**	5.5	0.01
	2	**clay loam**	**16-80**	8.0	0.03
	3	**clay**	**80-170**	8.0	0.03
	4	**clay loam**	**170-250**	8.0	0.02
# texture and EC based on laboratory measurements * pH based on field measurements					
Source: Geoff Cunningham Natural Resource Consultants Pty Ltd (2007) - Table 2					

The pH 6.0 to 6.5 range is usually regarded as the optimum for growth of most plants and there are some more serious impacts on the growth of many species at the lower, or acid, end of the range.

Table 4B.52 indicates that both of the topsoil samples tested showed pH levels within the 4.0 to 8.5 range. The subsoil values of the two profiles from both SMUs were also within this acceptable range. This is also generally the case for the topsoils and subsoils of the profiles that were not subjected to laboratory analysis but were tested in the field.

Soil salinity is a measure of the presence of water-soluble salts, mainly of sodium, calcium and magnesium in the soil solution. These salts may be chlorides, sulphates or carbonates and can have a major impact on plant growth if they occur in sufficiently large quantities.

Table 4B.53 shows the calculated EC_e values for the samples analysed in the laboratory and shows the salinity status of the various horizons based on these EC_e values. The data in **Table 4B.53** indicate that topsoils and subsoils in all tested profiles are non-saline.

Table 4B.53
Calculated EC_e Values and Salinity Status for Selected Soil Profiles

SMU / Pit No.	Layer	Texture (Fine Earth)#	Depth (cm)	Calculated EC_e	Soil Salinity Status
SMU 1 PIT 2	1	loam	0-21	0.95	non-saline
	2	clay	21-65	0.29	non-saline
	3	loamy sand	65-145	0.14	non-saline
SMU 1 PIT 7	1	loam	0-13	0.95	non-saline
	2	clay	13-56	0.64	non-saline
SMU 2 PIT 9	1	loamy sand	0-18	0.23	non-saline
	2	sandy clay loam	18-58	0	non-saline
	3	clay	58-85	0.23	non-saline
	4	clay loam	85-150	0.17	non-saline
	5	clay loam	150-250	0.26	non-saline
SMU 2 PIT 12	1	sandy loam	0-16	0.14	non-saline
	2	clay loam	16-80	0.26	non-saline
	3	clay	80-170	0.17	non-saline
	4	clay loam	170-250	0.17	non-saline
# EC based on laboratory measurements					
Source: Geoff Cunningham Natural Resource Consultants Pty Ltd (2007) - Table 6					

4B.10.3.3 Erosion Potential

The soils within and adjacent to the Project Site are currently generally stable except for some areas of sheet erosion on the slopes and some gully erosion in the main drainage lines and tracks.

The more sloping sections of the "Sunnyside" property have been protected in the past by soil conservation graded bank and waterway systems. These would be retained on areas that are not subject to disturbance with appropriate modifications as necessary.

Groundcover varies over the site, but there is generally a reasonable groundcover present. It would be essential, if erosion is to be prevented, to maintain an adequate groundcover on the existing landscape, on any stockpiles during the proposed mining and on the reformed landscapes after rehabilitation work is carried out.

The design services provided by the Soil Conservation Service would be utilized to ensure that any disturbance of the existing soil conservation works does not predispose the landscape to erosion and that the post-mining landscape is adequately protected.

The SOILOSS computer program computes soil loss values for a given site under various land uses and climatic (rainfall) conditions and so provides an indication of erosion hazard. Data from the representative soil samples for each SMU were analysed using the SOILOSS computer program to determine erosion hazard. The program indicated that the majority of soils have a moderate erodibility.

Cunningham (2007) recommended that because of this moderate erodibility, as assessed by the SOILOSS analysis and field observations, the SMUs would be managed carefully during the stripping and rehabilitation stages to ensure that soil structure damage is minimal and that they are suitably protected by vegetation or some other medium at all times.

4B.10.4 Handling Soil Material

Management procedures for both topsoil and subsoil are described in Section 2.3.3 and are summarised as follows.

- Topsoil from each SMU would be stripped to a depth of 15cm. There is no requirement to stockpile the different soil types separately. During the first 12 to 18 months of mine operations, topsoil would be stockpiled for later retrieval and spreading over specific areas. Beyond this initial period, it is proposed that the Project Site topsoil would typically be directly transferred onto sections of the final landform.
- Subsoil from each SMU would be stripped to a depth of 50cm below the topsoil and there would be no requirement to stockpile the different soil types separately. The subsoil would be available for respreading as areas become available for rehabilitation.
- Further subsoil to bedrock would be stripped and generally each SMU would be segregated. The higher alkalinity soils would be placed over the surface of the overburden emplacement to provide neutralising capacity in the event pockets of acid forming rock are encountered. Installing erosion protection around stockpiles of this material would be a priority given the higher erosion potential with direct transfer from source to sink commenced as soon as practicable.

- Topsoil stockpiles would not exceed 2m in height and, where practical, be maintained as windrows in preference to larger structures. The placement of these stockpiles would reflect the likely destination of the soil on the final landform. To assist in the maintenance of the biological viability of the soil all stockpiles would be sown with stabilising species as soon as possible after placement and watered, if necessary to encourage vegetative cover. When stockpile construction is conducted in stages, the stockpiles would be progressively rehabilitated.
- Subsoil stockpiles would generally not exceed 3m in height and would typically be placed in larger stockpiles than the topsoil.
- An inventory of soil resources present on the Project Site, ie. both in stockpiles and awaiting stripping, would be maintained and regularly reconciled with rehabilitation requirements.
- Water management structures would be utilised to divert surface water flow away from soil stockpile areas, thereby reducing the potential for erosion. Additionally, silt-stop fencing or similar would be placed immediately downslope of stockpiles where required, until stable vegetation cover is established.

4B.10.5 Impact Assessment

Analyses of the physical and chemical attributes of the soil to be stripped, stockpiled and respread indicate that the soils have a texture and pH levels generally suitable for plant growth, but display moderate erosion potential. By adopting the soil management controls presented in Section 2.3.3 and Section 4B.10.4, there would be minimal impact as a consequence physical or chemical alteration and/or loss of biological activity. Erosion from soil stockpiles or rehabilitated surfaces would be monitored throughout the life of the Project with remedial works undertaken should erosion be observed.

4B.10.6 Land Capability and Agricultural Land Suitability

The Soil Conservation Service of NSW developed a land capability classification system based on the management and protection needs of different types of land. The 1: 100 000 scale Land Capability map of the Boggabri map sheet area prepared by the Soil Conservation Service shows the Study Area mapped mainly as Class II (lower slopes) and Class III (mid-slopes) with an area of Class IV land associated with the scarp adjacent to the southern boundary of the proposed open cut mine.

Class II land is land suitable for regular cultivation. Soil conservation practices such as strip cropping, conservation tillage and adequate crop rotation would be used.

