Section 4A

Environmental Features, Management Measures and Impacts

PREAMBLE

This section describes the specific environmental features of the Project Site and its surrounds that would or may be affected during the life of the proposed Yarraboldy Extension. The proposed design and/or operational safeguards and management measures are presented, followed by an assessment of the predicted level of impact the proposed activities may have after implementation of these measures. Where appropriate, proposed monitoring programs are also described.

This section is presented in two parts:

Part A: *presents a range of background information relating to a number of the subsequent issues;*

Part B: *presents the predicted and related impacts associated with the proposed mining, processing and transport operations.*

This page has intentionally been left blank

4A.1 TOPOGRAPHY

4A.1.1 Regional Topography

The Project Site is located on the eastern margin of the Central Tablelands of New South Wales, within a broad valley bounded by the Great Dividing Range to the west and Newnes Plateau to the east. Regionally, the topography of the area is characterised by hilly to rugged terrain with moderate to high relief that is often dissected by steep-sided valleys within the catchments of the Coxs, Wolgan, Capertee and Turon Rivers.

Natural slopes within the region range from <1% along the valleys in the vicinity of the Project Site, to near vertical drops comprising competent yet eroding sandstone cliffs along the western margin of the Newnes Plateau.

Elevations in the region range from 1 179m AHD at Birds Rock, approximately 12 km east-northeast of the Project Site, to less than 650m AHD within the Wolgan Valley, approximately 10km northeast of the Project Site (**Figure 4A.1**).

4A.1.2 Local and Project Site Topography

The Yarraboldy Extension area is located within the opening of a valley at the base of a generally northeast-southwest trending ridgeline that branches from a main north-south trending ridge line located to the east of the proposed extension. A number of steep sided drainage lines are located along the ridge line with the topography to the northwest and southeast of the ridge flattening out. The former Yarraboldy Open Cut Mine also contains a number of sheer vertical faces that were left unrehabilitated from historic mining activities.

Local elevations range from 1 138m AHD at the highest point of the northeast-southwest trending ridgeline to 895m AHD at the lowest point of the former Yarraboldy Open Cut Mine (**Figure 4A.2**). Slopes within the local area range from 1:1.5 V:H along the sides of the ridge line and drainage lines to 1:12 V:H in the flatter areas to the south and west.

The elevations within the Yarraboldy Extension area range from approximately 945m AHD in the northwestern corner down to 895m AHD at the lowest point within the former Yarraboldy Open Cut Mine. Excluding the sheer vertical faces within the open cut, slopes range from 1:1.8 V:H at the base of the ridge line to 1:12 V:H across the flatter areas.

The topography within the existing Pine Dale Coal Mine has been extensively modified by previous mining activities associated with the Wallerawang Colliery and existing mining operations. Elevations within the existing Pine Dale Coal Mine range from approximately 890m AHD adjacent Neubecks Creek to the east to 920m AHD adjacent the Private Coal Haul Road.

