Section 4

Environmental Setting

PREAMBLE

This section describes the environmental setting within and surrounding the Quarry Site.

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 regional and Quarry Site topography, meteorology, land ownership and land uses.

Other features of the surrounding environment that would or may be affected by the Proposal 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 and Drainage

The Quarry Site is located approximately 2.5km from the southern boundary of the Bald Rock National Park, with surrounding land consisting mainly of lightly wooded ridges and predominantly cleared valleys. Regional topography is displayed on **Figure 4.1**. The Quarry Site is situated on a small ridge to the south of Washpool Creek. The area to the north of the Quarry Site is relatively flat land that is comprised of patches of remnant vegetation and areas cleared for cropping and light grazing. A small valley is present to the south of the Quarry Site, created by a further ridge aligned generally parallel to the Quarry Site.

The topography within the Quarry Site is displayed on **Figure 4.2** and consists of the existing areas of disturbance and a lightly wooded ridge running generally in an east-west direction with land outside the existing disturbance areas sloping at gradients between 5° and 30°. The existing extraction area is centrally located within the Quarry Site. The floor of the extraction area has an elevation of approximately 920m AHD. A ridge with an elevation of approximately 945m AHD has been retained between the existing quarry benches and the land to the south of the existing extraction area. To the north of the existing extraction area, a level area has been developed for emplacement of overburden and clay fines at an elevation of approximately 930m AHD. The land to the north of this area slopes to the north with average gradients between 20° and 35° to an elevation of 900m AHD at the Northern Sediment Dam and the northern boundary of the Quarry Site.

Figure 4.2 also displays the catchment areas in the vicinity of the Quarry Site. The bulk of the runoff from the Quarry Site is directed to the north, i.e. towards Washpool Creek. There are several small, ephemeral watercourses that periodically flow northwards between the Quarry Site and Washpool Creek. Most of the watercourses disappear before reaching Washpool Creek. Runoff to the south flows into a tributary of Tenterfield Creek that passes through a series of farm dams before joining Tenterfield Creek. Runoff from the southeastern corner of the Quarry Site would flow into Washbrook Creek that in turn flows around another small ridge to the south of the Quarry Site before turning west and eventually joining Tenterfield Creek south of Leechs Gully.

The Proposal would modify the existing topography through removal, in part, of the ridge to the east and west of the existing extraction area and development of an overburden and fines emplacement to an elevation of approximately 920m AHD to the north of the proposed extraction area. Potential impacts relating to topography and drainage would include alterations to drainage and sediment control structures as well as altering the visual environment through increased visibility of the modified landform. These issues are discussed further in Sections 5.4 and 5.8 respectively.