Class III land is sloping land suitable for cropping on a rotational basis. Structural soil conservation works such as graded banks, waterways and diversion banks, together with soil conservation practices such as conservation tillage and adequate crop rotations are required.

Class IV land is land not capable of being regularly cultivated but suitable for grazing with occasional cultivation and requiring soil conservation practices such as pasture improvement, application of fertilizer and minimal cultivation for the establishment or re-establishment of permanent pasture

After field assessments during the soil survey, Cunningham (2007) noted that it was evident that the areas delineated as Class II and Class III land had been correctly identified. However, the area of Class IV land is more correctly classed as Class VII land. Class VII land is land best protected by green timber. It generally comprises areas of steep slopes, shallow soils and/or rock outcrop. Adequate ground protection must be maintained by limiting grazing and minimising damage by fire.

Figure 4B.19 shows the boundaries of these land capability classes.

The NSW Department of Primary Industries (Agriculture) has classified the lands of the Study Area using its agricultural land suitability system.

The mapped agricultural suitability of the lands indicates the presence of Class 2, Class 3 and Class 4 (Agricultural Suitability) lands. The area comprises mainly Class 2 land with minor areas of Classes 3 and 4.

Class 2 land is arable land suitable for regular cultivation for crops but not suited to continuous cultivation. It has a moderate to high suitability for agriculture but edaphic (soil factors) or environmental constraints reduce the overall level of production and may limit the cropping phase to a rotation with sown pastures.

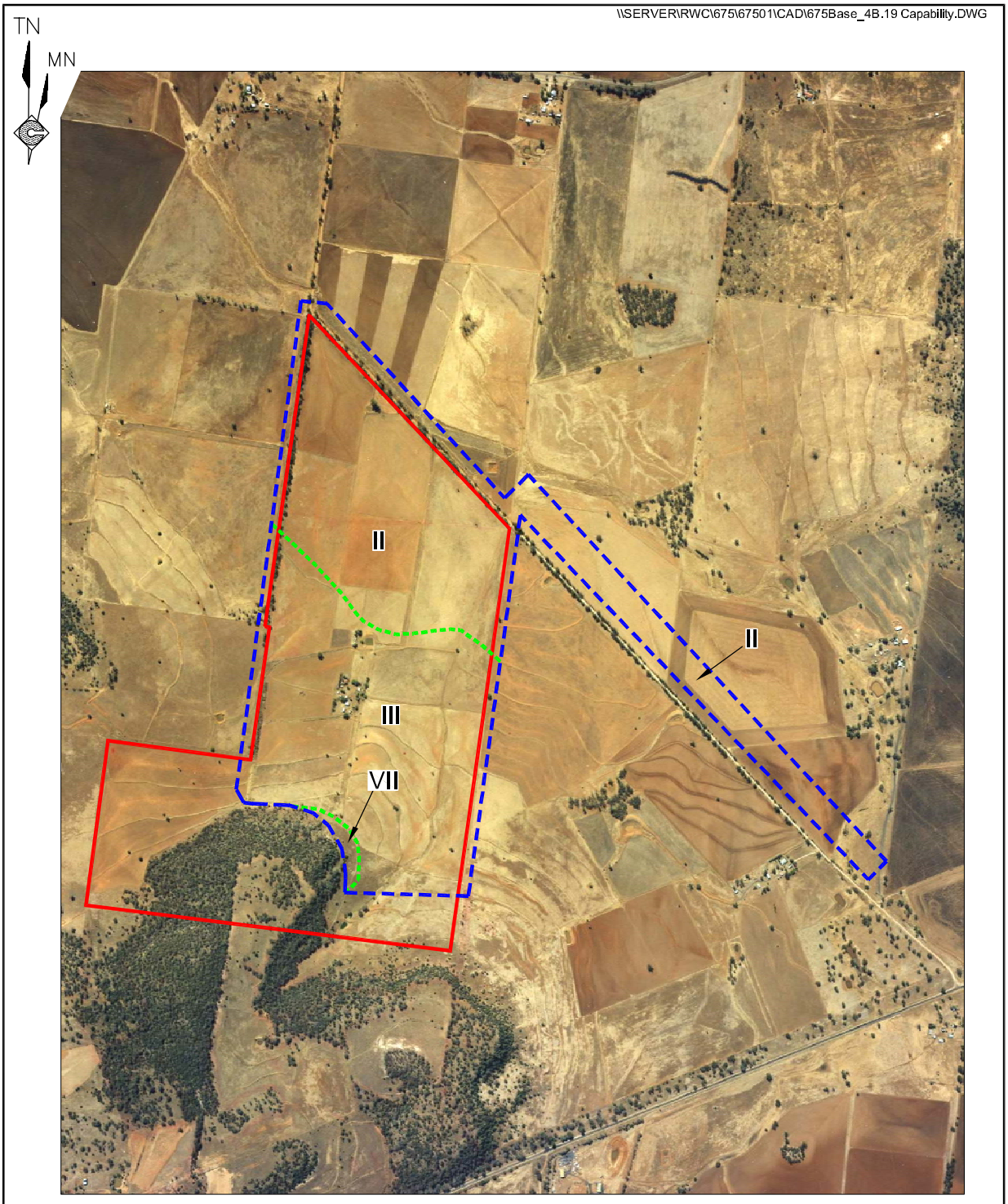
Class 3 land is grazing land that is well suited to pasture improvement. It may be cultivated or cropped in rotation with pasture. The overall level of production is moderate as a result of edaphic (soil related) or environmental constraints. Erosion hazard or soil structural breakdown limit the frequency of ground disturbance, and conservation or drainage works may be required.

Class 4 land is land suitable for grazing but not for cultivation. Agriculture is based on native pastures established using minimum tillage techniques. Production may be high seasonally but the overall level of production is low as a result of a number of major constraints, both environmental and edaphic (soil related).

Cunningham (2007) notes that the NSW Department of Primary Industries (Agriculture) assessment of the agricultural land suitability of the Study Area is generally correct, although the area of Class 4 land associated with the scarp near the southern boundary of the mine pit should be classed as Class 5 land.

Class 5 land is land unsuitable for agriculture or at best suited only to light grazing. Agricultural production is very low to zero as a result of severe constraints, including economic factors, which preclude improvement.

\\SERVER\RWC\675\67501\CAD\675Base_4B.19 Capability.DWG



Source: Geoff Cunningham Natural Resource Consultants (2007) - Figure 5

Figure Prepared by R.W. Corkery & Co. Pty Ltd

Figure 4B.19
PRE-MINING LAND CAPABILITY

Figure 4B.20 shows the boundaries of the pre-mining agricultural land suitability classes.

4B.10.7 Assessment of Impacts

4B.10.7.1 Project Site Impacts

Figure 4B.21 shows the post-mining land capability classification after rehabilitation. **Figure 4B.22** shows the post-mining agricultural land suitability classification after rehabilitation.

