Section 4

Assessment and Management of Key Environmental Issues

PREAMBLE

This section describes the specific environmental features of the Application Area, focussing on the Stage 2 Site and its surrounds that would or may be affected during the life of the Proposal. The proposed design and/or operational safeguards and management measures are presented, followed by an assessment of the predicted level of impact(s) the proposed activities may have after implementation of these measures. Where appropriate, proposed monitoring programs are also described.

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4.1 LOCAL SETTING

4.1.1 Introduction

The descriptions of various environmental aspects of the Proposal throughout this section are reliant upon a range of background information common to many of the key environmental issues. In this subsection, the local setting is described and background information is provided on the climate, land ownership and residences of the local setting. The local setting relevant to specific environmental features are described throughout the remainder of Section 4.

4.1.2 Meteorology

4.1.2.1 Introduction

Table 4.1 provides a brief statistical summary of climate data sourced from the following meteorological stations, chosen based on proximity to the Stage 2 Site and/or similar geographical context.

- Temperature: Lithgow Birdwood Street (Station # 063224) 1912 to 2006 (closure) and Lithgow (Cooerwul) (Station # 063226) 2006 to 2013.
- Rainfall: Lowther Park 1945 to 2014 (Station # 063049) (no other data is collected at this station).
- Evaporation: Bathurst Agricultural Station (Station # 063005) 1966 to 2013.

A meteorological station has been operated at the Site since 2003, however, temperature, humidity and rainfall data from the established meteorological stations has been used in preference due to the longer periods of monitoring. Wind data collected at the Austen Quarry meteorological station has been used in the generation of a wind data file for the local area which has been incorporated into dispersion (air) and noise modelling) for the Proposal.

4.1.2.2 Temperature and Humidity

January is the hottest month, having the highest mean temperature of 24.9°C, with November, December, February and March all with mean annual temperatures exceeding 20°C and maximum temperatures exceeding 30°C. The lowest temperatures were evident through June to August with the lowest mean temperature in July of 0.8°C.

4.1.2.3 Rainfall

Mean annual rainfall is 834.6mm, with mean rainfall highest from October to March. Statistically, the highest average rainfall occurs in January, however, be extremely variable, with infrequent, high intensity rainfall events occurring. This is exemplified by the cooler months of May to August which have the lowest mean rainfall, with no rainfall being recorded during these months in some years, but also several of the highest recorded monthly totals.

Table 4.1
Climate Data Summary

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Temperature (°C) Lithgow Birdwood Street (Station # 063224) 1912 to 2006 / Cooerwul (Station # 063226) 2006 to 2013													
Mean maximum temperature	24.9	24.0	21.8	18.0	14.1	11.0	10.3	11.8	15.1	18.3	21.1	23.9	17.8
Mean minimum temperature	11.6	11.8	9.8	6.6	3.8	1.9	0.8	1.3	3.3	5.9	8.0	10.2	6.3
Highest Daily Temperature	37.8	38.5	35.1	30.8	23.9	19.5	19.8	22.5	27.6	33.1	37.2	36.8	38.5
Lowest Daily Temperature	1.3	3.5	0	-4.0	-6.1	-7.0	-8.0	-7.7	-6.0	-2.3	-1.7	0.6	-8.0
Rainfall (mm) Lowther Park 1945 to 2014 (Station # 063049)													
Mean monthly rainfall	07.1	105.6	88.2	66.5	60.8	82.1	64.4	73.3	65.0	78.6	82.5	81.3	855.4
15th percentile month (2002)	72.2	226.6	81.2	52.2	60.4	35.0	38.0	16.2	29.4	9.2	28.2	45.6	694.2
90th percentile month (2010)	57.4	175.6	75.8	34.2	57.6	50.8	88.6	128.6	48.4	82.6	167.2	198.8	1 165.6
Highest daily rainfall	92.0	88.6	91.8	72.4	64.4	94.2	78.2	180.0	95.8	63.81	69.6	66.5	180.0
Evaporation (mm) Bathurst Agricultural Station (Station # 063005) 1966 to 2013													
Mean daily evaporation	6.8	5.7	4.5	2.9	1.7	1.1	1.2	1.8	2.8	4.0	5.2	6.5	3.7
Mean monthly evaporation	211	160	140	87	53	33	37	56	84	124	156	202	1 341
Source: Bureau of Meteorology 2014													

The 15th percentile (2002) and 90th percentile (2010) rainfall years have been presented as indicative of dry and wet years respectively. Notably, even in 'dry' years, there are likely to be periods of heavy rainfall which require consideration in the design of water and erosion and sediment control infrastructure.