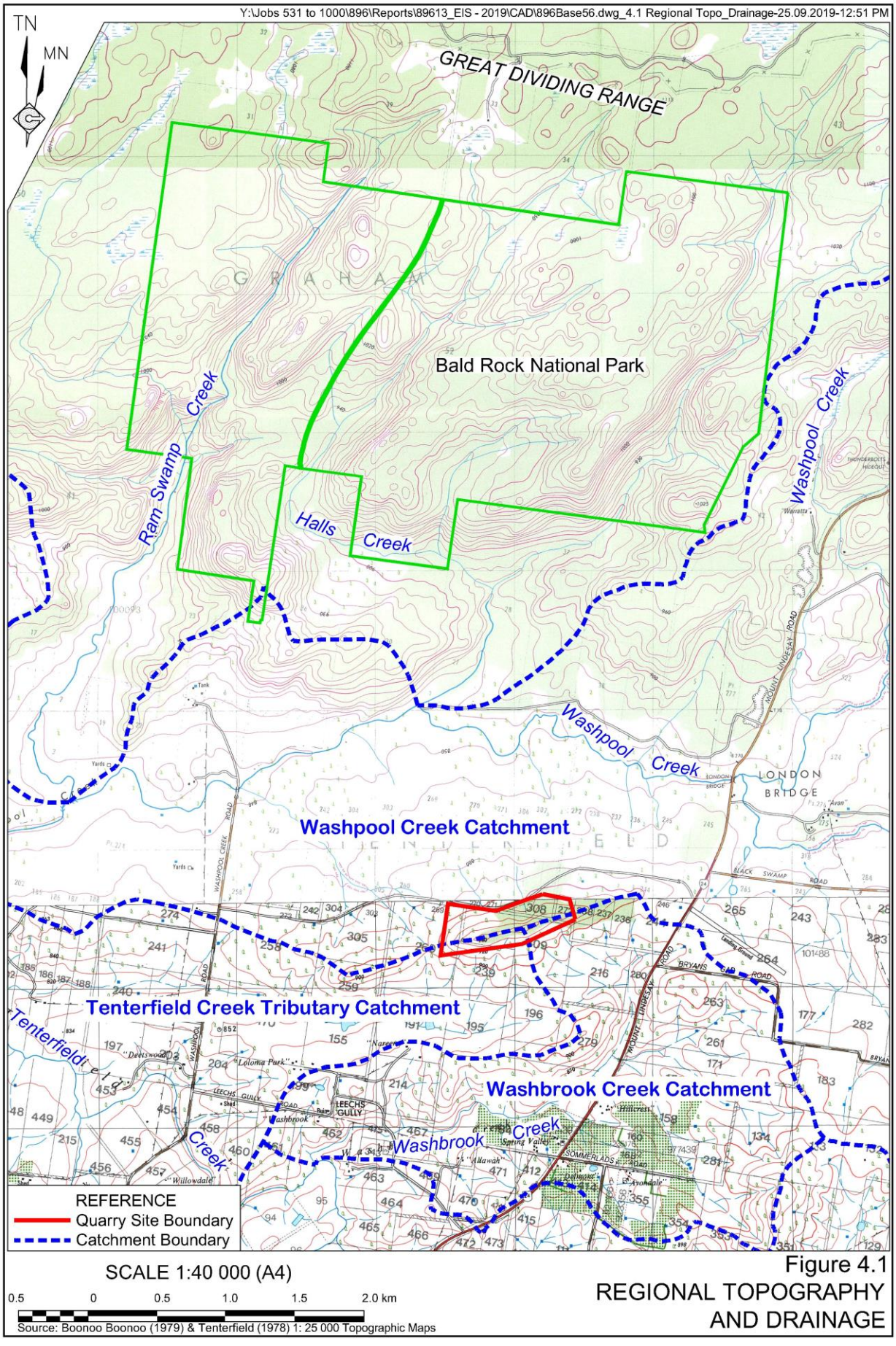


Figure 4.1
REGIONAL TOPOGRAPHY AND DRAINAGE

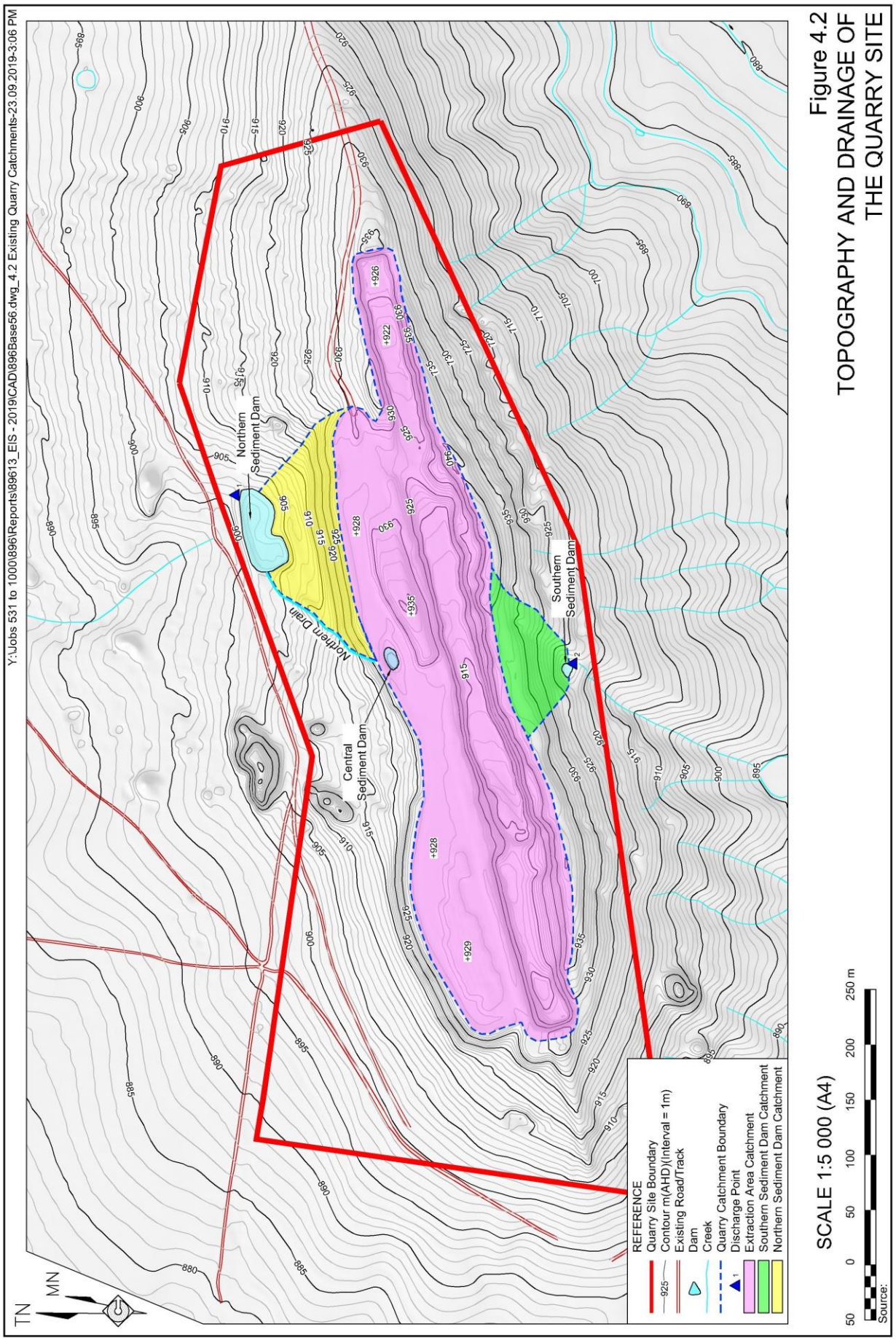


Figure 4.2
TOPOGRAPHY AND DRAINAGE OF THE QUARRY SITE

4.2 Meteorology

4.2.1 Introduction

Climatic conditions have the potential to influence a range of Proposal-related impacts at surrounding residences and the local environment. The climate in the vicinity of Tenterfield is referred to as "subtropical highland climate" with cold, frosty winters and warm, wet summers.

This subsection provides a brief overview of the climatic conditions surrounding the Quarry Site, focusing particularly on those aspects of the climate that are likely to influence the potential Proposal-related environmental impacts, particularly air quality, noise and surface water management.

Meteorological data for the existing environment was sourced from the local Federation Park Bureau of Meteorology (BOM) station (Station Number – 056032) which provides a data range from 1870 to the present for some parameters. Evaporation data was sourced from the Average Pan Evaporation Map compiled by the Bureau of Meteorology.

Table 4.1 provides a summary of the climate data which is discussed further in the following subsections.