Table 4B.54 summarises the respective areas of pre-mining and post-mining land capability and agricultural land suitability. The flat sections on the top of the out-of-pit emplacement would be covered with approximately 105cm of subsoil and 15cm of topsoil. This would enable the land to be cultivated on a rotational basis. Access to the flat top section would be achieved via rock flume wide enough for that purpose.

Table 4B.54
Pre-Mining and Post Mining

Land Capability			Agricultural Land Suitability		
Class	**Pre-Mining**	**Post Mining**	**Class**	**Pre-Mining**	**Post Mining**
II	70.4	71.8	2	158.7	115.2
III	90.7	53.1	3	3.0	11.4
IV	0	0	4	0	16.7
V	0	0	5	1.2	19.8
VI	0	16.7			
VII	2.0	3.1			
VIII	0	18.4			

Following rehabilitation, there would be five main landforms across the Project Site.

(i) The backfilled open cut pit area with contours and grades similar to those which existed pre-mining (covering approximately 50% of the area mined).

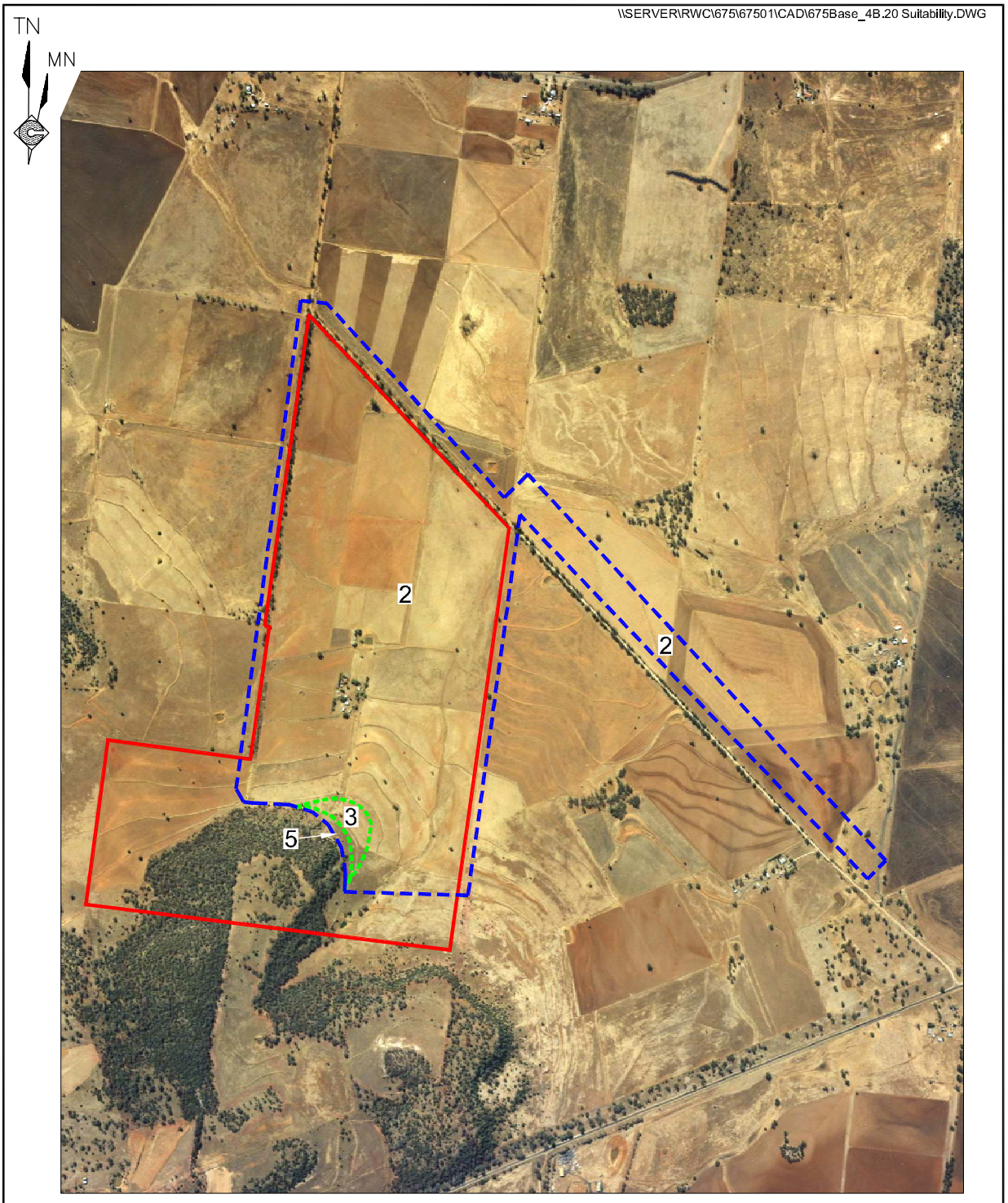
(ii) The depression representing the re-shaped final void (also covering approximately 50% of the area mined).

(iii) The mounded area created by the out-of-pit emplacement of overburden.

(iv) The shallow raised area formed by re-profiling the 15m amenity bund across the coal processing area.

(v) Those areas relatively undisturbed during the mining process which would be readily returned to agricultural use.

