Section 4 Environmental Features, Management Measures and Impacts

This section describes the specific environmental features of the Project Site and its surrounds that would or may be affected by the Project.

This section is presented in two parts:

Part A: *presents background information on a range of environmental features that, while not directly affected by the Project, may have some influence on a number of the subsequent issues; and*

Part B: *presents information on existing conditions, proposed safeguards and controls and potential impacts the Project may have after implementation of these measures on those environmental issues identified through the issue identification process of Section 3. Where appropriate, proposed monitoring programs are also described.*

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Section 4A Background Information

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

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4A.1 TOPOGRAPHY

4A.1.1 Regional Topography

The regional topography is shown on **Figure 4A.1**. The Project Site lies within the Namoi River Basin in an area representative of the transition from the higher broken country to the northeast and south associated with the Nandewar, Great Dividing and Liverpool Ranges and the open plains to the west in the Wee Waa and Coonamble areas.

Natural slopes within the region range from less than 1° along the flood plains of the Namoi River to in excess of 25° within areas of Wondobah State Forest and in excess of 45° on the slopes of Blackjack and King Jack Mountains southeast of the Project Site.

Elevations in the region vary from 884m AHD within Kelvin State Forest (approximately 30km northeast of the Project Site), to 250m AHD within the Namoi River Valley near the Gunnedah Airport (approximately 11km east of the Project Site). There are isolated peaks elsewhere such as King Jack Mountain (762m AHD and approximately 7km to the south-southeast) and Blackjack Mountain (625m AHD and approximately 7km east-southeast).

4A.1.2 Local Topography

The local topography within the vicinity of the Project Site is shown on **Figure 4A.2** and **Plate 4A.1**.

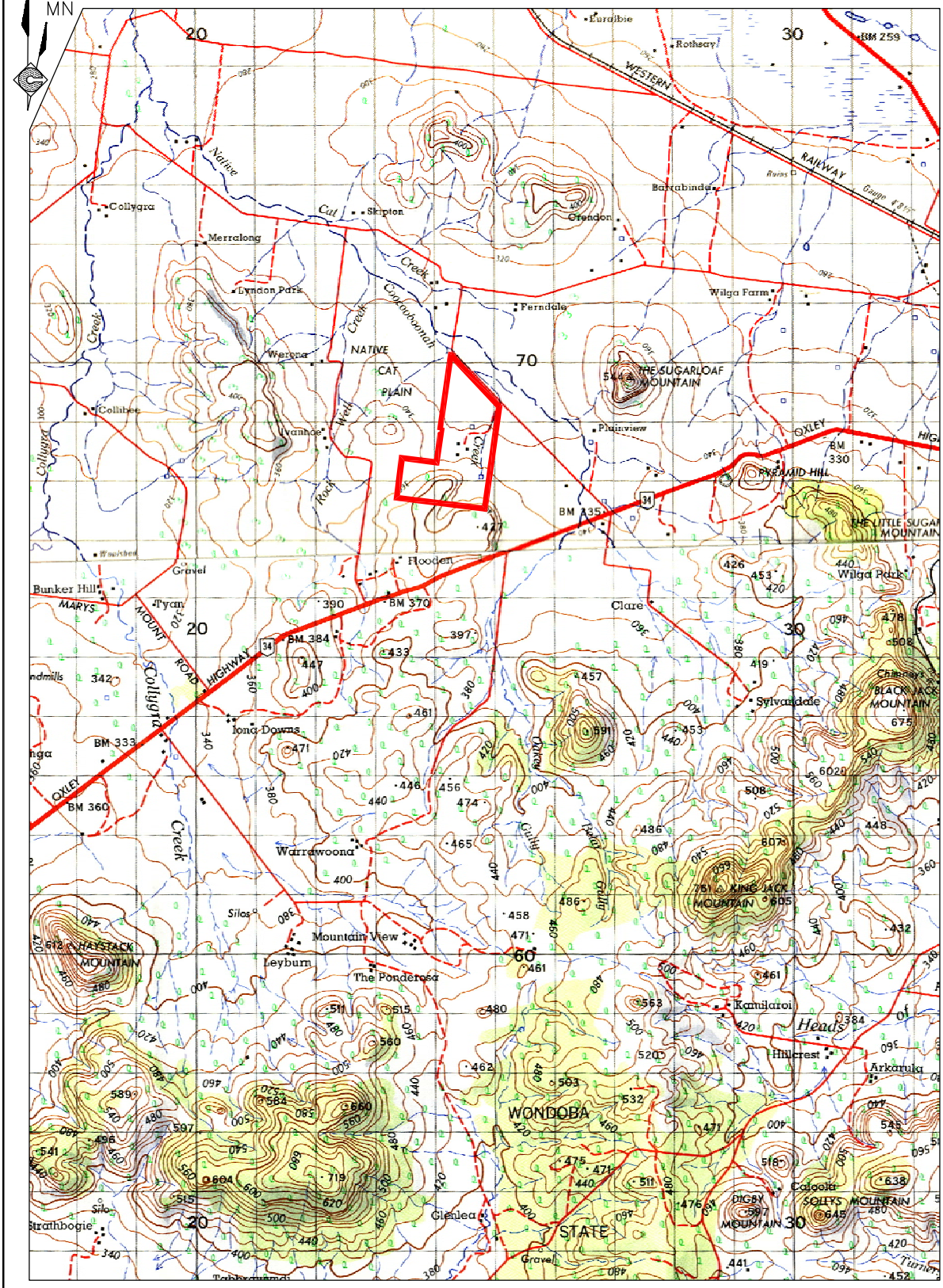
The Project Site is located on the lower slopes at the edge of the Coocooboonah Creek valley and extends upslope to an escarpment zone. To the north of the Project Site, the valley widens to ultimately form part of the Namoi River floodplain (**Figure 4A.2**).