Table 4.1
Climate Data Summary

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Temperature (°C) 1907 to 2019													
Mean maximum temperature	27.1	26.1	24.6	21.7	18.0	15.0	14.5	16.1	19.5	22.4	24.8	26.6	21.4
Mean minimum temperature	14.4	14.3	12.5	8.5	4.8	2.4	1.0	1.7	4.6	8.0	10.8	13.0	8.0
Highest Daily Temperature	38.3	39.9	35.6	32.9	27.1	24.6	23.3	30.0	31.2	33.9	36.2	36.8	-
Lowest Daily Temperature	4.5	4.0	-3.0	-5.0	-8.8	-9.3	-10.6	-9.5	-7.2	-3.4	-2.0	1.2	-
Rainfall (mm) 1870 to 2019													
Mean monthly rainfall	114.2	92.8	81.0	46.7	48.4	50.2	53.2	43.5	50.3	76.5	84.8	105.1	848.5
Highest daily rainfall	144.0	190.6	139.7	110.6	101.8	109.7	228.6	61.2	83.3	94.0	100.1	124.2	-
Rain Days ≥1mm	8.8	8.0	7.8	5.5	5.7	5.9	5.7	5.2	5.4	7.0	7.5	8.7	-
Evaporation (mm) BOM Pan Evaporation Map 1975 – 2005 (including at least 10 years of data)													
Mean monthly evaporation	200	175	150	125	80	60	60	80	125	150	200	200	≈ 1600
Source: Bureau of Meteorology 2019													

4.2.2 Temperature and Humidity

Temperature patterns follow seasonal expectations with higher mean temperatures during the summer months of December to February and lowest temperatures during winter. The mean maximum temperature varies between 27.1°C and 14.5°C while the mean minimum temperature varies between 1.0°C and 14.4°C. Temperatures in the past have reached 39.9°C in summer and -10.6°C in winter.

4.2.3 Rainfall and Evaporation

Mean annual rainfall is 848.5mm, with rainfall distributed unevenly throughout the year. The area displays a distinct drier period for the six months from April to September. Rainfall for January and December is on average higher than 100mm. Rainfall is infrequent with few rain days each month resulting in rainfall greater than 1mm. Rainfall can however be variable, with infrequent, high intensity rainfall events occurring throughout the year with rainfall received generally being twice the average monthly rainfall.

The estimated mean monthly evaporation is higher than mean monthly rainfall for each month resulting in an annual moisture deficit.

4.2.4 Wind

CSIRO prognostic meteorological model TAPM was configured for five complete years between 2013 and 2017 to review prevailing annual wind conditions at the Quarry Site for the purpose of predicting dust dispersion patterns. **Figure 4.3** displays the wind rose predicted by the model for 2015 which is considered representative of the general wind trend across the five year period.