4.1.2.4 Evaporation

Mean evaporation at the Bathurst Agricultural Station throughout the year is 3.7mm per day or 1 341mm per year. Monthly evaporation varies between 33mm in June and 211mm in January. Mean monthly evaporation is greater than mean monthly rainfall between September and April.

4.1.2.5 Wind

A site-representative meteorological data file was generated using The Air Pollution Model (TAPM) using data collected from the Austen Quarry Meteorological station for the year 2012. The TAPM file contained values for temperature, wind speed, wind direction, mixing height, stability class and the sigma theta parameters. **Figure 4.1** presents a summary of wind patterns generated by the TAPM meteorological data file. The wind roses indicate that on an annual basis, prevailing winds are from the northwest and west with significant winds also experienced from the south and southeast, especially during summer.

Calm conditions (<0.5m/s) are experienced approximately 6% of the time and the average wind speed is 2m/s.

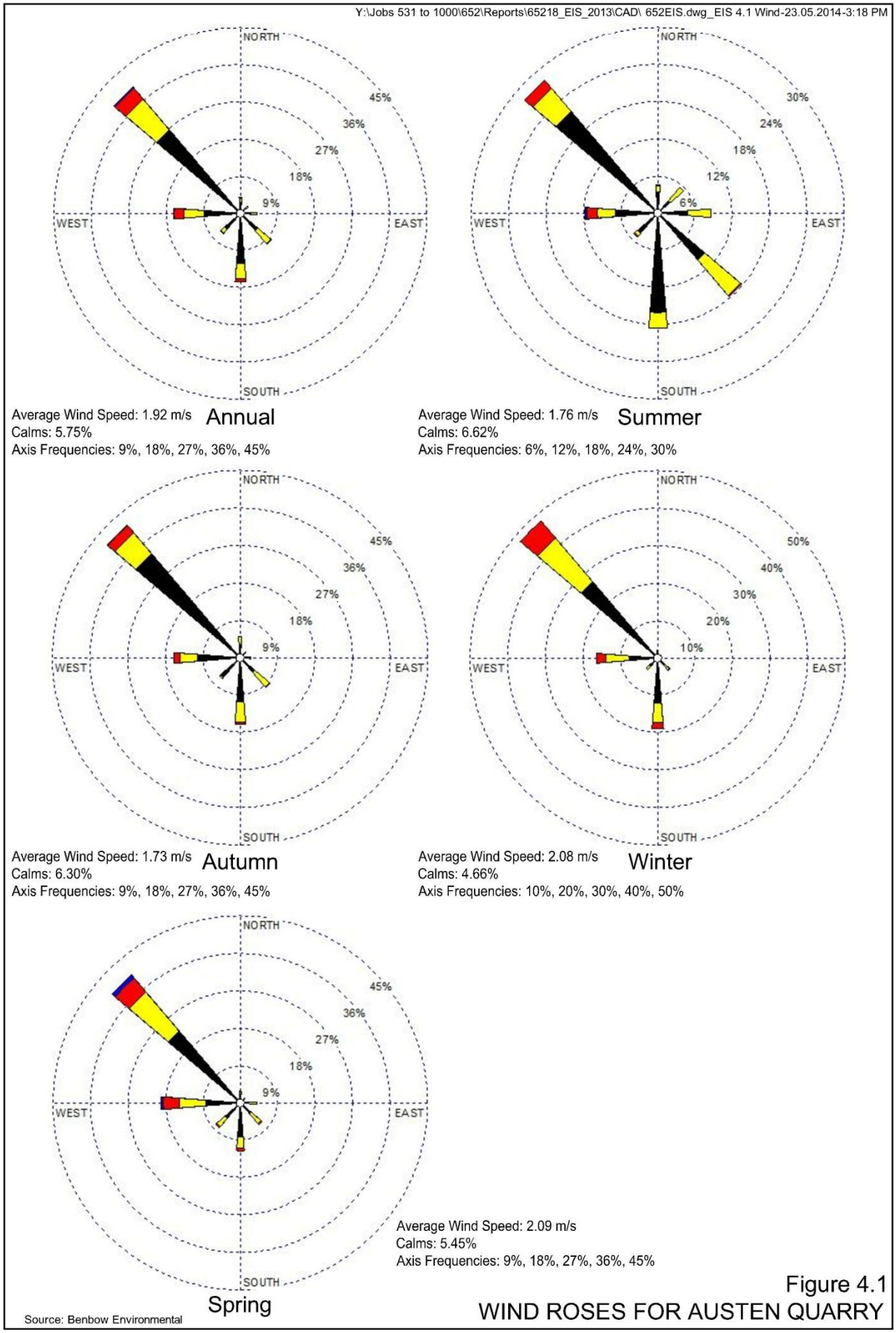


Figure 4.1
WIND ROSES FOR AUSTEN QUARRY

4.1.3 Land Ownership and Surrounding Residences

4.1.3.1 Surrounding Land Ownership

Figure 4.2 displays the land ownership of the Stage 2 Site and surrounds illustrating the large landholding of HPC which provides a significant buffer to neighbouring properties.