Elevations within the local area range from approximately 544m AHD at the top of Sugarloaf Mountain and 428m AHD on the hill above the open cut pit to approximately 310m AHD to the immediate north of the "Sunnyside" property.

Figure 4A.2 also shows the tributaries to Coocooboonah Creek. Coocooboonah Creek Tributary 1 is the main catchment that flows through the Project Site. It has a number of minor diversions associated with soil conservation structures. However, general flow is towards the northwest corner of the "Sunnyside" property. All project disturbance activity occurs within this tributary.

Water from Coocooboonah Creek Tributary 2 does not enter the "Sunnyside" property. It is directed by soil conservation structures to join Tributary 1 immediately outside the northwestern boundary of the property.

\\SERVER\RWC\675\67501\CAD\675Base_4A.1 Regional Topography.DWG



REFERENCE

Project Site Boundary

SCALE 1:100 000

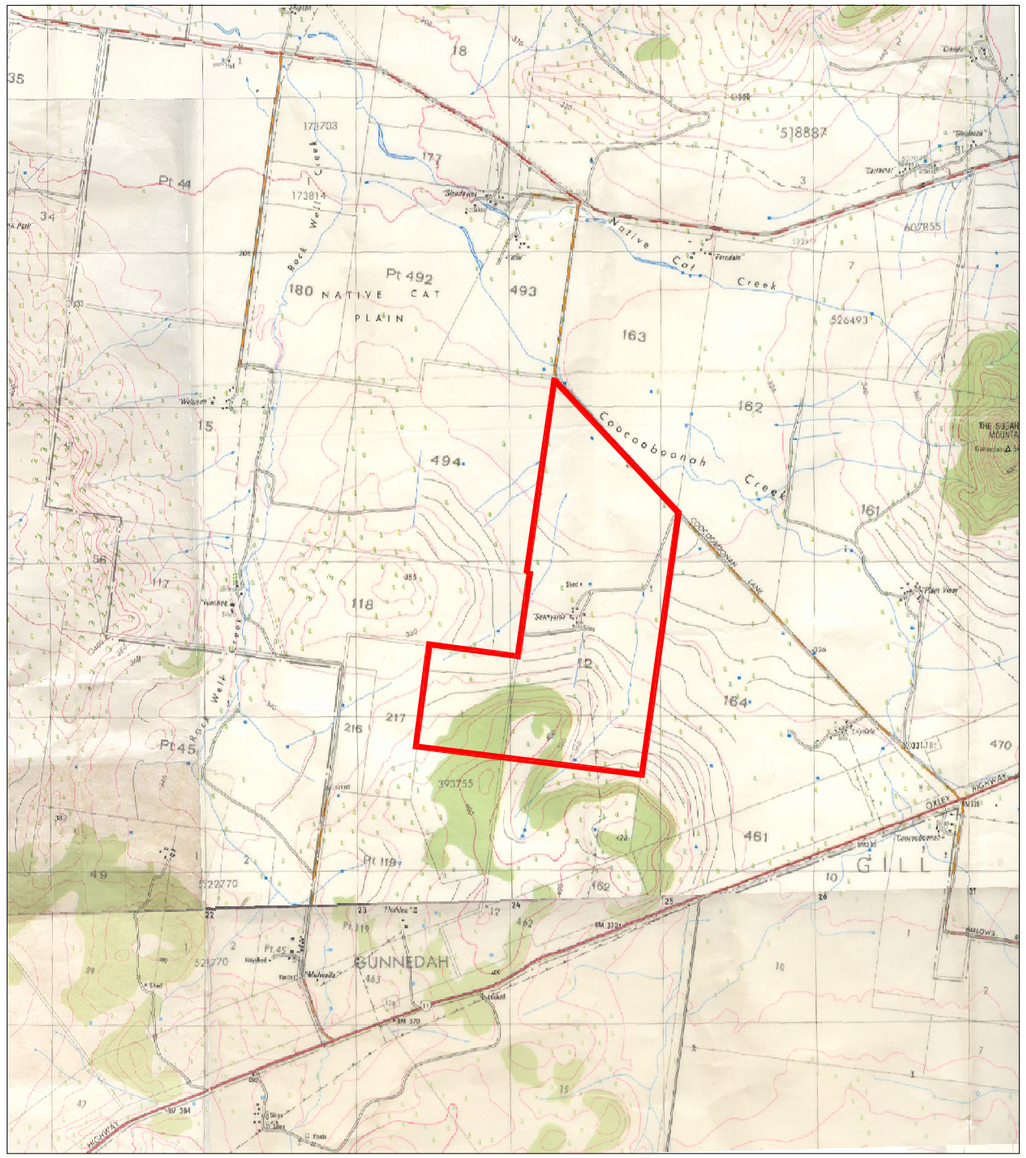
1 0 1 2 3 4 5 km

Source: Boggabri & Curlewis 1:100 000 Topographic Maps

Figure 4A.1
REGIONAL TOPOGRAPHY

\\SERVER\RWC\675\67501\CAD\675Base_4A.2 Local PS Topography.DWG

TN
MN

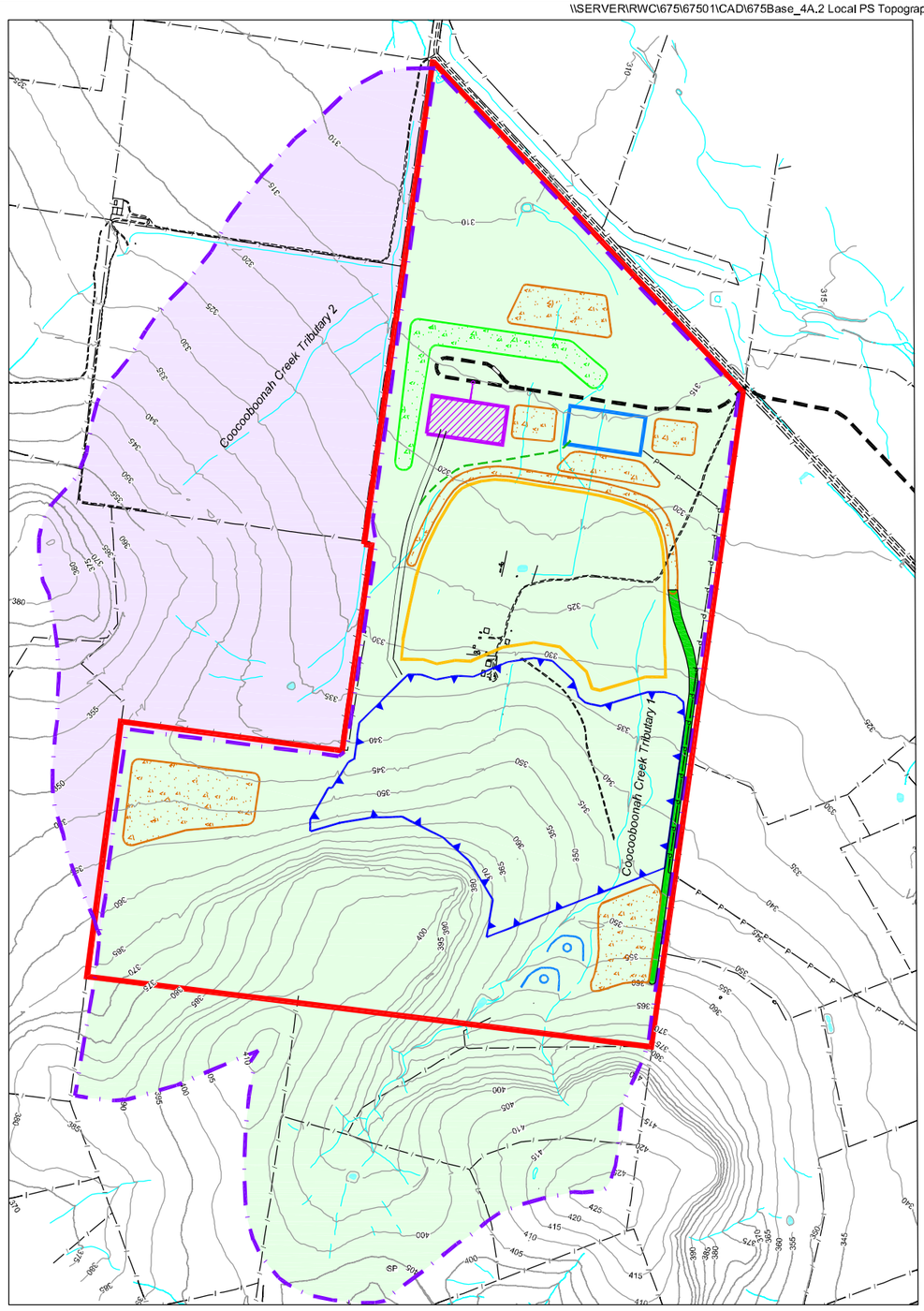


SCALE 1:40 000

0.5 0 0.5 1.0 1.5 2.0 km

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
- Site Facilities Area