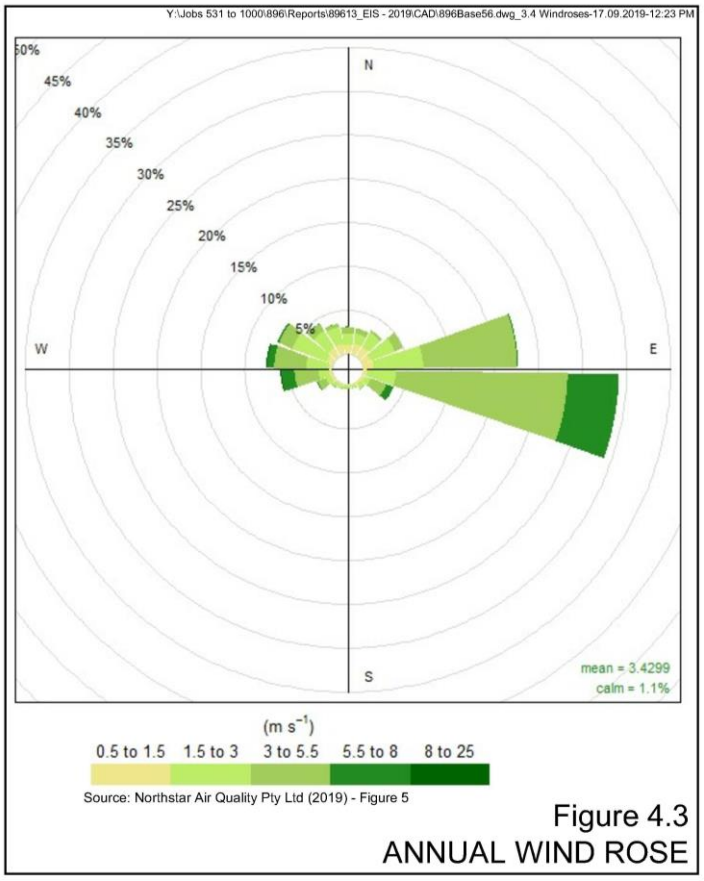


Figure 4.3
ANNUAL WIND ROSE

Dominant winds were predicted from the east and the west which may be a result of the topography of the Quarry Site (see **Figure 4.1**). Very little wind in other directions was predicted by the model. The dominance of these winds was also verified in discussions with site employees.

4.3 Land Ownership and Surrounding Residences

4.3.1 Land Ownership

The land on which the existing quarry is situated is owned by Mr Rod Dowe and has been leased by the Applicant. **Figure 4.4** displays the land ownership within and surrounding the Quarry Site. Land ownership does not constrain the Proposal.

4.3.2 Land Uses

The Quarry Site is currently used principally for the extraction of quartzose rock. The land owner periodically grazes cattle around the margins of the Quarry to control bush fire fuel loads.

The land uses surrounding the Quarry Site include light grazing and pasture improvement. The existing Quarry is surrounded by remnant vegetation with small patches of vegetation extending approximately 1km to the north to Washpool Creek and further north to Bald Rock National Park.

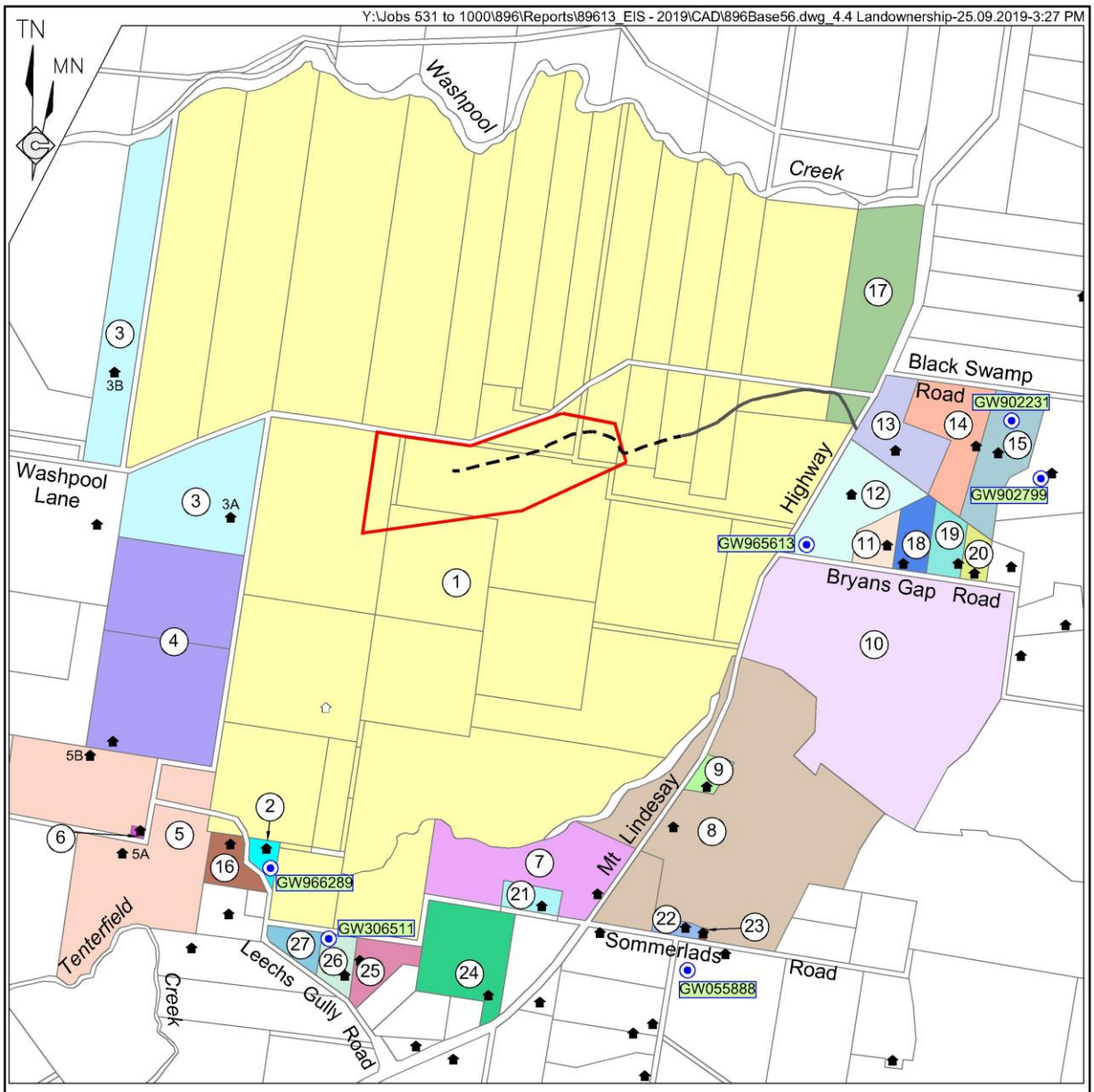
The Proposal would not result in changes to commercial agricultural land uses surrounding the Quarry Site. Potential indirect impacts resulting from air quality and noise impacts in the surrounding environment are discussed in Sections 5.2 and 5.3, respectively. As described in Section 2.14, it is proposed to rehabilitate the Quarry Site such that it may be used predominantly for nature conservation post-quarry life.

