Section 4

Environmental Setting

PREAMBLE

This section describes the environmental setting within and surrounding the Project Site for the proposed Teralba Quarry Extensions.

Emphasis is placed in this section on providing information about the environmental features that would contribute to or influence the assessment of a wide range of other environmental parameters. Information is provided on the local and Project Site topography, meteorology, land ownership and land use.

Other features of the surrounding environment that would or may be affected by the Project are detailed in Section 5 in conjunction with the design and operational safeguards and impact assessment for those features.

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4.1 TOPOGRAPHY

4.1.1 Regional and Local Topography

The Project Site straddles a series of spurs and drainage depressions emanating from a northeast/southwest trending ridge that discharges run-off to Cockle Creek to the north and to Cockle Bay of Lake Macquarie to the east. Notably, Cockle Creek flows into Cockle Bay, approximately 1km from the Project Site. The topography to the west of Lake Macquarie comprises a range of north-south and to a lesser extent east-west ridge lines that occur at elevations of between 80m AHD and 100m AHD. Further west, a high north-south ridge line in the form of the Watagan Mountains is present and reaches a maximum height of approximately 460m AHD. The steeper slopes subside to small, gently undulating foothills which roll to the lake's edge and to the Pacific Ocean. **Figure 4.1** displays the local topography.

4.1.2 Project Site Topography

Project Site topography is characterised by gently inclined to moderately inclined slopes with some prominent moderately steep to steep ridgelines that have level to gently inclined crests (see **Figure 4.2**). Gently inclined lower slopes are prominent in the southeastern corner of the Project Site where drainage is in a direction easterly towards Lake Macquarie.

The existing Southern Extraction Area comprises a stepped stockpiling and processing area located below the elevation of Rhondda Road. Elevations vary from over 70m AHD along the ridge crest to the west down to approximately 25m AHD in the drainage line at the surface of the former settling pond in the southeastern corner of the Project Site.

The existing Southern Extraction Area and the proposed Southern Extension are sheltered to the south and east by a ridge line that is segmented by creek lines, draining to the north and west towards the existing Southern Extraction Area. The proposed Southern Extension Area is dominated by slopes that are moderately inclined to steep with broad flat crests.

The proposed Northern Extension Area is dominated by moderately inclined to very steep slopes forming a north-south orientated ridgeline, which delineates its eastern boundary and will provide screening of the extraction activities from the east. The ridgeline has a maximum elevation of 90m AHD and is characterised by incised drainage lines. From the top of the ridge, the topography slopes westwards through the proposed Northern Extension and existing Mid Pit Extraction Area.

4.2 METEOROLOGY

4.2.1 Introduction

This section provides a summary of the meteorological data relevant to the Project Site and the environmental issues considered in the various Specialist Consultant Studies and Section 5 of this document. The information provided in this section has been presented to provide an overview of meteorological conditions within and surrounding the Project Site. The Specialist Consultants studies undertaken include the following data sets, however, may also include additional data sets.