Within the approximate 4km radius of the Stage 2 Site displayed in **Figure 4.2**, several individual residences are present on larger properties, including but not limited to:

- "Good Forest" – 1km southwest of the Stage 2 Site boundary.
- "Glenroy" – 2.6km north of the Stage 2 Site boundary.
- "Ecclesbourne" – 3.1km west of the Stage 2 Site boundary.
- "Ant Hill" – 3.5km southwest of the Stage 2 Site boundary.
- "Glenleigh" – 3.8km southwest of the Stage 2 Site boundary.
- "Wuthering Heights" – 2.5km south of the Stage 2 Site boundary.
- "Duddawarra" – 2.7km south of the Stage 2 Site boundary.

In addition, there are several areas of smaller rural holdings with residences. These are concentrated as follows.

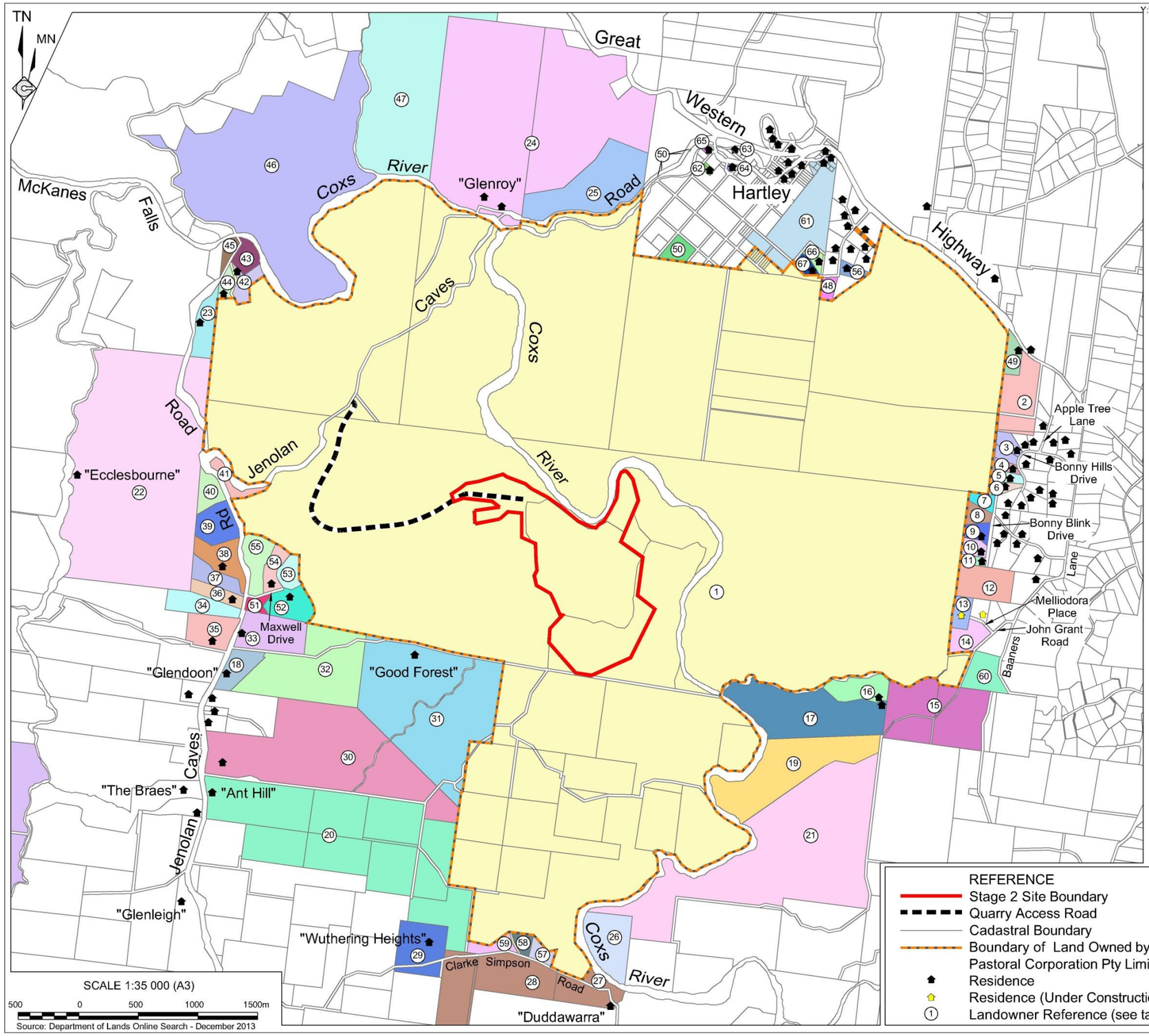
- Residences within the village of Hartley which occur between 2.5km and 3km to the north-northeast and northeast of the extraction area.
- Baaners Lane, Apple Tree Lane, Bonny Hills Drive, Bonny Blink Drive, Melliodora Place and John Grant Road with residences between 2.9km and 4.3km to the east and east-northeast of the Stage 2 Site boundary.
- Various residences on Jenolan Caves Road to the west of the Stage 2 Site boundary.
- A group of three residences on McKanes Falls Road to the northwest of the Stage 2 Site boundary.