- Coal Processing Area
- Turkey's Nest Dam
- Amenity Bund
- Existing Track
- Fence (beyond Project Site)
- Contour (m AHD)(Interval = 5m)
- Creek / Dralnage Line
- Relocated Power Line
- Coocooboonah Creek Tributary 1 Catchment Area
- Coocooboonah Creek Tributary 2 Catchment Area



SCALE 1:15 000

250 0 250 500 750 m

Base Map Source: Emerald Hill & Wondoba 1:25 000 Topographic Mapss

Figure 4A.2
LOCAL AND PROJECT SITE TOPOGRAPHY

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4A.1.3 Topography of the Project Site and Proposed Coal Transport Route

Slopes within the Project Site generally range from 2° to 10°. Along the realigned Coocooboonah Lane section of the proposed coal transport route, slopes are generally less than 1°. The Oxley Highway passes over a ridge adjacent to Pyramid Hill and slopes range up to 5°. The slopes along Blackjack Road, Quia Road and Torrens Road are generally less than 2°.

4A.2 METEOROLOGY

4A.2.1 Introduction

The Project Site is situated within the Namoi River Valley between the tropical and temperate climatic zones, and between the belts of the sub-tropical highs and the zone of mid-latitude westerlies. In summer, synoptic highs dominate the climate. Low pressure systems pass at regular intervals bringing milder temperatures and winds from the southerly quadrant.