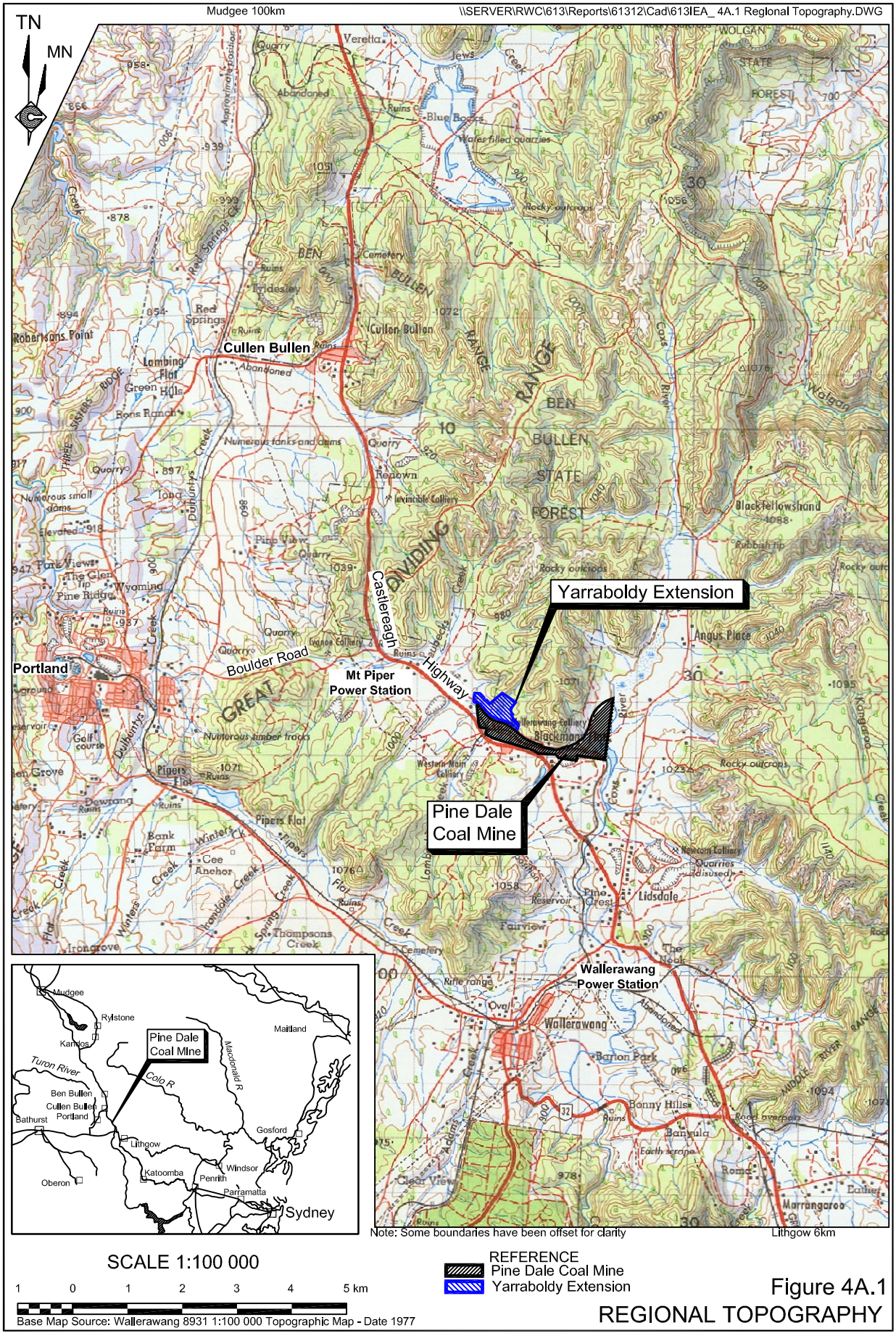

Figure 4A.1
REGIONAL TOPOGRAPHY

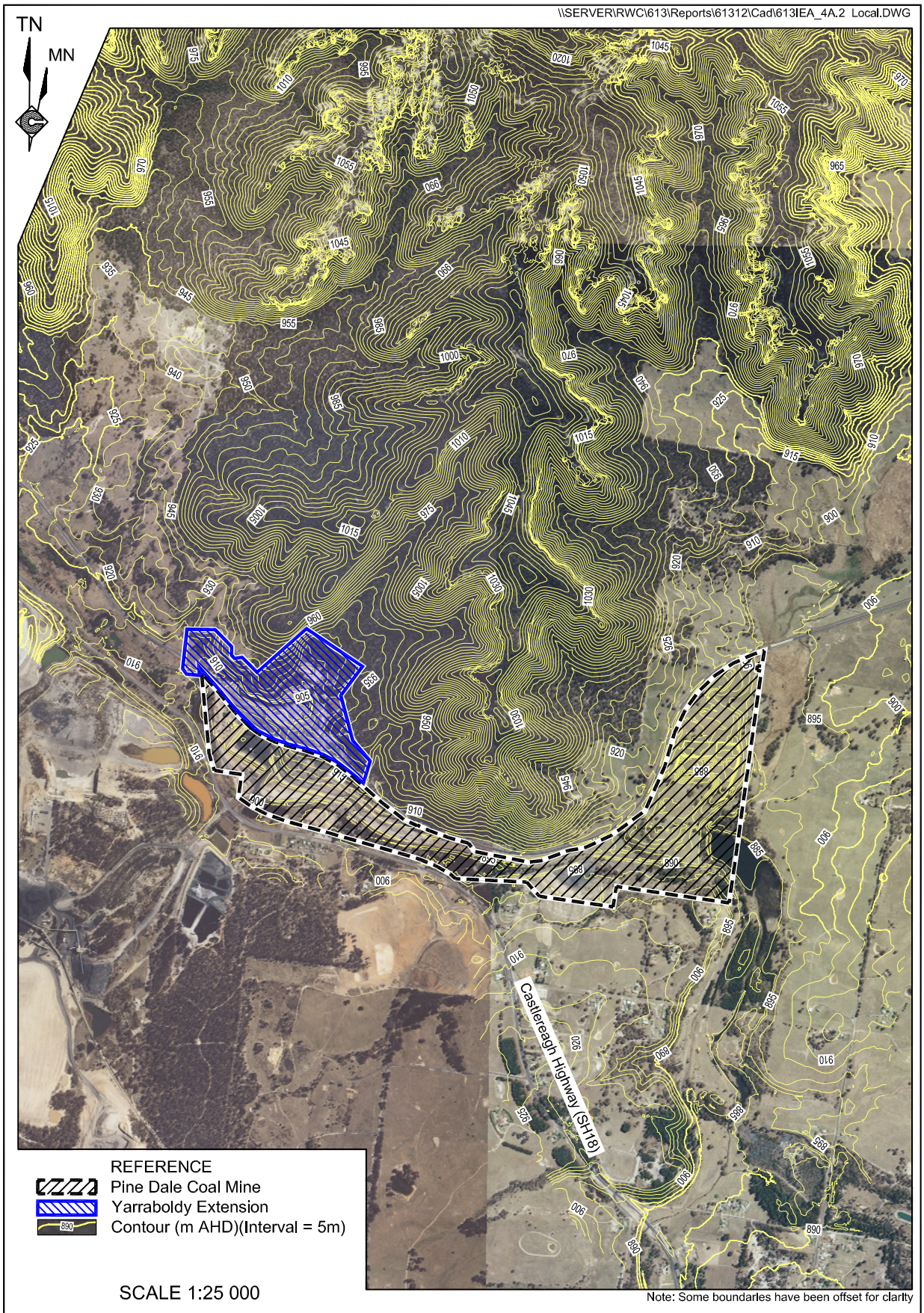

Figure 4A.2
LOCAL TOPOGRAPHY

4A.2 METEOROLOGY

4A.2.1 Source of Data

Meteorological data has been sourced from the Bureau of Meteorology as well as from the Proponent's own weather station at the Pine Dale Coal Mine. Details of the weather stations used to collate the data for this section are listed below.

- Bureau of Meteorology - Lithgow (Birdwood St) – Station Number: 063224, Coordinates: 33.49°S, 150.15°E, Elevation: 950m, approximately 18km from the Project Site.
- Bureau of Meteorology - Lidsdale State Forest – Station Number: 063046, Coordinates: 33.45°S, 150.05°E, Elevation: 975m, approximately 10km from the Project Site.
- Bureau of Meteorology - Bathurst Agricultural Station – Station Number: 063005, Coordinates: 33.43°S, 149.56°E, Elevation: 713m, approximately 60km from the Project Site.
- Enhance Place Pty Limited – Pine Dale Coal Mine Weather Station.

4A.2.2 Temperature

Table 4A.1 presents the mean daily maximum and minimum temperatures recorded at Lithgow based on historical temperature data. An average monthly temperature based on data from 2008 and 2009 from the Pine Dale Coal Mine weather station is also presented. January and February are the warmest months (average maximum 25.5^{o}C, average minimum 12.1^{o}C and average daily temperature between 19.2^{o}C and 17.3^{o}C) and July the coldest month (average maximum 10.4^{o}C and average minimum approximately 0.7^{o}C). However, August recorded the lowest average daily temperature of 4.3^{o}C.