\\SERVER\RWC\675\67501\CAD\675Base_4B.20 Suitability.DWG



Source: Geoff Cunningham Natural Resource Consultants (2007) - Figure 6

Figure Prepared by R.W. Corkery & Co. Pty Ltd

Figure 4B.20
PRE-MINING AGRICULTURAL LAND SUITABILITY

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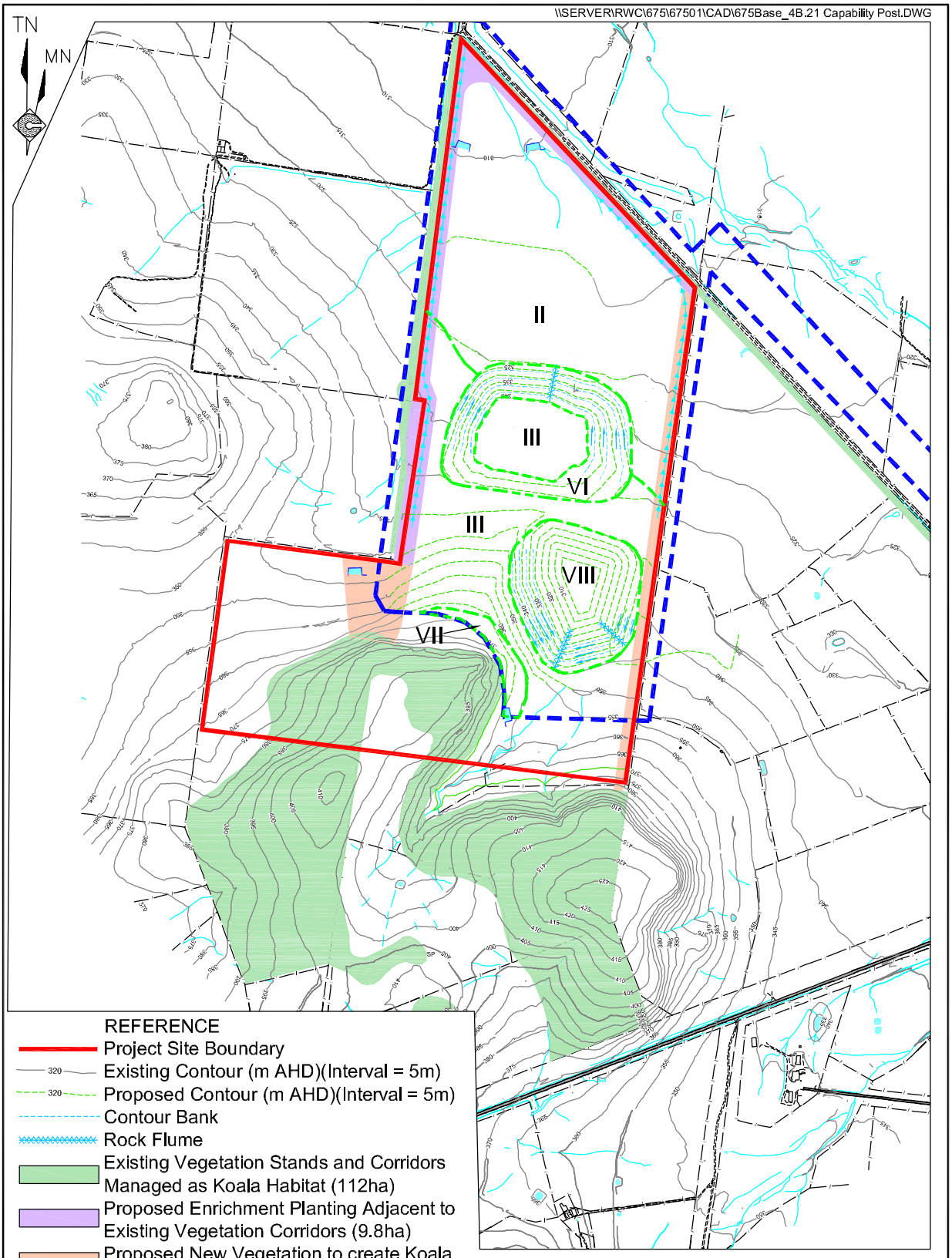

Figure 4B.21
POST-MINING LAND CAPABILITY

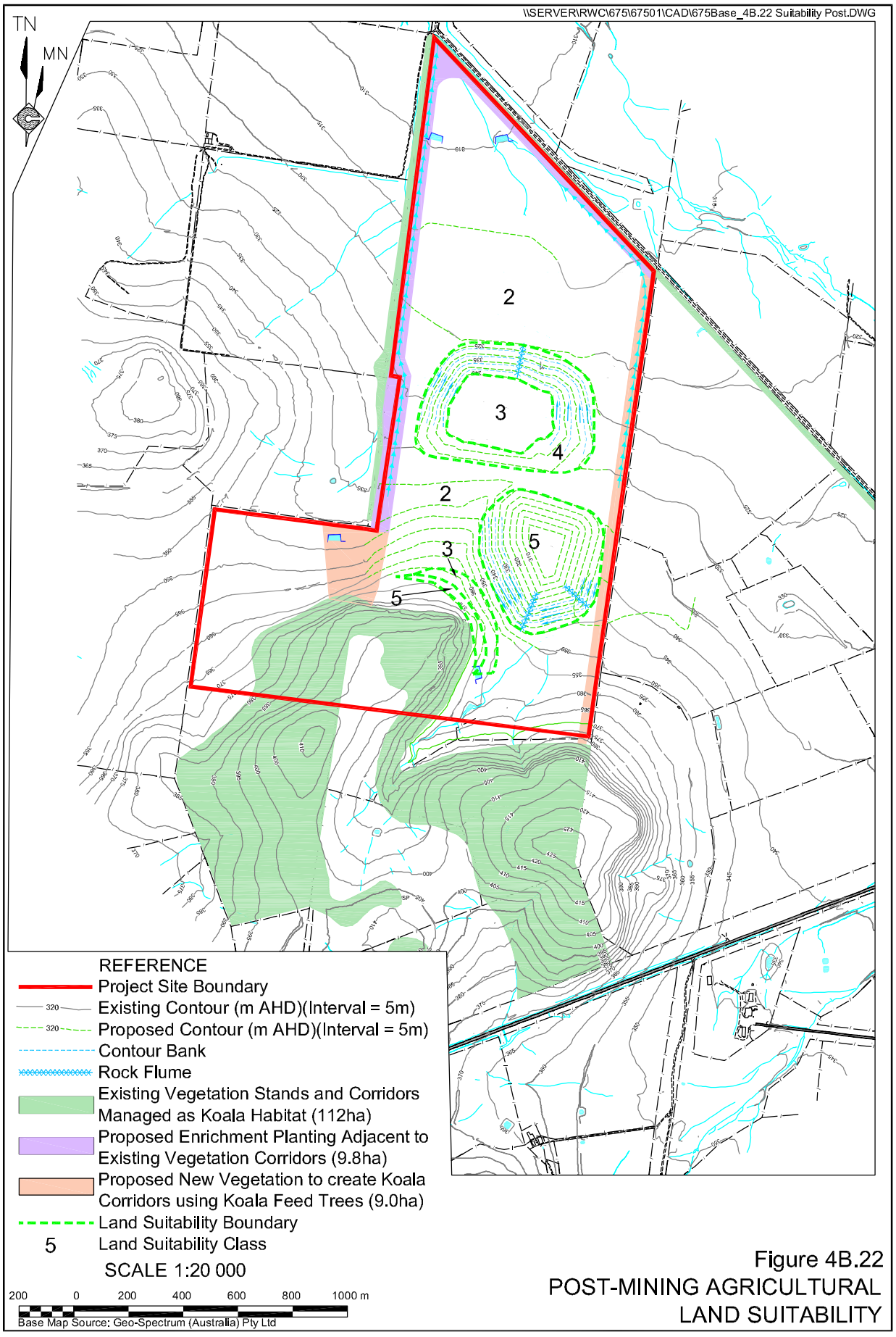

Figure 4B.22
POST-MINING AGRICULTURAL LAND SUITABILITY

Approximately 50% of the backfilled open cut pit area would have land capability and agricultural land suitability similar to pre-mining levels.