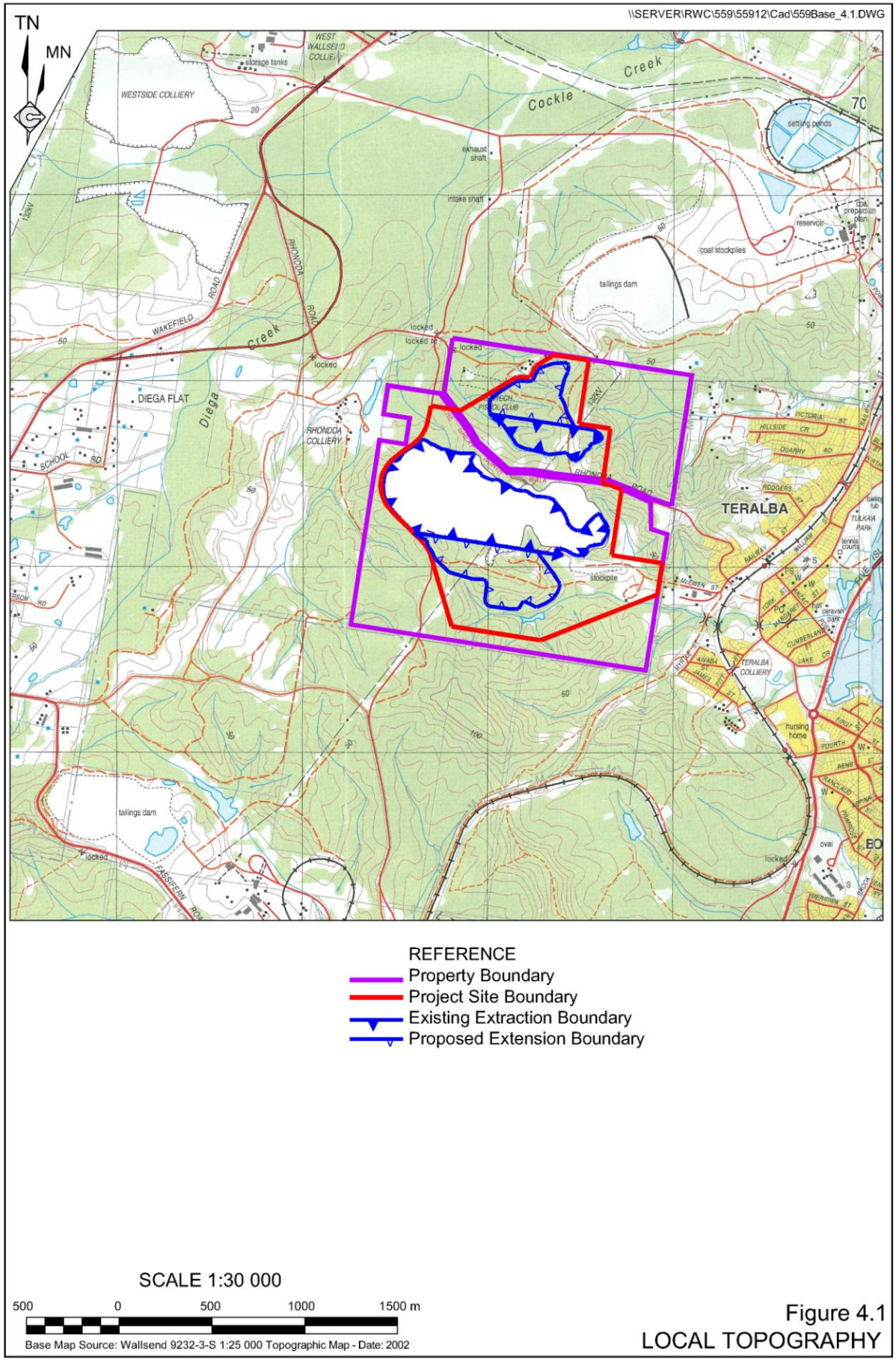


Figure 4.1
LOCAL TOPOGRAPHY

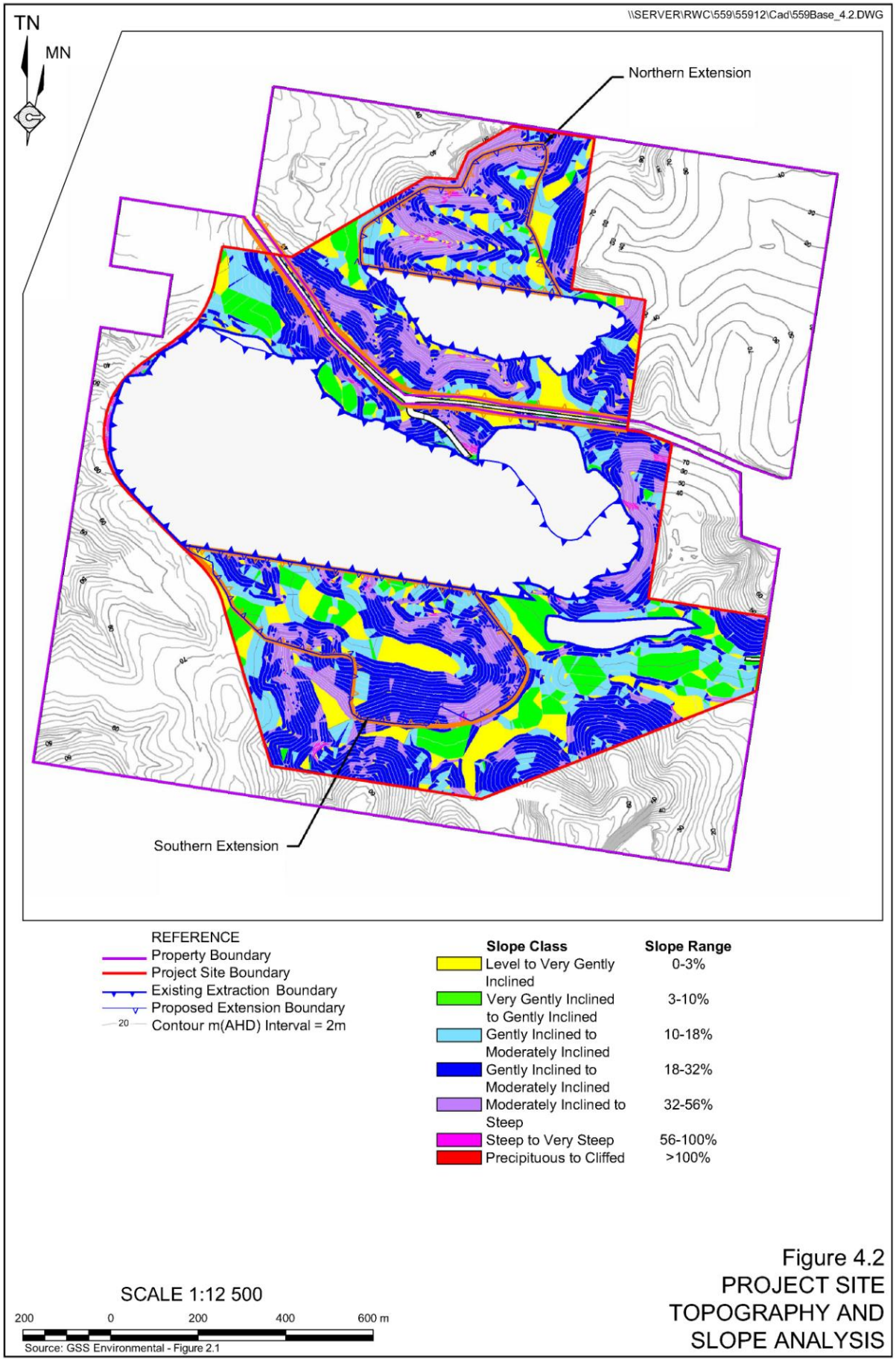


Figure 4.2
PROJECT SITE
TOPOGRAPHY AND
SLOPE ANALYSIS

Climatic data collected over a 48 year period are available from the Bureau of Meteorology (BOM) meteorological station located on The Ridge Way (Bolton Point – Station Number 61133), approximately 2.5km southeast of the Project Site. The closest meteorological station to provide suitable temperature data was located at the Nobby's Signal (Station Number 61055), approximately 19.3km northwest of the Project Site.