Table 4A.1
Mean Monthly Temperature Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
TEMPERATURE - ^{O}C - Lithgow (84 years of records)													
Mean Daily Maximum	25.5	24.7	22.4	18.4	14.3	11.1	10.4	12.0	15.4	18.7	21.5	24.5	18.2
Mean Daily Minimum	11.9	12.1	10.1	6.7	3.9	1.8	0.7	1.3	3.4	6.0	8.1	10.4	6.4
TEMPERATURE - ^{O}C – Pine Dale Coal Mine (2 years of records)													
Mean Daily Temperature	19.2	17.3	16.0	11.6	8.2	7.4	5.2	4.3	10.2	12.2	16.8	16.9	12.1
Source: Bureau of Meteorology, Enhance Place Pty Limited													

4A.2.3 Relative Humidity

Table 4A.2 presents the mean morning and afternoon relative humidity recorded at Lithgow. June has the highest relative humidity (averaging up to 82% in the morning and 67% in the afternoon) and October having the lowest relative humidity (averaging up to 60% in the morning down to 51% in the afternoon).

Table 4A.2
Mean Monthly Relative Humidity

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
RELATIVE HUMIDITY - % - Lithgow (19 years of records)													
9.00 am	64	70	73	76	81	82	79	73	64	60	60	61	70
3.00 pm	54	58	60	59	66	67	66	56	54	51	53	50	58
Source: Bureau of Meteorology													

4A.2.4 Rainfall

Table 4A.3 presents the mean monthly rainfall recorded at Lithgow, Lidsdale State Forest and the Pine Dale Coal Mine weather station. The annual mean rainfall for the area is between 609mm to 875mm. The wettest month of the year is January and the driest month of the year is April.

Table 4A.3
Mean Monthly Rainfall Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
RAINFALL - mm - Lithgow (92 years of record)													
Mean	94.3	83.8	83.9	62.7	63.0	67.6	67.6	63.4	58.9	67.7	70.0	76.1	858.5
Median	85.1	65.6	65.6	50.3	44.0	52.0	50.7	48.6	53.3	59.5	66.4	67.0	845.8
Mean Rain days	10.6	10.2	10.6	9.1	10.4	11.7	11.7	11.1	10.2	10.3	10.0	9.8	125.7
RAINFALL - mm – Lidsdale State Forest (40 years of records)													
Mean	108.5	85.2	71.2	59.0	66.2	74.3	52.2	65.8	59.4	84.4	74.1	74.0	874.6
Median	109.0	80.1	50.4	45.8	46.5	58.6	47.5	61.1	55.5	79.3	62.8	58.0	827.1
RAINFALL - mm – Pine Dale Coal Mine (5 years of records)													
Mean	76.6	98.6	37.3	28.6	28.7	69.1	29.0	31.1	31.8	38.3	62.9	77.2	609.0
Source: Bureau of Meteorology, Enhance Place Pty Limited													

4A.2.5 Wind

Table 4A.4 presents the mean morning and afternoon wind speeds recorded at Lithgow. **Figure 4A.3** illustrates the predominant wind direction for each season. August and September are the windiest months (averaging up to 10.9km/hr in the morning and 13.3km/hr in the afternoon). Wind direction throughout the year is predominantly from the west to northwest.