The mounded area covering approximately 25.4ha would have land capability classifications of Class III (8.7ha) and Class VI (16.7ha). Class III land is *sloping land suitable for cropping on a rotational basis. Structural soil conservation works such as graded banks, waterways and diversion banks together with soil conservation practices such as conservation tillage and adequate crop rotations are required.* Class VI land is *land not suitable for cultivation, but suitable for grazing with use of soil conservation practices such as limitation of stock, broadcasting of seed and fertilizer, fire prevention and destruction of feral animals.*

The mounded area would have an agricultural land suitability classification of Class 3 (8.7ha) and Class 4 (16.7ha). Class 3 land is *grazing land that is well suited to pasture improvement. It may be cultivated or cropped in rotation with pasture*. Class 4 land is *suitable for grazing but not for cultivation. Agriculture is based on native pastures established using minimum tillage techniques*.

The depression located within the final void covering approximately 18.4ha would have a land capability classification of Class VIII. Class VIII land *includes cliffs, lakes and swamps and other lands incapable of sustaining agricultural or pastoral production*.

The depression would have an agricultural land suitability classification of Class 5. Class 5 is *land unsuitable for agriculture or at best suited only to light grazing. Agricultural production, if any, is low due to major environmental constraints*. There would be approximately 19.8ha of Class 5 land at the conclusion of rehabilitation.

There would be approximately 3.1ha of Class VII at the conclusion of the Project. Class VII land is *land best protected by green timber. It generally comprises areas of steep slopes, shallow soils and / or rock outcrop. Adequate ground protection must be maintained by limiting grazing and minimising damage by fire*.

4B.10.7.2 Regional Impacts

The Namoi Catchment Management Board has established targets to be achieved within the Namoi River Catchment with reference to soils (NCMB, 2003). The Project has been assessed against the following three targets.

- *Target S.1 - Land capability*

  By 2010 increase the percentage of resource managers using land within its capability throughout the catchment to 60% and an area of 18 600km^2 and in identified hazard areas to increase the adoption rate to 80%.

Throughout the life of the Project, all land which is not to be disturbed would be fenced off to enable ongoing grazing and rotational cropping which is well within the land's capability.

- *Target S.2 - Property plans*

  Increase the percentage of resource managers implementing integrated property management plans on their property from 5% to at least 20% by 2010.

  This has not been considered as part of the Project. NMPL's emphasis on rehabilitating the areas of disturbance on the Project Site to accommodate both agriculture and Koala habitat/nature conservation illustrates a commitment to integrated property management particularly where the emphasis is placed upon tree growth to limit dryland salinity production.

- *Target S.3 - Conservation farming*

  Increase the percentage of landholders using conservation farming practices (minimum/no till cropping, crop and pasture rotation, sustainable stock management, stubble retention and soil/water conservation works) from 25% to at least 75% by 2010.

  NMPL's intention to return the disturbed area back to agricultural uses would be undertaken with recognition of conservation farming practices.

4B.11 BUSHFIRE HAZARD

4B.11.1 Existing Bushfire Hazard

Table 2.1 in the NSW Rural Fire Service publication *"Planning for Bushfire Protection, 2006"* identifies the development control process for developments in bushfire prone areas.

Where development is assessed in accordance with Part 3A of the EPA Act, the Department of Planning, in conjunction with the NSW Rural Fire Service, reviews the Project in relation to bushfire protection measures.

Much of the Project Site has been cleared for agricultural activities and would be expected to exhibit a low bushfire hazard. The vegetation along and adjacent to the proposed coal transport route comprises a mixture of cleared areas and small patches of native woodland vegetation.

Areas like the Project Site and proposed coal transport route should not be considered in isolation as the bushfire risk of surrounding areas may raise the level of bushfire risk associated with the site. The vegetation of land surrounding the proposed coal transport route is predominantly cleared for agriculture and is therefore likely, if anything, to decrease bushfire risk.

4B.11.2 Safeguards and Controls

The activities of the Project that may increase the risk of fire on the Project Site and proposed coal transport route, and the controls proposed to limit the risk posed by these are presented in **Table 4B.55**.

Table 4B.55
Bushfire Hazard – Activities and Controls

Activity	Possible Ignition Source	Safeguards and/or Controls
Blasting	• Coal dust • Ejected Shot	• Clear vegetation away from blast (>20m). • Remove all coal from open cut around blast. • Blast design to be undertaken by qualified personnel. • Inspection of blast conducted prior to blast. • Blast Management Plan to be prepared and followed. • Water truck available to douse any smouldering vegetation etc.
Refuelling	• Spilt fuel ignited by spark	• Refuelling undertaken within designated fuel bays or within cleared area of the Project Site. • Vehicles to be turned off during refuelling. • No smoking policy to be enforced in designated areas of the Project Site. • Fire extinguishers maintained within site vehicles.
Product Stockpiling	• Spontaneous Combustion	• The coal has a propensity for spontaneous combustion. • Stockpiles to be regularly inspected and watered. • Stockpile height and volume to be controlled to limit the duration coal retained in stockpiles.
General Activities	• Cigarette • Rubbish, eg. glass, metal.	• No smoking policy to be enforced in designated areas of the Project Site. • Focus on housekeeping to be maintained by mine management. • Water cart available to assist in extinguishing any fire ignited. • Site vehicles to carry a fire extinguisher.

4B.11.3 Assessment of Impact

The Project would undoubtedly increase the number and type of ignition sources in the local area. The proposed controls and safeguards, in conjunction with general clearing activities associated with the mining activities would, however, ensure that a low bushfire hazard was maintained on the Project Site and along the proposed coal transport route.

4B.12 SOCIO-ECONOMIC SETTING

A social assessment for the East Boggabri Project was undertaken by Key Insights Pty Ltd in 2005. The social assessment described the socio-economic environment in both Gunnedah and Narrabri Shires and, due to the low levels of predicted population change resulting from the Project, provides a suitable basis for the assessment of the Sunnyside Coal Project. This subsection draws upon the East Boggabri findings to provide a socio-economic assessment for the Sunnyside Project. Relevant information from the assessment is summarised in the following subsections.

4B.12.1 Introduction

Based on the environmental risk analysis undertaken for the Project (Section 3.3 and **Table 3.5**), the potential environmental socio-economic impacts requiring assessment and their unmitigated risk rating are as follows.

- Alteration of social activities or employment due to employment generation and capital expenditure (no risk rating).
- Actual or perceived reduction in quality of life (moderate risk).
- Reduced property values (moderate to high risk).

In addition, the Director-General's requirements issued by the DoP require that the assessment of socio-economic impacts make particular reference to any increased demand for infrastructure and services.

4B.12.2 Background

The proposed Sunnyside Coal Project is located within a regional and rural setting in central northern NSW which, like many other regional areas, has been in relative decline in socio-economic terms over the past twenty years. Recent demographic trends in Australia have demonstrated acceleration in the trend to the "move to the coast" phenomenon, or to large community centres, placing considerable stress and change on areas in decline.