Table 4.1 presents rainfall and evaporation data from Bolton Point between 1962 and 2010 and temperature and humidity data from Nobby's Signal between 1862 and 2010.

Table 4.1
Temperature, Humidity and Rainfall Data

	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Temperature (°C) and Humidity (%)													
Mean maximum temperature	30.3	29.4	28.3	26.3	24.1	20.3	20.7	22.2	25.3	26.1	28.8	30.4	25.2°C
Mean minimum temperature	22.0	22.0	21.0	17.2	14.2	13.1	10.4	11.1	15.1	18.7	20.4	21.3	17.8°C
Mean 9am relative humidity (%)	77	80	79	78	79	79	77	72	69	68	72	74	75%
Mean 3pm relative humidity (%)	72	74	72	66	64	63	59	56	59	64	68	71	66%
Rainfall (mm)													
Mean rainfall	112.1	112.9	134.2	111	93.8	112.5	50.9	55.4	62.5	71.8	85.8	82.7	1089.5 mm/year
Highest rainfall	354.2	549.2	371.5	389.4	229.4	293	133.2	172	205	166.2	272.4	219.2	1745.3 mm/year
Lowest rainfall	4.2	15.3	11.1	2.4	4.2	3.1	0	5	3.4	1.8	11.4	11.2	605.3 mm/year
Highest daily rainfall	98	292.6	135.2	105.2	117	110.7	84	81	102.1	97	85	81.8	
Evaporation (mm) (1975 to 2005)**													
Mean monthly evaporation (mm)	200	150	125	100	100	60	80	100	125	175	200	200	1615 mm/yr
Note: Rainfall data was sourced from Bolton Point Met. Station for the months of Jan 1962 – December 2010. Temperature and Humidity from Nobby's Signal Station for the months of February 1862 – December 2010. ** Data sourced from Open Pan Average Monthly Evaporation Map – Bureau of Meteorology 2011.													
Source: Bureau of Meteorology Stations – Bolton Point NSW (Station No. 61133) & Nobby's Signal Station (Station No. 61055)													

4.2.2 Temperature and Humidity

The annual average maximum and minimum temperatures at Nobby's Signal are 25.2°C and 17.8°C respectively. On average, the hottest month of the year is December (30.4°C). July is the coldest month, with an average minimum temperature of 10.4°C.

The annual average humidity reading collected at 9:00am at Nobby's Signal is 75%. At 3:00pm the average humidity reading is 66%. The month with the highest average humidity is February for both 9:00am and 3:00pm, with readings of 80% and 74% respectively.

4.2.3 Rainfall

Rainfall data shows that March is the wettest month, with an average rainfall of 134.2mm. The driest month is July, with an average rainfall of 50.9mm.

It is noted that Metromix ceases production on days when substantial rainfall events make operations too difficult. This, on average, would typically occur approximately 2 to 3 days a year.

4.2.4 Evaporation

Evaporation was calculated using the BoM Average Pan Evaporation Map. This map allowed the extraction of monthly evaporation rates for regions across Australia. The region within which the Project Site occurs is distinguishable and therefore monthly and annual evaporation rates could be derived.

The highest mean monthly evaporation rates occur in November, December and January with an evaporation rate of 200mm/month. The lowest mean monthly evaporation rate occurs in June, with an average evaporation rate of 60mm/month. Annually, the evaporation rate for the region is approximately 1 600mm/ year.

4.2.5 Wind

Wind speed and direction are important factors to consider in the assessment of noise and air quality. In the absence of adequate wind data in the vicinity of the Project Site, data from the nearby (former) Pasminco Pty Ltd smelter at Cockle Creek was considered in the Noise Assessment (Spectrum, 2011).

For the assessment of air quality, SLR (2011) undertook meteorological modelling using The Air Pollution Model (TAPM) meteorological model (Version 4) which in turn reflects the data from the former Pasminco smelter. TAPM model predicts wind speed and direction. Observed meteorological conditions are then used to realign the predicted solution towards the observed values. However, in this situation, there were no available monitoring stations at Teralba to include in the modelling. SLR (2011) provides a description of how the wind roses were generated in this instance.

A summary of the 2008 calendar year annual wind behaviour experienced at the Project Site (based on the TAPM output) is presented as wind roses in **Figure 4.3**.

Figure 4.3 indicates that winds experienced at the Project Site are generally light to moderate (between 1.5m/s and 5.5m/s), are seasonally dependent but predominantly occurring from the western quadrant. Winds occur more frequently from the west during winter and from the northwest during spring. During summer, winds predominantly blow from the east, while in autumn there is a high frequency of winds from the northwest to west-southwest and the southeast east.

Calm wind conditions (wind speeds less than 0.5m/s) were predicted to occur 1.4% of the time throughout 2008. It is recognised, however, that TAPM V4 tends to overestimate the number of low wind events hence in reality the frequency of calm wind conditions is likely to be lower than this.

4.3 LAND OWNERSHIP, LAND USE AND SURROUNDING RESIDENCES

4.3.1 Surrounding Land Ownership and Land Use

Figure 4.4 presents the boundaries of the underground coal mines (collieries) located beneath and surrounding the Project Site together with the residential areas within the various southwestern suburbs of Newcastle.