Table 4.2 lists the residences displayed on **Figure 4.4** and their respective distances to the closest point of both the existing extraction area and the proposed extraction area.

For the purposes of this document, surrounding residences are assessed in the following three groups:

- those to the east of the Quarry Site;
- those to the northwest, west and southwest of the Quarry Site; and
- those to the south and southeast of the Quarry Site.

It is noted that there are no residences to the north, between the Quarry Site and the southern boundary of Bald Rock National Park.



REFERENCE
- Quarry Site Boundary
- Cadastral Boundary
- Proposed Quarry Access Road
- Existing Sealed Quarry Access Road
- Residence (Project Related)
- Residence (Non-Project Related)
- (1) Landowner Reference (See Table)
- GW965613 Groundwater Bore and Identifier

Ref	Landowner	Ref	Landowner
1	RSH & MO Dowe	15	AJ & BW Lawrence
2	JP Jacquet, MJ Bielski	16	PJ Della & TM Curry
3A,3B	RF & LL Tumbridge	17	The State of New South Wales
4	RL Caldwell	18	MN & DN Larsen
5A,5B	GL & JM Smith	19	GB & DK Phillips
6	DB Weir, GR Smith, WF Marsden	20	CA Jackson, D Bunic
7	JM Dowe	21	DM & AJ Mullins
8	RB & CA Sewell	22	JP & SL Doyle
9	MJ & NJ Lewis, RB & CA Sewell	23	LD Merchant
10	KR & LA Willcocks	24	Harewood Investments Pty Limited
11	KH Baxman & CC Haynes	25	D Puglisi
12	BL & JA Morrow	26	BJ & RL Tom
13	RM Ibbett, S Ibbett	27	BJ Tom & Brad Tom Investments Pty Ltd
14	GM O'Reilly, MP Watt		

SCALE 1:25 000 (A4)

250 0 250 500 750 1000 1250 m

Cadastral Source: LPI (2014)
Landowner Source: Department of Lands Online Search - April 2019