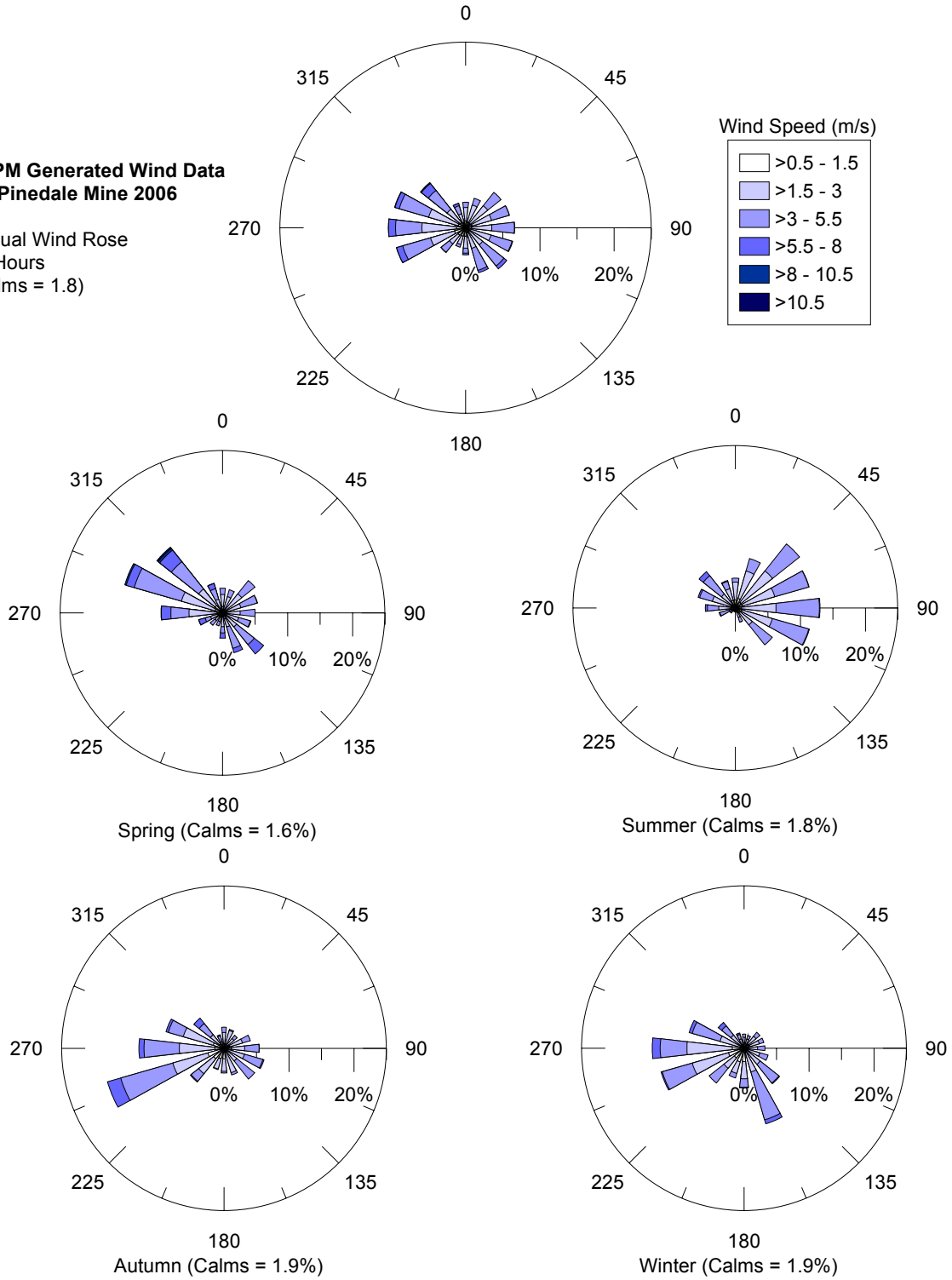

Figure 4A.3
SEASONAL WIND ROSES

Source: Heggies (2010a) Figure 3

The seasonal wind roses indicate that:

- in spring winds from the west dominate including some moderate to strong winds;
- in summer fresh to light winds are experienced predominantly from the northeast through southeast directions;
- in autumn light to moderate winds are experienced predominantly from the west to south southwest; and
- in winter fresh to light winds are experienced predominantly from the west and southeast.

Table 4A.4
Mean Monthly Wind Speed Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
WIND SPEED – km/hr - Lithgow (39 years of records)													
9.00 am	6.7	6.1	6.5	7.5	7.2	8.3	8.4	10.2	10.9	9.8	8.9	7.9	8.2
3.00 pm	10.3	9.0	8.8	9.2	9.6	10.6	11.4	13.3	12.7	11.8	11.3	11.3	10.8
Source: Bureau of Meteorology													

4A.2.6 Evaporation

Table 4A.5 presents the mean monthly evaporation rates at the Bathurst Agricultural Research Centre. The annual mean evaporation rate for the area is 3.7mm. Evaporation rates are the greatest in January (6.8mm) falling to rates of 1.1mm in June.

Table 4A.5
Mean Monthly Evaporation Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
EVAPORATION - mm - Bathurst Agricultural Research Centre (38 years of records)													
Mean	210.8	168.2	139.5	87.0	52.7	33.0	37.2	55.8	84.0	124.0	156.0	204.6	1353
Source: Bureau of Meteorology													

4A.3 LAND OWNERSHIP, SURROUNDING RESIDENCES AND LAND USE

4A.3.1 Introduction

The Project Site is predominantly surrounded by the Ben Bullen State Forest to the north, east and west. The township of Blackmans Flat is located to the south of the Project Site, with a number of privately owned residences situated in close proximity to the Yarraboldy Extension.