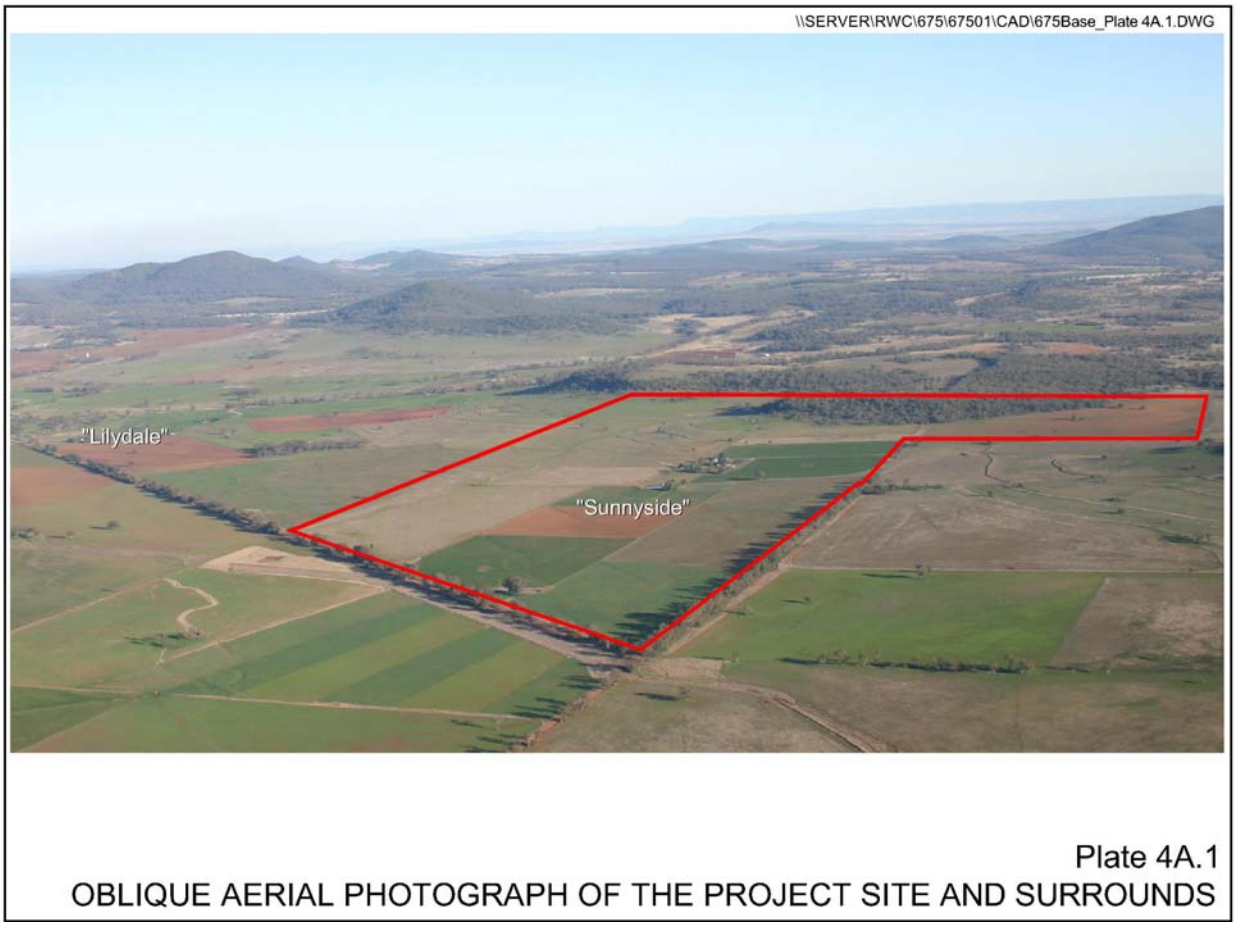


Plate 4A.1
OBLIQUE AERIAL PHOTOGRAPH OF THE PROJECT SITE AND SURROUNDS

The following summaries of meteorological information for the Project Site have been derived from both long term data collected by the Bureau of Meteorology at Stations No. 055023 and No. 055024 in Gunnedah (Gunnedah Pool Station and Gunnedah Soil Conservation Research Station respectively).

A meteorological station was installed on the Project Site in March 2007. Data was not available at the time of writing this report, however it will be collected throughout the life of the Project.

Data collected from each of the above sources is as follows.

- Station 055023: temperature, rainfall, relative humidity, fog and frost frequency and wind (9:00am and 3:00pm).
- Station 055024: pan evaporation.
- Sunnyside Meteorological Station: temperature, rainfall, pan evaporation and continuous wind speed and direction.

With the exception of continuous wind data, all meteorological data is summarised in **Table 4A.1**.

4A.2.3 Temperature

The data summarised in **Table 4A.1** indicates that the area is characterised by mild to hot summers and cool winters. December, January and February are the warmest months with mean daily maximum temperatures approximating 34°C. July is the coldest month with a mean daily minimum of 2.9°C. Autumn and Spring are generally mild with occasional erratic temperature fluctuations. Mean diurnal temperature variation is relatively constant throughout the year at about 15°C.

4A.2.4 Relative Humidity

The relative humidity of Gunnedah region can be described as moderate based on the observed conditions at the Gunnedah Pool Meteorological Station. The mean 9:00am and 3:00pm relative humidity is 67% and 46% respectively, with an increase occurring through the winter months.

4A.2.5 Rainfall

Rainfall in the local area results from localised convective thunderstorms, or the passage of any of the following major synoptic systems.

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

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

Monthly rainfall for Gunnedah is presented in Table 4A.1 and shows that highest rainfalls recorded at Gunnedah occur during Spring and Summer with January having the highest median rainfall of 53.9mm. March through to September are dry months with median rainfall in the low 30mm range. On average, Gunnedah experiences 72 rain days per year.