Figure 4.4
LAND OWNERSHIP, SURROUNDING RESIDENCES AND GROUNDWATER BORES

Table 4.2
Nearby Residences and Distances from Dowe's Quarry

Residence Number[1]	Name	Residence on Property	Direction from Quarry	Distance to Existing Quarry	Distance to Proposed Quarry
1	RSH & MO Dowe	Y	SW	1 100m	730m
2	JP Jacquet, MJ Bielski	Y	SW	1 590m	1 270m
3A	RF & LL Tumbridge	Y	W	1 050m	540m
3B	RF & LL Tumbridge	Y	NW	1350m	1120m
4	RL Caldwell	Y	SW	1 730m	1 240m
5A	GL & JM Smith	Y	SW	1 940m	1 530m
5B	GL & JM Smith	Y	SW	1700m	1430m
6	DB Weir, GR Smith, WF Marsden	Y	SW	1 840m	1 420m
7	JM Dowe	Y	SSE	1 530m	1 530m
8	RB & CA Sewell	Y	SSE	1 370m	1 400m
9	MJ & NJ Lewis, RB & CA Sewell	Y	SE	1 290m	1 330m
10	KR & LA Willcocks	N	-	-	-
11	KH Baxman & CC Haynes	Y	E	1 300m	1 060m
12	BL & JA Morrow	Y	E	1 150m	1 300m
13	Richard Mervyn Ibbett & Steven Ibbett	Y	E	1 310m	1 470m
14	GM O'Reilly, MP Watt	Y	E	1 600m	1 770m
15	AJ & BW Lawrence	Y	E	1 690m	1 850m
16	PJ Della & TM Curry	Y	SW	1 650m	1 300m
17	The State of NSW	N	-	-	-
18	MN & DN Larsen	Y	E	1 370m	1 140m
19	GB & DK Phillips	Y	E	1 580m	1 710m
20	CA Jackson, D Bunic	Y	E	1 640m	1 400m
21	DM & AJ Mullins	Y	S	1 540m	1 520m
22	JP & SL Doyle	Y	SE	1 740m	1 750m
23	LD Merchant	Y	SE	1 770m	1 790m
24	Harewood Investments Pty Limited	Y	S	1 840m	1 800m
25	D Puglisi	Y	S	1 760m	1 650m
26	BJ & RL Tom	Y	S	1 830m	1 730m
27	BJ Tom & Brad Tom Investments Pty Ltd	N	S	-	-

4.3.2.1 Residences Adjacent to the Transport Routes

Figure 4.5 displays the residences located adjacent to the transport routes currently used to transport raw materials to the Sunnyside Crushing and Screening Plant and to back-load clay fines for emplacement at Dowe's Quarry. The setback distances to the residences adjacent to Mount Lindesay Road, New England Highway and Old Ballandean Road, are as follows.