Regional areas are often sensitive to employment loss where the economic support for villages and towns can be relatively single dimensional, ie. dominated by a single industry or even a single employer. Technology change, industry reform and rationalisation have led to closure of many regional businesses including key employers and economic drivers in a region.

In recent times, the reintroduction of a viable coal mining industry in the Gunnedah local government area has provided welcome diversification of industry, employment generation and skills provision. In this context, the Project has the potential to maintain and increase the economic drive provided by this industry.

However, the structure within the town likely to benefit from the development and operation of the Project, ie. Gunnedah, may be tested in terms of the social structure and the employment and housing capacity. To assess the potential positive implications of the Project, the proportional distribution of these impacts, as well as the possible negative socio-economic impacts associated with any added strain on infrastructure capacity, this subsection builds on the results of a previous socio-economic study completed by Key Insights Pty Ltd (social impact assessment) and Castlecrest Consulting (economic impact assessment) for a similar scale coal mine development (the East Boggabri Coal Mine) in 2005 (Key Insights – Castlecrest, 2005).

4B.12.3 Method

The socio-economic assessment was undertaken in phases. The first phase involved an analysis of the Key Insights – Castlecrest (2005) social and economic assessment in order to obtain a general understanding of the local setting, social issues of greatest concern and community views/opinions on mining.

Phase 2 involved more detailed qualitative research of those social issues identified by the Phase 1 assessment to be of greatest significance to local stakeholders, namely:

(i) housing;

(ii) education;

(iii) industry diversification;

(iv) employment opportunities; and

(v) community services and facilities.

4B.12.4 Results

4B.12.4.1 Phase 1 - Literature Review

Key Insights – Castlecrest (2005) identified the following in relation to the local setting and socio-economic issues of greatest concern.

(i) The Narrabri/Gunnedah regions have been experiencing declining populations over recent decades.

(ii) There had been net out-migration from rural areas, especially as a result of young people moving to regional centres in search of further work and educational opportunities.

(iii) There is generally wide community support for mining in the area. Residents apparently welcomed the economic and employment benefits that would flow through to the areas as a result of expanded mining activity.

(iv) The communities saw mining as a positive way to achieve population growth and much needed diversity to the local economy.

(v) Housing supply concerns were raised with separate houses being the overwhelmingly dominant form of housing in the area. While there is land that would accommodate population increase in Gunnedah, an influx of new workers may provide short-term stress on the market.

(vi) The Narrabri and Gunnedah economies are primarily driven by agriculture and subsequently, the labour market and skills pool are not particularly deep. The labour market is quite tight in the areas of professionals and skilled trades. The development and operation of the Whitehaven and Tarrawonga Coal Mines in the region has provided increased opportunities for the necessary skills to be attained through employment direct or ancillary to these mines, however, it still might be necessary to import a proportion of the workforce, notably those with highly developed, mining-related skills.

(vii) There may be some transfer of workers from the agriculture sector to the better paid mining sector, however, high levels of youth unemployment suggest a considerable pool of young workers, who would be available to engage in low-skill jobs or participate in structured training.

4B.12.4.2 Phase 2 - Qualitative Research

4B.12.4.2.1 Existing Services and Facilities

The following information on existing services and facilities has been taken from (Key Insights – Castlecrest, 2005) and has been confirmed by NMPL's Community Liaison Officer and discussions with a Planning Officer from Gunnedah Shire Council.

Educational Facilities and Services

Gunnedah is serviced by four primary schools: 2 State schools, 1 Catholic and 1 Christian Community School. There are also two high schools in Gunnedah, a State School and a Catholic High School, St Mary's College. Gunnedah is served by a range of childcare centres and preschools. Gunnedah TAFE operates from Hunter Street, providing a range of State-approved courses, and local content. It is most likely that Gunnedah TAFE would benefit from mining growth in the region and is likely to provide flexible delivery options to new and young workers.

The nearest university is the University of New England, which has a campus in Armidale.

Healthcare Facilities and Services

Gunnedah has a 50 bed capacity hospital which provides a high standard of general medical and surgical services including a Slow Stream Rehabilitation Unit, a day surgery care facility, a Public Health Dental Clinic and a Physiotherapy Unit. A range of additional healthcare services including but not limited to mental health, drug and alcohol, dental, family health and speech therapy are provide by the Gunnedah Community Health Service.

Other healthcare facilities are available in Gunnedah include the following.

- The Gunnedah Nursing Home has 58 nursing home places. The Alkira has 32 hostel places and McAuley Aged care has 22 hostel places. Yalambi has 13 units. The Frail Aged hostel provides 24 hour-a-day care.
- NSW Ambulance.
- Baby health centre.
- X-ray facilities.
- Pathology services.

General Facilities and Services

Gunnedah, as a larger regional centre, provides numerous sporting and recreational clubs, sporting grounds and facilities, restaurants, retail facilities and several franchises.

Gunnedah is attractive to business because of its rail and road transport links. There is an airport at Gunnedah, although regular commercial services to Sydney are available from Tamworth. A focal point for activity of a cultural nature within Gunnedah and surrounding areas is the Gunnedah Cultural Centre. It includes the Civic Theatre, which houses new cinema/theatre facilities. Also included are the original town hall and the creative arts centre. The creative arts centre displays the Shire's art collection. Gunnedah also has a swimming centre which includes a 50m Olympic pool, 25m indoor heated pool, children's wading pool, kiosk and BBQ facilities.

Gunnedah has the following business and industry groups.

- Gunnedah and District Chamber of Commerce and Industry.
- Gunnedah Stock and Station Agents Association.
- New South Wales Farmers Association.
- Tourism Gunnedah (Gunnedah Visitors Information Centre).
- Gunnedah District Unlimited. (Main Street Program).

4B.12.4.2.2 Local Capacity: Demand and Supply

As indicated in Section 4B.12.4.2.1, the Gunnedah Shire is well serviced by a range of clubs, service organisations, facilities and government services and has high levels of social capital.

Key Insights (2006) prepared a profile of the current demand placed on local services such as health and education. This assessment builds on this profile and attempts to quantify the subsequent extra demand placed on local services as a result of new residents being drawn to the area as a result of employment, or employment of an immediate family member. While the estimates on changes in demand for 'soft' infrastructure such as access to education and health services are purposefully provided as indicative only, they provide a basis for assessing the potential impact on the ability of Gunnedah and surrounding communities to manage any potential population increase.

Existing Supply and Demand

(i) Gunnedah is serviced by 4 primary schools and 2 high schools. In 2001[1], there were reportedly, 819 primary school children and 580 high school aged students, most of whom were presumably attending a local school (ABS, 2001).