Table 4A.1
Mean Monthly Meteorological Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
TEMPERATURE (°C)													
Gunnedah Pool (Station No. 055023) – 116 Years of Records													
Mean Maximum	34.0	32.9	30.8	26.4	21.2	17.5	16.7	18.9	22.7	26.6	30.2	33.0	
Mean Minimum	18.3	18.1	15.8	11.4	7.1	4.2	2.9	4.1	6.9	10.6	14.0	16.8	
RAINFALL (mm)													
Gunnedah Pool (Station No. 055023) – 126 Years of Records													
Mean	72.4	65.9	48.5	38.2	43.3	42.5	42.3	41.9	39.5	55.6	59.9	66.3	616.4
Median	53.9	50.2	34.4	32.5	33.1	36.3	33.3	35.7	32.6	52.4	52.8	50.2	619.9
Mean Rain Days	6.5	6.0	4.7	4.3	5.3	6.2	6.2	6.2	5.8	6.9	6.7	6.9	71.7
Highest	301.0	253.5	367.6	151.4	171.2	172.5	177.8	138.5	128.0	161.2	259.3	185.4	
Lowest	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.3	0.0	
EVAPORATION (mm)													
Gunnedah Soil Conservation Research (Station No. 055024) – 20 Years of Records													
Mean Monthly Pan Evaporation *	238.7	187.6	186.0	129.0	83.7	57.0	58.9	83.7	117.0	164.3	198.0	244.9	1 752
RELATIVE HUMIDITY (%)													
Gunnedah Pool (Station No. 055023) – 33 Years of Records													
Mean 9:00am	61	65	64	67	73	78	77	71	65	61	58	57	67
Mean 3:00pm	43	43	44	46	52	55	53	48	43	43	39	38	46
WINDS km/hr													
Gunnedah Pool (Station No. 055023) – 42 Years of Records													
Mean 9:00am Wind Speed	7.7	8.4	8.2	6.7	5.8	5.8	5.4	5.8	6.8	8.0	7.9	7.3	7.0
Mean 3:00pm Wind Speed	9.8	9.1	9.7	8.7	7.7	9.2	10.2	11.0	11.0	10.5	11.2	10.5	9.9
FROST FREQUENCY (DAYS/MONTH)													
Gunnedah Pool (Station No. 055023) – 33 Years of Records													
Mean Monthly	0.0	0.0	0.0	0.0	1.0	3.8	3.8	5.0	1.2	0.0	0.0	0.0	
FOG FREQUENCY (DAYS/MONTH)													
Gunnedah Pool (Station No. 055023) – 33 Years of Records													
Mean Monthly	0.1	0.0	0.0	0.1	0.3	0.4	0.4	0.1	0.3	0.1	0.0	0.1	
Source: Bureau of Meteorology *Based on daily data													

A statistical review of rainfall records has identified that for a dry year (10th percentile rainfall event) the annual rainfall is 373.6mm. For a wet year (90th percentile rainfall event) the annual rainfall is 843.4mm.

4A.2.6 Wind

Wind data obtained from the Gunnedah Airport Automatic Weather Station (Station No. 055202) was used by Heggies (2007) to generate annual and seasonal wind roses for the Project Site. The Air Pollution Model (TAPM) software developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) enabled annual and seasonal wind roses to be compiled from this data. These are presented in **Figure 4A.3**.

TAPM is a prognostic model used to predict three-dimensional meteorological data. General information on local terrain, vegetation and soil type, and synoptic scale meteorological analyses was incorporated into the model to generate the annual and monthly wind roses. For further information on TAPM, see Part 5 of the *Specialist Consultant Studies Compendium*.

The annual wind rose for the Project Site indicates that winds are experienced predominantly from the south-southeast and the southeast quadrants and are mild to moderate in nature, having an average wind speed of between 1.5m/s and 8m/s. Calm conditions occur approximately 2.3% of the time. Seasonal variations include the following.

- In summer, the prevailing wind directions are from the east-southeast and southeast.
- In autumn, the prevailing wind directions are from the southeast and east-southeast.
- In winter, the prevailing wind directions are from the east-southeast and southeast.
- In spring, the prevailing wind directions are from the east-southeast, southeast and east.
- The strongest winds occur in the summer and autumn months and prevail from the southeast and east-southeast respectively.