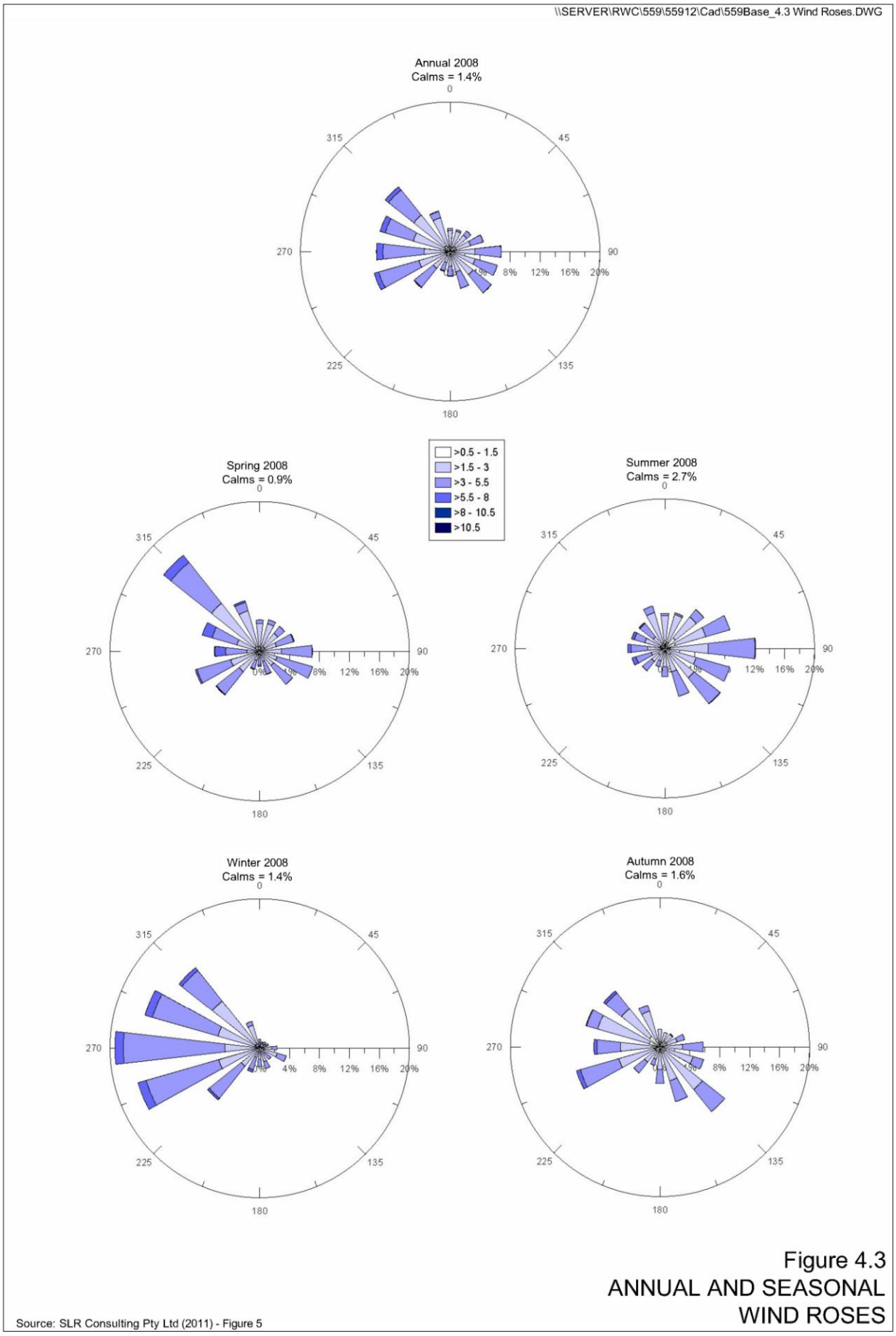


Figure 4.3
ANNUAL AND SEASONAL
WIND ROSES

Source: SLR Consulting Pty Ltd (2011) - Figure 5

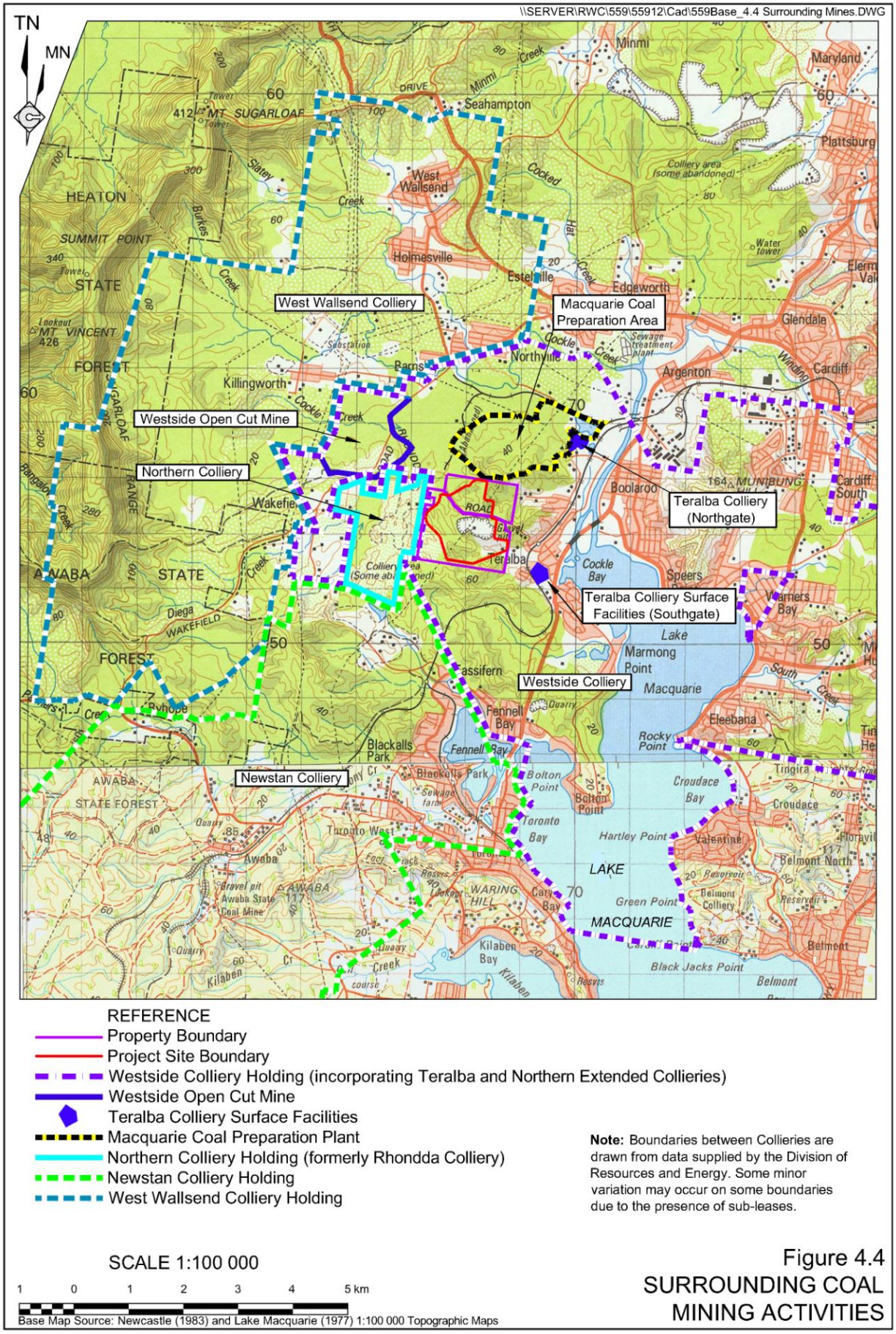


Figure 4.4
SURROUNDING COAL MINING ACTIVITIES

The four collieries beneath and surrounding the Project Site are as follows.

1. Westside Colliery – incorporating the former Teralba and Northern Extended Collieries – now owned by Oceanic Coal Australia Limited (80%); Marubeni Coal Pty Ltd (17%); and JFE Mineral (Australia) Pty Ltd (3%). Oceanic Coal Australia Limited is a fully owned subsidiary of Xstrata Coal (Australia) Pty Ltd. The mining of coal from the Great Northern Coal Seam and the Fassifern Coal Seam was undertaken within the then Northern Extended Colliery in the mid-20th Century.
2. Northern Colliery – located immediately west of the Project Site. This colliery formerly known as Rhondda Colliery, ceased operations in 1971, however, in 1994 an underground fire commenced in a coal seam and took approximately 12 years to extinguish using in part waste water from Metromix's processing plant. The owner of the Northern Colliery, Coal and Allied Industries Limited (a fully owned subsidiary of Rio Tinto Coal Australia) maintains an Environment Protection Licence (EPL) 3139 for the ongoing discharge of water from the Northern Colliery via the Mine Adit Dam on the southwestern side of the existing Southern Extraction Area.
3. Newstan Colliery – located south of the Project Site. This colliery is owned by Centennial Coal, a subsidiary of Banpu Public Company Limited. The surface area above the colliery incorporates the private coal haul road that traverses the western side of the Project Site and provides access for the delivery of coal from the collieries to the north to Eraring Power Station.
4. Wallsend Colliery and the related Macquarie Coal Preparation Plant are located to the north and northwest of the Project Site. Coal from these facilities is transported via the private coal haul road to the Eraring Power Station or despatched by train for export from the Port of Newcastle.

The closest residential suburb of Teralba is located approximately 0.5km to the east of the active areas within the Project Site.