(ii) Varying over time, Gunnedah is serviced by between 5 and 6 general practitioners, providing a FTE GP Ratio of around 1:1 400. This is generally higher than optimal, however, is generally within the range considered adequate.

(iii) Additional 'soft' infrastructure such as clubs and sporting groups are well represented as indicated in Section 4B.12.4.2.1.

Gunnedah Developments Present and Proposed

Table 4B.56 lists existing and proposed major developments in the Gunnedah area. This list was prepared by NMPL from publicly available information (primarily from Gunnedah Shire Council) and reflects the situation in March 2007.

The list indicates that Gunnedah is experiencing a solid growth considering the difficult times being experienced in the agricultural industry. There is substantial investment in the region which is based on expected growth in the mining industry throughout the Gunnedah area. The economy is responding to this stimulation and is demonstrating an ability to accommodate the projected growth. The existing and proposed developments do not only include mining projects, but also include land and industrial subdivision, energy provision, commercial and shopping developments.

[1] 2006 Census data was unavailable at the time of writing.

Table 4B.56
Summary of Present and Proposed Developments in the Gunnedah Area (March 2007)

DEVELOPMENT	DETAILS
Central Ranges Natural Gas. Tamworth – Dubbo Line	• Constructed from Tamworth to Dubbo and opened August 2006. • Breeza-Gunnedah lateral is proposed (subject to the Gunnedah ethanol project). • Would bring considerable energy price savings to existing industry and assist in attracting further industry to town.
Eastern Star Gas	• Fields in Pilliga region. • Electricity generation for Narrabri commenced in July 2005. • Other fields to be investigated towards Coonabarabran.
Hunter – Queensland Gas Pipeline.	• From Wallumbilla (Qld) through Gunnedah to Hexham. • Easement confirmed for 850km route. • EA predicted to be lodged November 2007 and opened in 3 years. • Designated by NSW Government as a priority project.
Ethanol Plant	• $200M development. • Off-take secured with BP. • 18 month construction phase with 500 employees. • 350 jobs to support industry. • 50 permanent positions. • Feedstock 400,000tpa of sorghum and wheat. • Awaiting EA to State Government.
Shopping Centre	• GWH Building. • Opened November 2006. • Major retailers (Coles, Liquorland, The Reject Shop and Target Country), 2 other retailers plus speciality shops and 169 car parking. • Direct link to Conadilly Street CBD via walkways.
Franklins Supermarket	• $1.8M outfit of former Bi-Lo and Chalkleys site of 2,000m^2. • 60 – 70 jobs. Commenced trading February 2007.
Nursing Home Extension	• $5.6M development in next 12 months. • 30 beds additional to 50 existing.
Country Energy Depot	• $1M development in Borthistle Road.
New Wave Leathers	• $5.4M major upgrade of plant underway. • Would enable increased employment to over 100.
South School Hall and Canteen	• $2M development.
Ambulance Station	• $686,000 development at Hospital.
Other Developments	• CBD upgrade $2.8M. • McCafe $1M. • Gracelands Units $1.5M. • Subway.

Table 4B.56 (Cont'd)
Summary of Present and Proposed Developments in the Gunnedah Area (March 2007)

DEVELOPMENT	DETAILS
Residential Subdivisions	• 332 lots proposed for Rugby Club/Lincoln Street area. • Gallen Estate ((Sunnyside) 14 lots. • East Gunnedah (Pearson Estate) 20 lots. • Kamilaroi Road 9 lots.
Industrial Subdivision	• North West Business Park on abattoir site (300 acres). • 97 lots proposed from 2,000 to 55,000m^2.
Rail Upgrade	• ARTC work on construction of passing loop and control equipment north end of Gunnedah. • Completed May 2009.
Whitehaven Open Cut Coal Mine – Canyon Extension	• Opened mid 2006. • Extends Whitehaven Mine's life by 3 years. • 35 employees • 1.25Mtpa.
Idemitsu Boggabri Open Cut Coal Mine	• Commenced operations 2006. • 10 year life, 80 employees.
Tarrawonga (East Boggabri) Mine	• 15km NE of Boggabri, next to Idemitsu open cut. • Whitehaven/Idemitsu joint venture. • 70 employees. • Commenced operations 2006. • 1.5 to 2.0Mtpa with 8 to 10 years life.
Belmont Open Cut Mine	• Project Application lodged with Department of Planning in July 2006. • Anticipated to commence operations second or third quarter, 2008.
Narrabri Coal Project	• This will be a large underground mine employing up to 150 people. • Located 8km NW of Baan Baa. • Construction work on site commenced on 18 March 2008.
Sunnyside Mine	• The Project addressed in this *Environmental Assessment*.
Curlewis	• Redeveloping interest.
Caroona Area	• Understood to be a substantial deposit of coal (500Mt). Underground and possible open cut. • Exploration licence granted to BHP Billiton. • 5 years before mining.
Mining Contractors	• Roche Mining and Hunter Valley Mining are providing a number of contractors to the region at present. Roche Mining staff located in Gunnedah and Boggabri. • About 35 employees.

The Sunnyside Coal Project would support this development activity and with only a maximum of five employees predicted to be employed from outside the Gunnedah area, would not create any negative impacts in the economic environment.

4B.12.5 Management Measures

4B.12.5.1 Social

NMPL expects that all but up to five employees would be sourced locally (Refer Section 2.8.2). The resulting small increase in population would not noticeably impact housing, infrastructure or services in Gunnedah.

Agricultural Lands

NMPL has minimised this potential impact through a commitment to return a proportion of the Project Site to agricultural land. The areas associated with the out-of-pit emplacement and depression remaining after the final void has been rehabilitated would have reduced agricultural potential post-mining. However, they would be capable of limited production and would be operated in accordance with the agricultural/habitat conservation focus of ongoing "Sunnyside" property management.

4B.12.5.2 Economic

Apart from the potential contributions to the surrounding local communities, which may be either financial or in-kind contributions, NMPL would be contributing significantly to the local economy through wages and payment for services. NMPL would implement a policy that encourages employment of local district personnel, with arrangements for training and certification put in place to ensure suitable applicants can acquire the necessary skills.

Gunnedah Shire Council has a Section 94A Contributions Plan which was adopted in May 2007 and amended in June 2007. The plan was prepared in accordance with the requirements of Section 72 of the *Environmental Planning and Assessment Act, 1979* and the *Environmental Planning and Assessment Regulation, 2000*.

The primary purposes of the plan include the following.

- To authorise the imposition of a condition on certain development consents requiring the payment of a levy determined in accordance with the plan.
- To assist the Council to provide the appropriate public amenities and services required to maintain and enhance amenity and service delivery within the Gunnedah Shire Local Government Area.

The plan also details the framework for collection, management and expenditure of the funds collected.