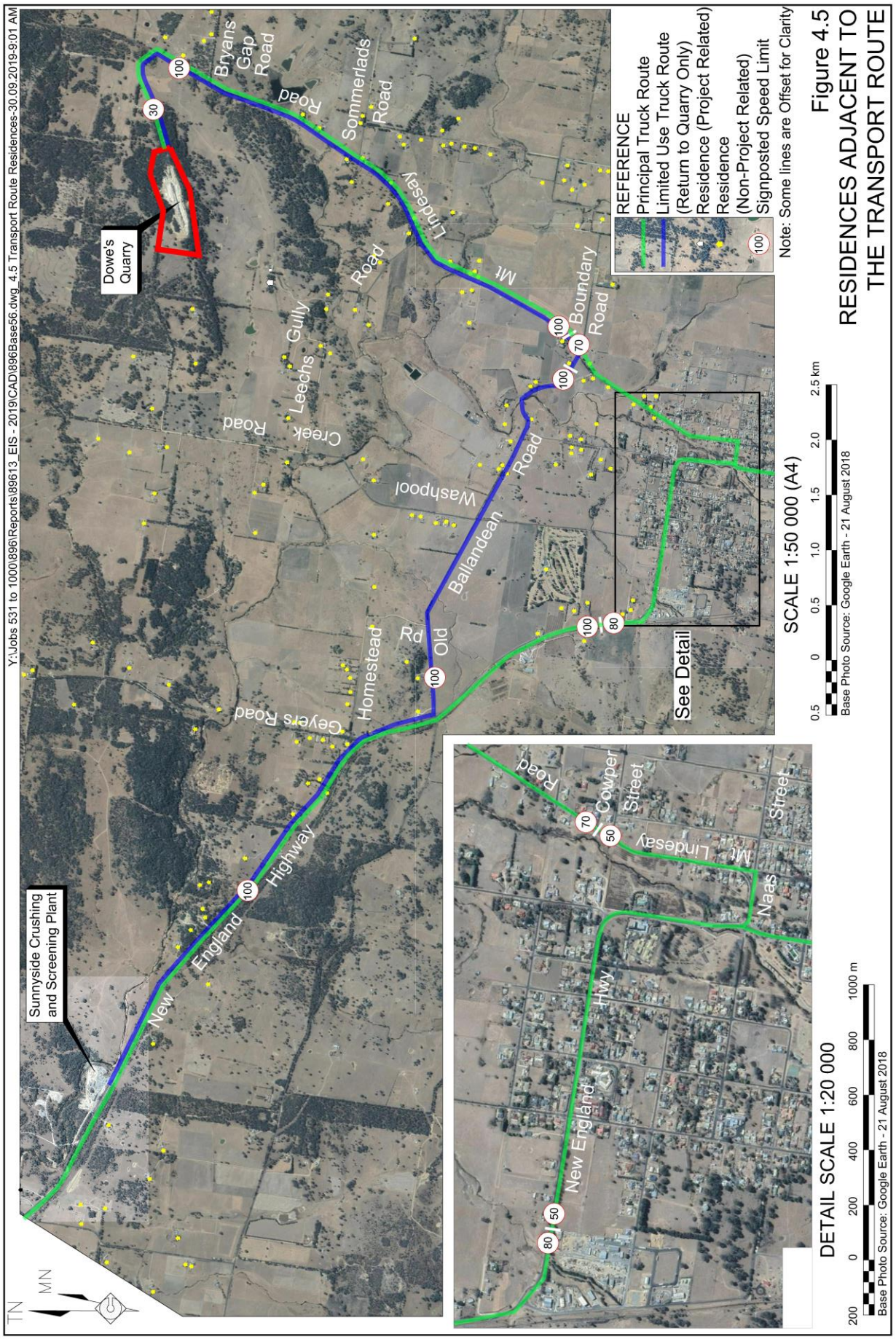


Figure 4.5 RESIDENCES ADJACENT TO THE TRANSPORT ROUTE

Mount Lindesay Road

- 100kph Section (28m to 46m)
- 70kph Section (18m to 35m)
- 50kph Section (15m to 30m)

New England Highway.

- 100kph Section (18m to 190m)
- 80kph Section (32m to 60m)
- 50kph Section (10m to 30m)

Old Ballandean Road.

- 100kph Section (20m to 140m)

It is noted there are no school zones along the transport route between Dowe's Quarry and the Sunnyside Crushing and Screening plant.

4.4 Bush Fire Hazard

The RFS mapping tool, accessed on 29 August 2019, identifies the Quarry Site as being within a designated bush fire prone area. A detailed bush fire hazard analysis is provided in Section 5.9.3.

4.5 Services

There are currently no infrastructure, utilities or services located at the Quarry Site. No amenities are regularly kept on site. It is proposed that a mobile administration and cribroom building would be located on site with "portaloo" style facilities for ablutions. Truck drivers would also make use of facilities at the Sunnyside Crushing and Screening Plant, as required.