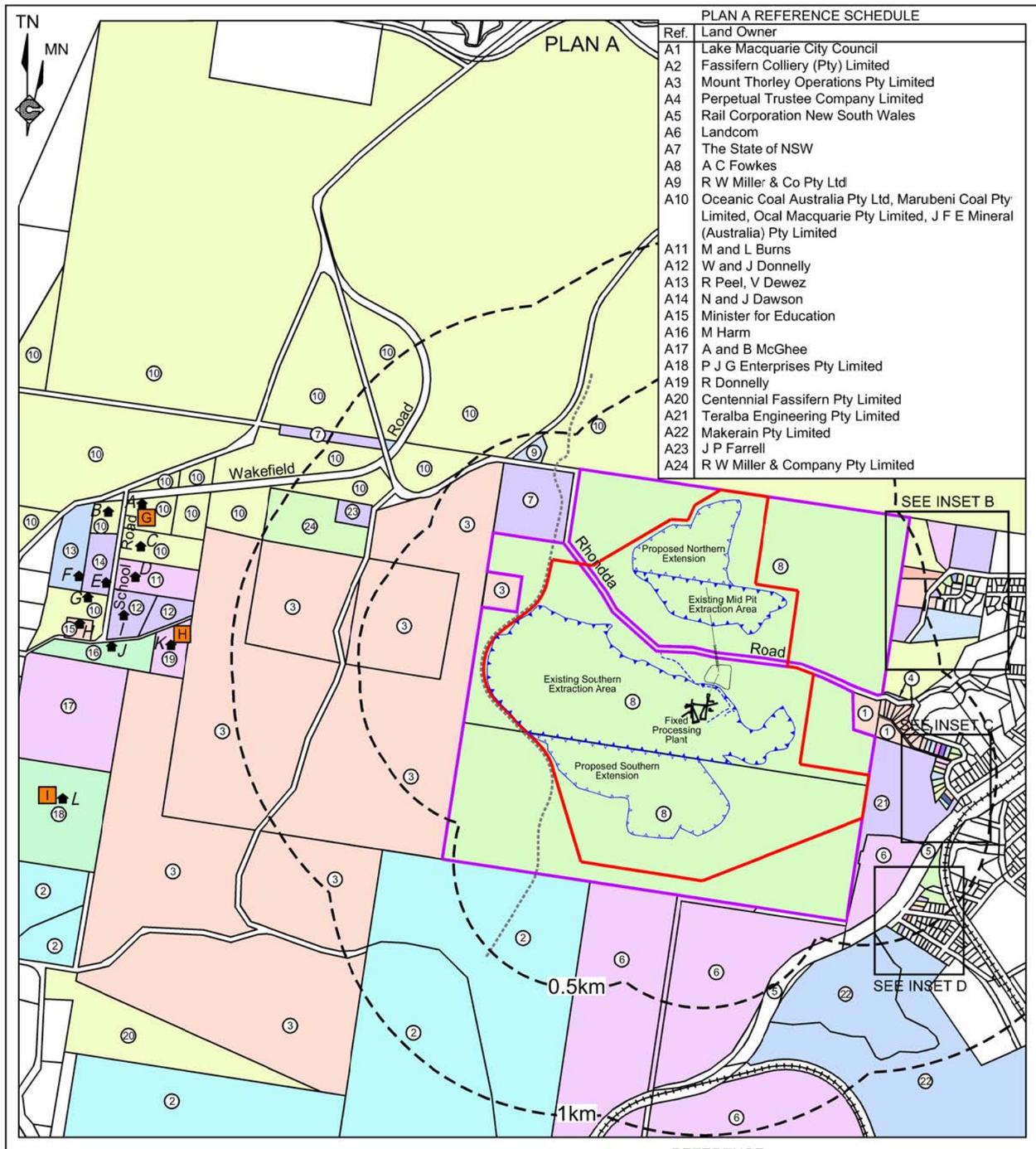
Rural residential land uses dominate the area to the west of the former Rhondda Colliery in the vicinity of Wakefield, a small rural residential community.

The residential suburbs of Barnsley and Northville are located approximately 2km to 3km north of the Project Site and straddle sections of the northwestern transport route from the Teralba Quarry.

The area immediately to the east of the Project Site and adjacent to the Northern Railway line comprises an industrial precinct with a range of light industries such as engineering workshops, fabrication plants and a concrete batching plant.

Figure 4.5 presents the land ownership details surrounding the Project Site. This information has been sourced from the publicly available Land Ownership Register maintained by the Department of Lands. The distances and directions of residences from the closest point of extraction and the relocatable crusher are included in **Table 4.2**.

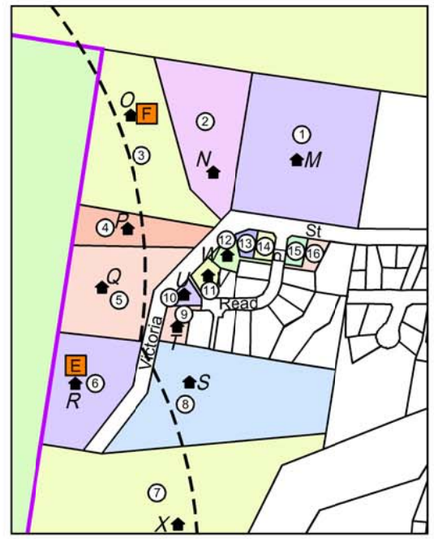
\\SERVER\RWC\559\55912\Cad\559Base_4.5 Ownership.DWG



PLAN A REFERENCE SCHEDULE

Ref.	Land Owner
A1	Lake Macquarie City Council
A2	Fassifern Colliery (Pty) Limited
A3	Mount Thorley Operations Pty Limited
A4	Perpetual Trustee Company Limited
A5	Rail Corporation New South Wales
A6	Landcom
A7	The State of NSW
A8	A C Fowkes
A9	R W Miller & Co Pty Ltd
A10	Oceanic Coal Australia Pty Ltd, Marubeni Coal Pty Limited, Ocal Macquarie Pty Limited, J F E Mineral (Australia) Pty Limited
A11	M and L Burns
A12	W and J Donnelly
A13	R Peel, V Dewez
A14	N and J Dawson
A15	Minister for Education
A16	M Harm
A17	A and B McGhee
A18	P J G Enterprises Pty Limited
A19	R Donnelly
A20	Centennial Fassifern Pty Limited
A21	Teralba Engineering Pty Limited
A22	Makerain Pty Limited
A23	J P Farrell
A24	R W Miller & Company Pty Limited

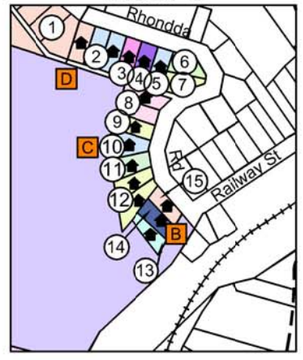
INSET B



INSET B REFERENCE SCHEDULE

Ref.	Land Owner
B1	C & H Stellar
B2	C Roche
B3	N W Green
B4	M A Burgess
B5	G B Hillyard, M L Ashton
B6	D P and S I Black
B7	G and V Hardes
B8	J and R Mannweiler
B9	M L Stocker
B10	K W Philp, P D Noble
B11	M A Philippa
B12	B F and K E Folbigg
B13	P J and D M Hansen
B14	S D and P R Wilson
B15	S M and L C Toomey
B16	P W and C Wilson