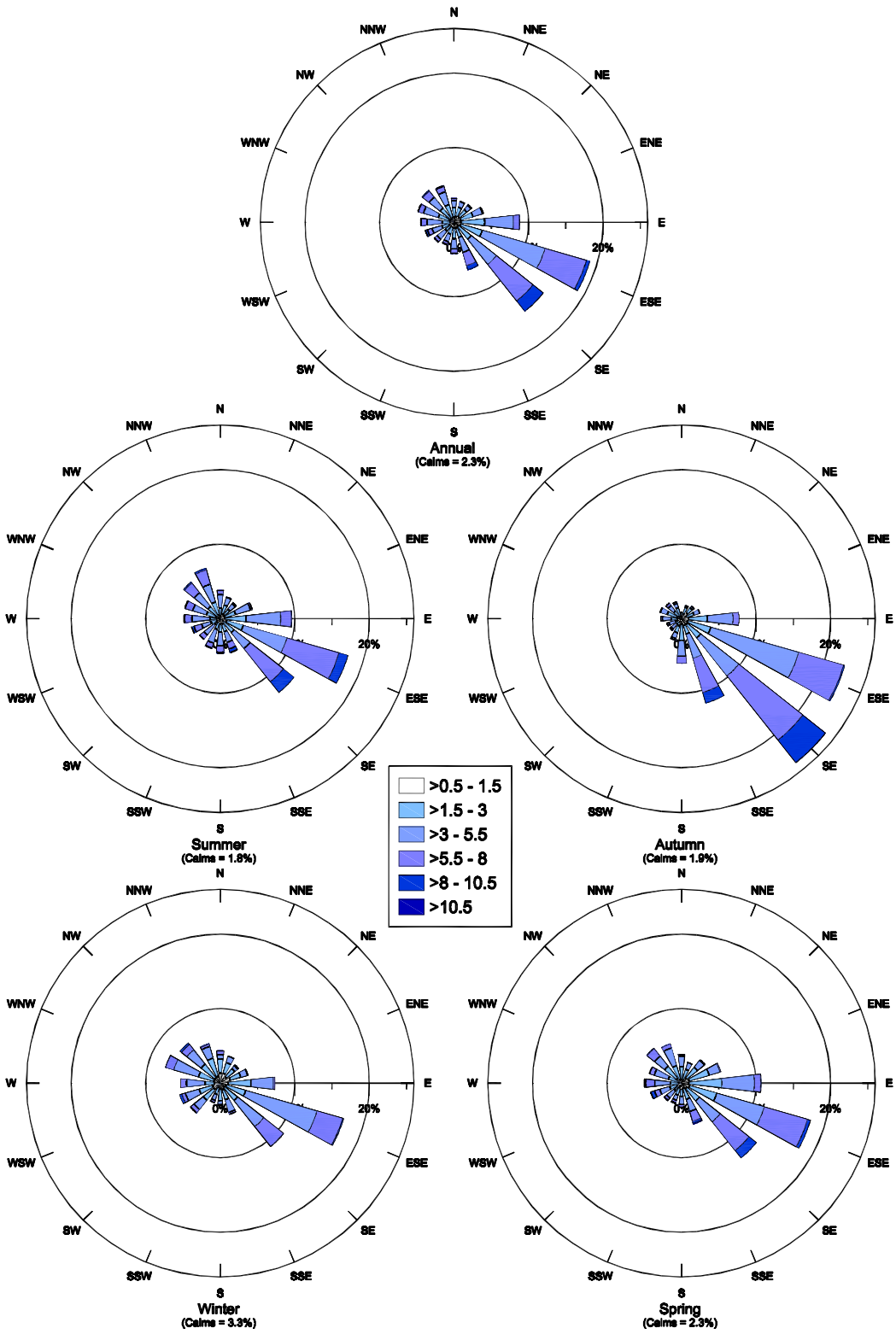
Analysis of meteorological data recorded at the nearby Whitehaven Coal Mine between 2004 and 2005 shows similar wind behaviour to that experienced at Gunnedah. The annual wind rose for Whitehaven Coal Mine indicates that winds tend to be experienced predominantly from the southeast.

The prevailing meteorological conditions are indicative of moderately stable Class "D" conditions (see Part 5 *Specialist Consultant Studies Compendium*). Atmospheric stability refers to the tendency of the atmosphere to resist or enhance vertical motion of air particles. The Pasquill-Gifford-Turner assignment scheme identifies six Stability Classes, "A" to "F", to categorise the degree of atmospheric stability. Stability Class "A" represents highly unstable conditions that are typically found during summer and categorised by strong winds and convective conditions. Conversely, Stability Class "F" relates to highly stable conditions, typically associated with clear skies, light winds and the presence of a temperature inversion. Classes "B" through to "E" represent conditions intermediate to these extremes.

4A.2.7 Evaporation

Mean monthly evaporation data for Gunnedah is presented in **Table 4A.1**. Mean monthly evaporation is greatest from November to March and corresponds to the months of highest temperatures and lowest relative humidity. During each of these months, evaporation exceeds 180mm. Mean monthly evaporation is least during June and July at 57mm and 59mm respectively. Average evaporation exceeds rainfall in all months and exceeds median annual rainfall by a factor of nearly four.

\\SERVER\RWC\675\67501\CAD\675Base_4A.3 Wind Roses.DWG



Source: Heggies (2007) - Appendix 3

Figure 4A.3
WIND SPEED AND DIRECTION

4A.2.8 Temperature Inversions

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

Table 4A.1 shows that frosts generally occur in the Gunnedah area between May and September. Fogs may occur at any time of year but are a rare phenomenon. Based on these records alone, it may be concluded that temperature inversions could occur on up to 20% of days each year. However, in a detailed review of the meteorology of the Gunnedah area, Garradd (1997) noted that "*surface inversions might be expected on 50% or more nights throughout the year*".

An assessment of inversion occurrence at the Whitehaven Coal Mine during 2001 showed a similar result to that identified in Garradd, with weak to strong inversions occurring on 42%, 46%, 54% and 47% of nights in summer, autumn, winter and spring. Night-time inversions generally prevail from about 8:00 pm.

During the day-time, ie. 7:00am to 6:00pm, weak to strong inversions occurred on less than 1% of summer, autumn and spring days and on approximately 3% of winter days, but only prevailed to approximately 8:00 am before dissipating. Given the proximity of the Whitehaven and Sunnyside sites, similar inversion occurrence patterns would be expected for the Sunnyside Project Site.