4.1.3.2 Residences Adjacent to Transport Routes

The only residence located on the section of Jenolan Caves Road forming part of the primary transport route to Sydney is that on the Glenroy property adjacent to the bridge over the Coxs River. This residence is set back approximately 45m from the road. A second dwelling is located closer to the road (~12m), however, this is not inhabited.

Residences are also located on Jenolan Caves Road to the south of the quarry entrance, as well as on the Great Western Highway.

Y:\Jobs 531 to 1000\652\Reports\65218_EIS_2013\CAD\ 652EIS.dwg_EIS 4.2 Landowner 23.05.2014-3:18 PM



Ref	Landowner
1	Hartley Pastoral Co Pty Limited
2	T A & M Ashcroft
3	R L & D M Fairbairn
4	J W & D A Holmes
5	A E Raynor, J A Littlewood
6	B D & K N Berthon
7	D J & C Wessell
8	B R & K L Helmrich
9	M A Hilder
10	V J & J Turnbull
11	R J & S J Lawrence
12	S M Taylor, A R Thompson
13	R & W Knight
14	R D & D K Boland
15	Di Falco Brothers Pty Limited
16	J J & E E Turner
17	Lewis Brothers Pty Limited
18	R A Smith, R J Hall
19	R J Matthews
20	A V Joseph
21	P J & C A Meakin
22	B N & J K Houlison
23	J R & D A Young
24	B & R Barber
25	T Barber
26	J D & B L De Losa
27	J E Bell
28	J E & N A Bell
29	CH,CG,RA & JT Ward, ME Laidlow, MF King
30	R H & H E Berry
31	D W & L R Cullen
32	A M & B M Guinan
33	G Kitchener
34	J M & A D Luchetti
35	J A McDonald
36	C Hindle
37	D P Coates
38	L G & M L Swift
39	M Muntanion
40	K J & P F Reddacliff
41	T G Kelly, H C Kongdon
42	B L & C Fitzpatrick
43	R Bennett
44	P J & J L McPhail
45	The Minister for Public Works
46	G J & D M Corney
47	Nosbor Pty Limited
48	B J & D A Murphy
49	G M & E J Corbett
50	The State of New South Wales
51	N E Wilkinson
52	W H Samuels
53	N L Gastaldin
54	Kitchner Super Investments Pty Ltd
55	P A Deane
56	R S & J Gavin
57	T C & C H Watts
58	S K & P A Jones
59	A J & S D Jack
60	G & B M James
61	M J Dunstan
62	I Campbell
63	D Hirsch
64	J Farrag
65	J Cliffed
66	C & L B Grace
67	S J & K T Edwards

Figure 4.2
LAND OWNERSHIP AND RESIDENCES

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4.2 LAND RESOURCES

4.2.1 Introduction

The DGRs issued for the Proposal identified "*Land Resources*" as a key issue for assessment requiring that the EIS provide a*" detailed assessment of the potential impacts on:*

- *soils and land capability;*
- *landforms and topography, including rock formations, steep slopes, land slippage;*
- *land use, including forestry use; and*
- *extractive material resources, including assessment of the size and quality of the resource and description of the methods used to assess the resource and its suitability for the intended applications.*

Based on the risk analysis undertaken for the Proposal (Section 3.3.1 and **Table 3.9**), the potential impacts relating to soil, land capability and agricultural suitability and their risk rankings (in parenthesis) after the adoption of pre-existing or standard mitigation measures are as follows.