The plan defines the type of development to which it applies as applications for development consent and applications for complying certificates to be made by or under Part 4 of the *Environmental Planning and Assessment Act, 1979*. In relation to the Sunnyside Coal Project, NMPL is seeking Project Approval under Part 3A of the *Environmental Planning and Assessment Act 1979*. Consequently, the Gunnedah Contributions Plan 2007 does not formally apply to this Project Application.

4B.12.6 Impact Assessment

4B.12.6.1 Local Capacity

Impacts on local capacity are likely to be relatively modest considering the Whitehaven Coal Mine is unlikely to keep operating beyond 2008. The Belmont Coal Project would be largely replacing, rather than adding to, the demands on employment, housing etc. created by the Whitehaven Coal Mine. NMPL has assumed a worst case scenario of employing five employees from outside the Gunnedah area. Allowing for three people per household, it is estimated that, the Sunnyside Project would add an additional 10 to 15 people (maximum) to Gunnedah's population and accommodate those people in five households (Refer Section 2.8.2).

In light of the employment and training policies of NMPL and the range of available services in Gunnedah, and particularly the courses and expertise offered by the local TAFE colleges, combined with the positive attitude of the local Council, it is concluded that the region currently has, or would quickly develop, capacity in the three key areas of education/training, housing capacity and economic development to meet the demands resulting from the start up of the Sunnyside Project.

It is assessed that any increase in demand on 'soft' infrastructure such as schools and medical services would be relatively minor and manageable.

4B.12.6.2 Social

In addition to the direct and indirect employment opportunities that would arise from the Project, the following positive social impacts may occur.

- Reduction of social stress through maintenance of employment levels in the mining and related industry for the next 5 to 7 years.
- Training opportunities for local people, including young people and indigenous people, in a growth industry (mining).

- Stimulus to local businesses, particularly in Gunnedah, including motel and hotel trade, cafes and restaurants, mining-related engineering and surplus spending activity such as gyms, cinema, recreational goods and services, beauty salons, and hair dressers.
- Maintenance of, or increase to, the population to participate in locals clubs, sporting groups, cultural activities, and organisations, therefore contributing to stronger social networks and social capital.
- More volunteers for community service organisations.

With respect to potentially adverse social impacts resulting from the Project, the following assessments are made.

- Noise levels in areas immediately surrounding the Project Site and proposed coal transport route would increase marginally. This is discussed in Section 4B.2.
- The number of trucks using the Coocooboonah Lane, Oxley Highway, Blackjack Road, Quia Road and Torrens Road coal transport route would increase significantly, however, appropriate controls would be put in place, and would be maintained for the Sunnyside Coal Project, to minimise impacts on other road users, in particular the school bus services that share the route.
- The Project would require a cessation of agricultural activities on the Project Site for the duration of the Project. This would be partially mitigated through the rehabilitation of a portion of the Project Site to agricultural land of a similar agricultural suitability class. The area is restricted to 231ha and the loss of such a small parcel of agricultural land is not seen as a significant impact.
- It has been postulated that employment of the Project workforce has the potential to impact local business through the potential loss of employees to the mining operation. Section 2.8.2 details the proposed employment policies and training and re-training strategies that should ensure the workforce would consist primarily of local persons trained by NMPL personnel. The Project would have positive impacts on the local economy and should a person transfer to the mining industry, the vacated position would not be lost from the local economy but rather provide employment to another person presumably residing locally.

4B.12.6.3 Economic

A significant proportion of the capital costs to establish the Project would be related to construction labour, power supply, on site facilities construction and materials. Much of this capital would be spent locally where possible, with labour and materials sourced from the region where possible.

It is anticipated that annual labour costs would be in the order of $4.5M. A significant portion of this money would be retained locally through payment of local contractors and employees.

Additionally, consumables and the purchase of sundry materials would inject a significant amount of money into the local services and suppliers, as well as those based in the Hunter Valley and beyond.

Royalties would be payable to the NSW government on the coal product which would contribute to the State economy, as would port and rail fees.

4B.12.6.4 Land Values

There are many factors that combine to determine the value of land, including for example, location, soil type, climate, distance from services, schooling opportunities, social interaction opportunities, climatic conditions, and location in relation to markets.

The eventual effect of a development such as the Sunnyside Coal Project on land values would be a balance between positive and negative influences.

The positive influences would include such factors as:

- increased opportunity for off-farm employment to replace or augment current income opportunities;
- employment opportunities for children;
- improved communication and transport facilities; and
- diversification of the local economy reducing the implication of market and seasonal influences on the economy.

The negative influences would include:

- actual and perceived environmental impacts such as noise, dust, increased traffic and visibility issues;
- not wanting to live near a mine; and
- reduced agricultural activity in the local region as land is used for mining.

NMPL would implement management strategies to address predicted environmental issues. This action should address actual environmental impacts and would also help to address any perceived impacts.

The personal preference for living near a mine is more problematic, however, there are a number of valid reasons for deciding to do so and these are included in the above list of positive factors.

The small size (231ha) of land temporarily removed from agricultural production (for 5 to 7 years) is not likely to have a significant impact on local agricultural production.

Consequently, NMPL believes that there would be both positive and negative influences on property values as a result of the construction and operation of the Sunnyside Coal Project. It is impossible to predict whether there would be more positive or negative influences and it is most likely that the impact would be close to neutral, however, it should generate sufficient confidence in the district to promote growth and sound investment opportunities within the real estate sector, both residential and commercial.

Proposed management responses to predicted environmental impacts would help to minimise any negative impacts on property values and would enhance the likelihood of positive influences.

4B.12.6.5 Eventual Mine Closure

The Sunnyside Coal Mine has a planned production life in the order of 5 to 7 years at which time the open cut resource would have been extracted. The Whitehaven Group is currently undertaking an extensive exploration drilling program aimed at extending the activities of the Group and its employees into the future. Although no definite replacement reserves for the Sunnyside resource have been defined, it is reasonable to anticipate that there would be future employment for the Sunnyside workforce within the Whitehaven Group.

As discussed in Section 2.8.2, the Whitehaven Group operates a workforce over a number of developments and these are not considered in isolation with respect to employment and training opportunities. NMPL does not anticipate loss of employment for the Sunnyside workforce at the closure of that operation.

4B.13 EUROPEAN HERITAGE

4B.13.1 Desktop Search of Heritage Listed Items

A desktop search of the Gunnedah Local Government Area on the following heritage databases was conducted in March 2007.

- Gunnedah Local Environmental Plan 1998 – Schedule 1.
- Australian Heritage Database (which includes places listed in the World Heritage List, National Heritage List, Commonwealth Heritage list and Register of the National Estate).
- State Heritage Register.
- State Heritage Inventory.

No listed heritage sites were identified within the Project Site, or within the vicinity of the Project Site.

4B.13.2 Management Measures

As no sites were identified, no management measures are required.

4B.13.3 Assessment of Impacts

As no sites were identified, there would be no impact on any items or places of European heritage significance.