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

4A.3.1 Introduction

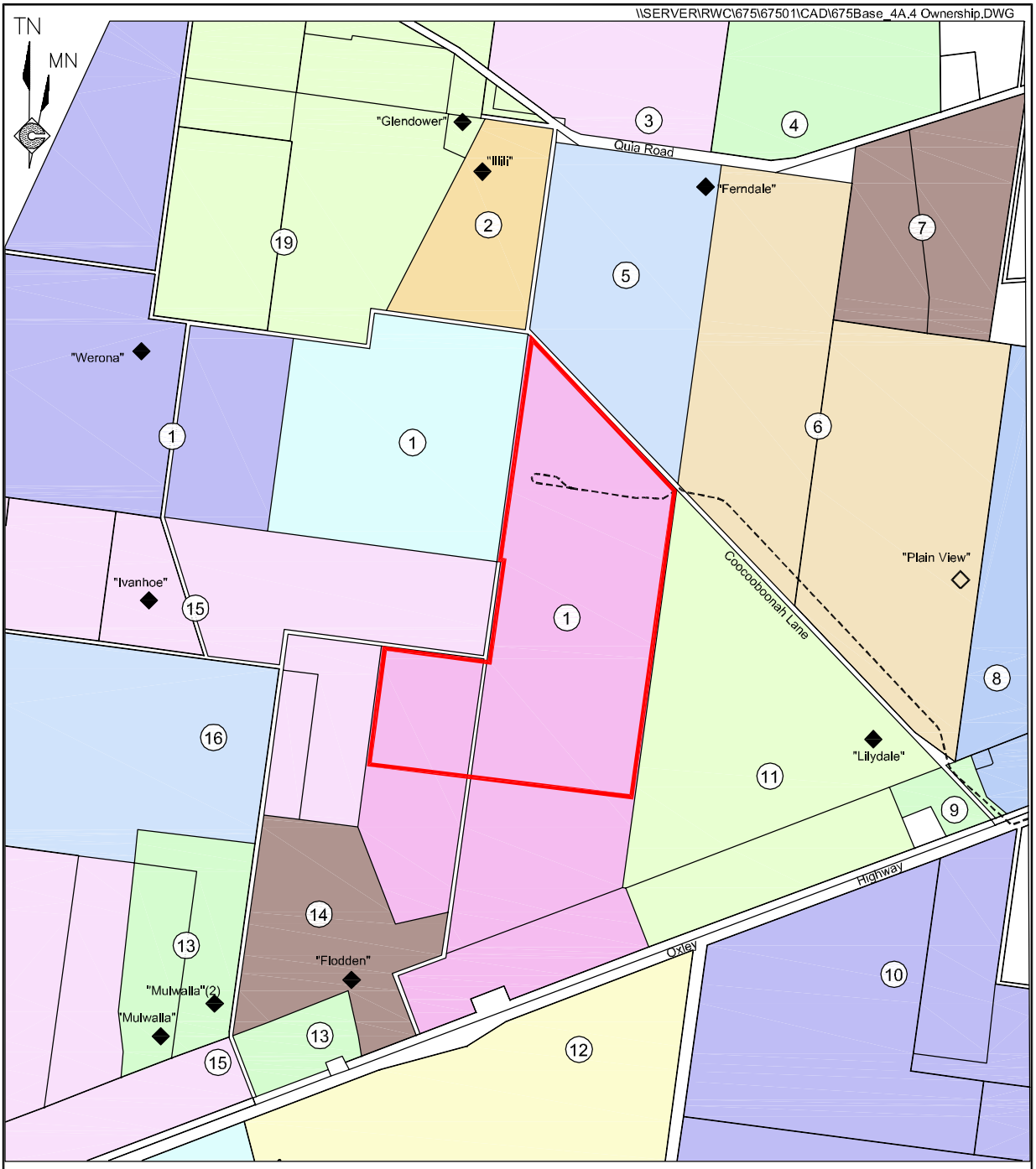
In order to assess the impact the establishment and operation of the Sunnyside Coal Project would have on the surrounding environment, an understanding of the number and location of surrounding landholdings and residences along with the land use is required. This subsection identifies the landholdings and residences in the vicinity of the Project Site and proposed coal transport route. The subsection also presents the proximity of surrounding residences to the proposed areas of activity and provides an overview of the land uses both in the local area and surrounding the Project Site.

4A.3.2 Land Ownership and Surrounding Residences

4A.3.2.1 The Project Site and Surrounds

Figure 4A.4 presents the ownership details within and immediately surrounding the Project Site and along the coal transport route. NMPL owns the "Sunnyside" property and has an agreement with the owner of "Plain View" to realign Coocooboonah Lane through that property. NMPL has also purchased the "Rosemar" and "Werona" properties, hence these are considered to be project-related.

There is a Travelling Stock Reserve owned by the Crown, running along the Oxley Highway to the south of the Project Site.



REFERENCE
Project Site Boundary
Coal Transport Route
Cadastral Boundary
Road Reserve
Project Related Residence
Non-project Related Residence

REFERENCE	LANDOWNER
1	Namoi Mining Pty Ltd
2	A.M. Norman
3	I.G. Braby
4	P.J. Stubbs
5	L.A. Coddington
6	C.J. Howarth
7	P.A. Scott
8	B.W. Reid
9	Gunnedah Shire Council
10	Howard Haulage

REFERENCE	LANDOWNER
11	A.J. Coddington
12	H.M. Standen
13	G.E. Doubleday
14	G.M. Fogarty
15	C.H.G. Douglas
16	L.B. Staughton
17	Namoi Mining Pty Ltd
18	Namoi Mining Pty Ltd
19	B.J. Bridges

SCALE 1:35 000

500 0 500 1000 1500m

Base Map Source: Emerald Hill & Wondoba 1:25 000 Topographic Mapss

Figure 4A.4
SURROUNDING LAND OWNERHIP

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

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Figure 4A.5 shows the locations of the various residences within and immediately surrounding the Project Site that are not owned by NMPL. The distances from each of the residences to the proposed areas of activity within the Project Site are listed in **Table 4A.2**. Of the Non-Project-related residences, "Lilydale" would be the closest to mining activities.