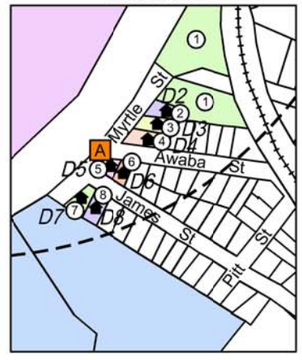
INSET C



INSET C REFERENCE SCHEDULE

Ref.	Land Owner
C1	Lake Macquarie City Council
C2	D & S Halton
C3	Mr Thomas
C4	A Bradbury
C5	Mr and Mrs Miller
C6	K & N M Johnson
C7	K J Lang
C8	T Bock
C9	D S Campbell
C10	Mr & Mrs Tate
C11	Mr Hutchinson
C12	P Hall
C13	R Pitstock & T Davies
C14	S Muller & J Cowand
C15	T & M T Brown

INSET D



INSET D REFERENCE SCHEDULE

Ref.	Land Owner
D1	P Adams
D2	S Odgers
D3	M Bass
D4	M & S Vale
D5	K and B Weatherstone
D6	B and S Hewitt
D7	K Lassig
D8	A Durrant

INSET SCALE 1:7 500

100 0 100 200 300 400m

REFERENCE

- Project Site
- Property Boundary
- Cadastral Boundary
- Railway Line
- Distance from Project Site
- (6) Land Owner Reference (see Schedules)
- Residence
- [A] Representative Residence for Assessments
- Formed Public Road
- Coal Haul Road

SCALE 1:20 000

200 0 200 400 600 800 1000 m

Land Ownership Source: Dept. of Lands - Date of Online Search: 25 January 2010

Figure 4.5
LAND OWNERSHIP AND SURROUNDING RESIDENCES

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Table 4.2
Proximity of Surrounding Residences

Land Ref.	Res. Ref	Landowner	Distance[1] (m)	Distance[2] (m)	Direction[3] (m)	Rep. Res.
A10	A	Oceanic Coal Australia Pty Ltd	1480	2200	WNW	
	B	Marubeni Coal Pty Limited	1590	2325	WNW	
	C	Ocal Macquarie Pty Limited	1430	2185	WNW	
	G	J F E Mineral (Australia) Pty Limited	1590	2395	WNW	G
A11	D	M and L Burns	1425	2205	WNW	
A12	I	W and J Donnelly	1440	2255	W	
A13	F	R Peel, V Dewex	1640	2425	WNW	
A14	E	N and J Dawson	1530	2400	WNW	
A15	H	Minister for Education	1610	2435	W	
A16	J	M Harm	1477	2315	W	
A18	L	P J G Enterprises Pty Limited	1740	2645	WSW	I
A19	K	R Donnelly	1245	2085	W	H
B1	M	C and H Stellar	750	1080	NE	
B2	N	C Roche	645	977	NE	
B3	O	N W Green	575	885	NE	F
B4	P	M A Burgess	525	870	ENE	
B5	Q	G B Hillyard, M L Ashton	485	840	E	
B6	R	D P and S I Black	460	830	ESE	E
B7	X	G and V Hardes	595	1000	NE	
B8	S	J and R Mannweiler	595	965	E	
B9	T	M L Stocker	575	935	E	
B10	U	K W Philp, P D Noble	585	940	E	
B11	V	M A Philippa	615	970	E	
B12	W	B F and K E Folbigg	640	990	E	
C1	C1	Lake Macquarie City Council	505	1115	E	D
C2	C2	D and S Halton	545	1155	E	
C3	C3	Thomas	565	1170	E	
C4	C4	A Bradbury	585	1190	E	
C6	C6	K and NM Johnson	605	1210	E	
C7	C7	R K and M T Duggan	605	1275	ESE	
C8	C8	T Bock	595	1215	ESE	
C9	C9	D S Campbell	590	1230	ESE	
C10	C10	Tate	585	1235	ESE	C
C11	C11	Hutchinson	595	1255	ESE	
C12	C12	P Y Hall	620	1290	ESE	
C15	C15	T De Waldon Brown and M T Brown	665	1320	ESE	
C14	C14	S Muller and J Coward	665	1330	ESE	B
C13	C13	R Pitstock and T Davies	655	1330	ESE	
D2	D2	S Odgers	795	1160	SE	
D4	D4	M and S Vales	810	1575	SE	
D5	D5	K and B Weatherstone	810	1575	SE	A
D6	D6	B and S Hewitt	825	1595	SE	
D7	D7	K Lassig	820	1595	SE	
D8	D8	A Durrant	840	1610	SE	

1 – Distance of residence to closest point of extraction area (proposed and existing).
2 – Distance of residence to closest point of Relocatable Crusher.
3 – Direction of residence from closest point of extraction area.
Res. Ref. = Residence Reference.
Rep. Res. = Representative Residence for Air Quality and Noise Assessments.

The closest residences to the existing Southern Extraction Area are located adjacent to Rhondda Road, where the closest five residences are located approximately 500m to 600m to the east of the existing Southern Extraction Area. The residences on the western side of Victoria Street are approximately 460m to 575m from the proposed Northern Extension. The closest residences to the west-northwest are located adjacent to Wakefield and School Roads, where 12 houses are situated between 1.25km and 1.75km from the existing Southern Extraction Area.

The land use between the Project Site and the closest residences is predominantly remnant native bushland with undulating ridge and creek topography.

4.3.2 Other On-site Land Uses

The other land uses that occur on the Project Site include the following.

- The Newtech Pistol Club leases an area of the lease held by Metromix in the northwestern quadrant of Lot 1 (see **Figure 4.5**). The sub-lease is renewed annually with Metromix.
- An asphalt plant operated by Downer EDI, occupying an area of approximately 3ha within the northern central section of the existing Southern Extraction Area.
- A pugmill operation conducted by Civilake, the civil works section of Lake Macquarie City Council, occupying an area of approximately 2.1ha adjacent to the active Southern Extraction Area.

Oceanic Coal leases a narrow, north-south tract of land covering parts of Lots 1 and 2. This lease covers the sealed road that Oceanic Coal uses to haul coal from the Macquarie Coal Washing Plant to the Eraring Power Station. The lease for the private coal haul road through the property does not have a completion date. The lease of this land is not intended to restrict the recovery of quarry materials from within the property.

4.3.3 Residences Adjacent to Transport Routes

Teralba

Figure 4.6 displays the outgoing and incoming transport routes through Teralba to Teralba Quarry from the quarry to Five Islands Road. The residences identified on the photo are typically between 10m and 20m from the road pavement.

Wakefield

A total of 22 residences are located within 200m of Wakefield Road with nine present within 50m of the road, six present between 50m and 100m and a further seven situated 100m to 200m from Wakefield Road. The closest residence to Wakefield Road is set back approximately 12m from the edge of the road pavement.

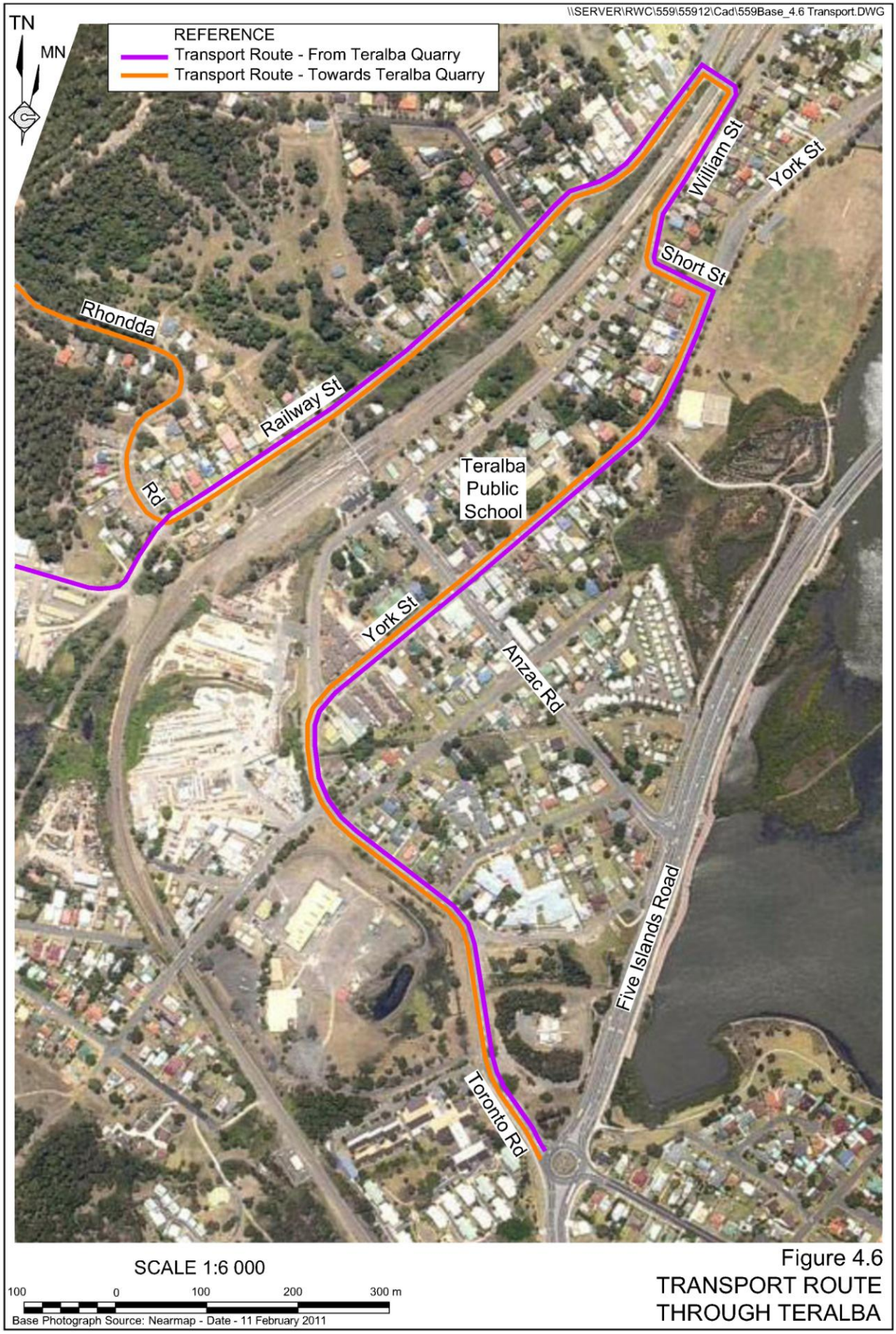

Figure 4.6
TRANSPORT ROUTE
THROUGH TERALBA

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