Table 4A.2
Closest Non-Project-related Residences to the Project Site

Residence ID	Residence Name	Approximate Distance (m) from Project Site Boundary	Approximate Distance to Coal Processing Area (m)	Approximate Distance to Open Cut Pit (m)
R1	"Flodden"	1200	2770	1660
R2	"Ivanhoe"	1320	2170	1900
R3*	"Werrona"	2000	2270	2600
R4	"Illili"	900	1760	2450
R5	"Ferndale"	1400	1890	2500
R6	"Plain View"	1700	2200	1800
R7	"Woodlawn"	2730	2770	3360
R8	"Sugarloaf"	3080	3990	3180
R9	"Lilydale"	1300	2130	1300
R10	"Mulwalla"	2400	3700	2600
R11	"Mulwalla" (2)	2000	3300	2200
R12	"Lyndon Park"	4500	4750	5050
R13	"Merralong"	4800	5070	6000
R14	"Skipton"	3100	3900	4300
R15	"Glendower"	1400	2100	3000
R16	"Carramar"	2650	3100	3500
R17	"Crendon"	3700	4000	4500
R18	"Glenfenzie"	3150	3500	4000
* Project-related Property / Residence				

4A.3.2.2 Proposed Coal Transport Route

The type of land use along the coal transport route changes as the route approaches the Whitehaven CHPP and rail facility. Around the Project Site, properties are used for mixed grazing and cropping activity. As the Oxley Highway approaches the Blackjack Road intersection, the predominant land use changes to rural residential with smaller acreages. The Waterways Wildlife Park is also located adjacent to this section of the coal transport route.

Land use in Blackjack Road becomes more light industrial with truck depots and general small business activity interspersed with small grazing blocks. The AgQuip site is located on the western side of Blackjack Road and the old Gunnedah Abattoir Site is located to the east of the intersection with Quia Road. There are proposals to develop this site as a light industrial estate. There is further light industry and coal processing land use in the Quia Road / Torrens Road precinct.

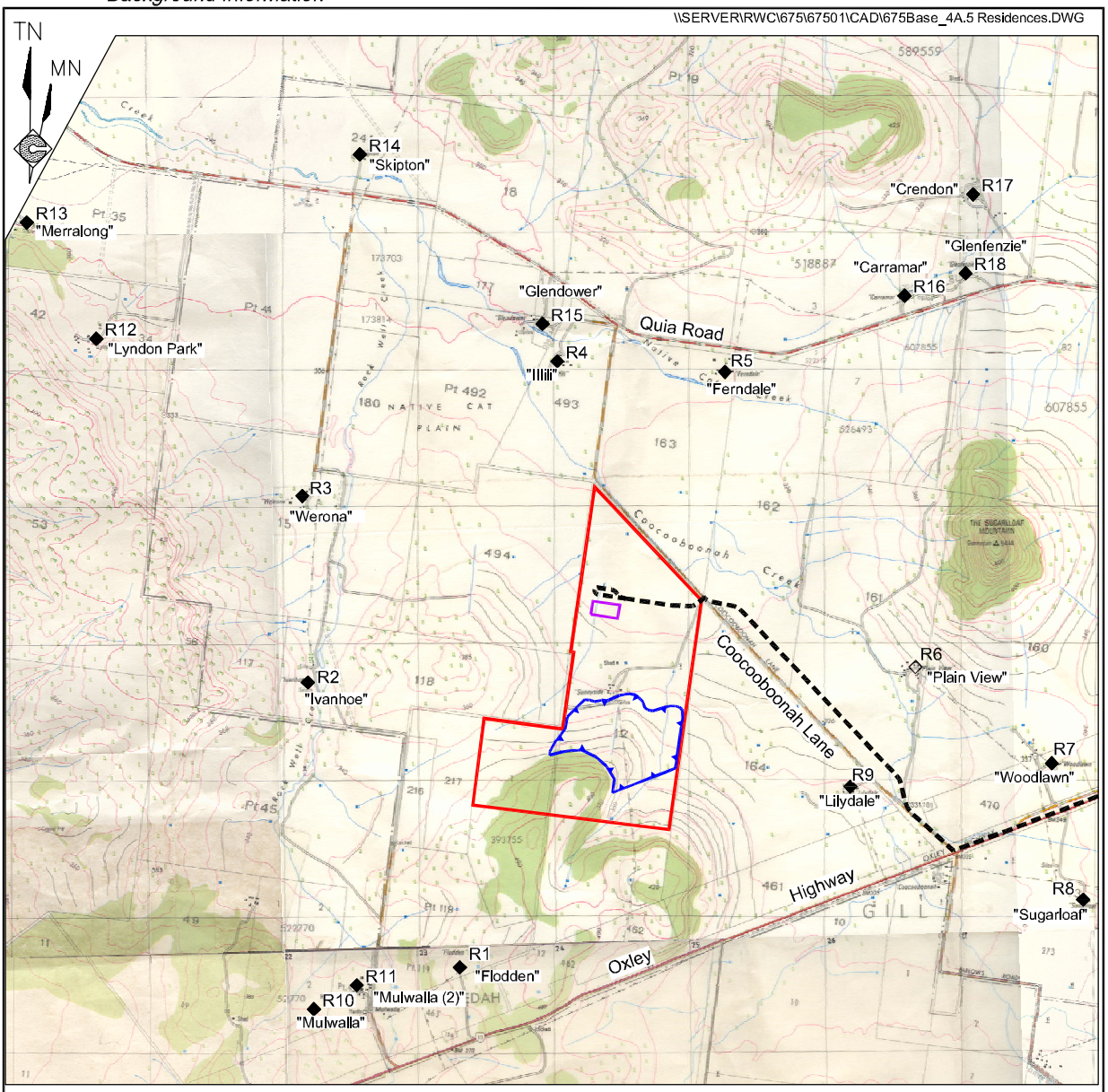

Figure 4A.5
SURROUNDING RESIDENCES

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

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