- Loss of soil resources as a result of land preparation activities leading to rehabilitation outcomes not meeting objectives (Medium Risk).
- Degradation of soil resources during stockpiling resulting in reduced productivity of the final landform (Medium Risk).
- Erosion as a result of vegetation clearing, from stockpiles, or following soil replacement during rehabilitation resulting in:
  - rehabilitation outcomes not meeting objectives (Medium Risk); or
  - increased erosion on the final landform (Medium Risk).
- Reduced amenity of the final landform (Medium Risk).
- Final landform and land use incompatible with surrounding landscape (Medium Risk).

A review of the attributed risk levels, following the adoption of the recommended operational safeguards and controls, is provided in Section 6.2.1 and **Table 6.1**.

An assessment of soil and land capability for the Proposal was undertaken by Mr Mark Passfield of Strategic Environment and Engineering Consultants (SEEC). The resulting report is presented as Part 10 of the *Specialist Consultants Studies Compendium* and is referred to hereafter as "SEEC (2014)". Assessment of landforms, topography and land use have been completed by R.W. Corkery & Co. Pty Limited (RWC) with the assessment of extractive material resources also completed by RWC with the input of Groundwork Plus Pty Ltd, Don Reed & Associates Pty Ltd and the Applicant.

This subsection of the EIS provides a summary of the existing environment, potential impacts, safeguards and controls and impact assessment for each of these features of the environment, concentrating on those matters raised in the DGRs and submissions to the DGRs provided by various government agencies. A consolidated list of the identified requirements and where each is addressed is presented in **Appendix 3**.

4.2.2 Landforms and Topography

4.2.2.1 Existing Environment

The regional topography around the Stage 2 Site is shown on **Figure 4.3**. The Stage 2 Site is located on the western fringe of the Blue Mountains with steeply sloped valleys and ridges with elevations in excess of 1 050m AHD at the western extent of the Blue Mountains National Park and to the north at Mt York and Hassans Walls. Steeply incised ridges and valleys amongst gently undulating grazing land typify the topography of the region, with notable features including:

- Mt Blaxland which rises to 1 006m AHD to the west of the Stage 2 Site (and signifies the western most point of the 1813 crossing of the Blue Mountains by Blaxland, Lawson and Wentworth);
- "The Peak" Trigonometric Station, rising to 800m AHD within the Kanimbla locality to the south; and
- the very gently undulating plain of Hartley Vale and the River Lett valley.

Local topography is dominated by the Coxs River which drains to the east and adjoins the Stage 2 Site to the north (see **Figure 4.4**). The Coxs River flows further to the south of the Blue Mountains where it ultimately drains into Lake Burragorang, Sydney's main water supply source. Yorkeys Creek, another dominant topographic feature of the local setting, passes between the secondary processing area and Yorkeys Creek stockpile area where it drains into Coxs River at northwestern corner of the Stage 2 Site. The topography rises moderately to steeply from both the Coxs River and Yorkeys Creek with a series of ridges and incised gullies features of the local topography, especially to the south and east. Land directly to the south, east and west of the Stage 2 Site consists mainly of forested ridges and gullies developing to wider predominantly cleared valleys. Land to the north of Coxs River is mainly gently undulating grazing land.

The topography of the Stage 2 Site itself is illustrated on **Figure 4.5**. The secondary processing area is located on a flat area (elevation approximately 665m AHD) to the immediate south of the Coxs River and east of Yorkeys Creek. The landform rises steeply to the south to an elevation of approximately 835m AHD which forms part of a relatively significant east-west oriented ridge line of the local topography. Slopes on and immediately surrounding the Stage 2 Site typically range from less than 5° at the Coxs River bank up to 30°.

The topography of the Stage 2 Site includes a series of smaller individual ridges, incised by gullies, through the extraction area. These ridges are identified on **Figure 4.5** as the Northern Ridge, Central Ridge and Southern Ridge for the purposes of the visual impact assessment which follows (Section 4.4). The current extraction area has modified the topography of the Northern and Central Ridges although it is noted that the northern aspect of the Northern Ridge, which falls within the approved Stage 1 extraction area, has been excised from quarry extraction plans to date in order to provide a visual barrier to vantage points to the north. At its maximum elevation, this retained slope reaches 790m AHD, falling to the northeast to an elevation of approximately 780m AHD. The Stage 2 extraction area would modify the topography of the Southern Ridge (which has a maximum elevation of 810m AHD) and the Stage 2 overburden emplacement would extend into two small gullies incised in the main east-west oriented ridge line through the Stage 2 Site.

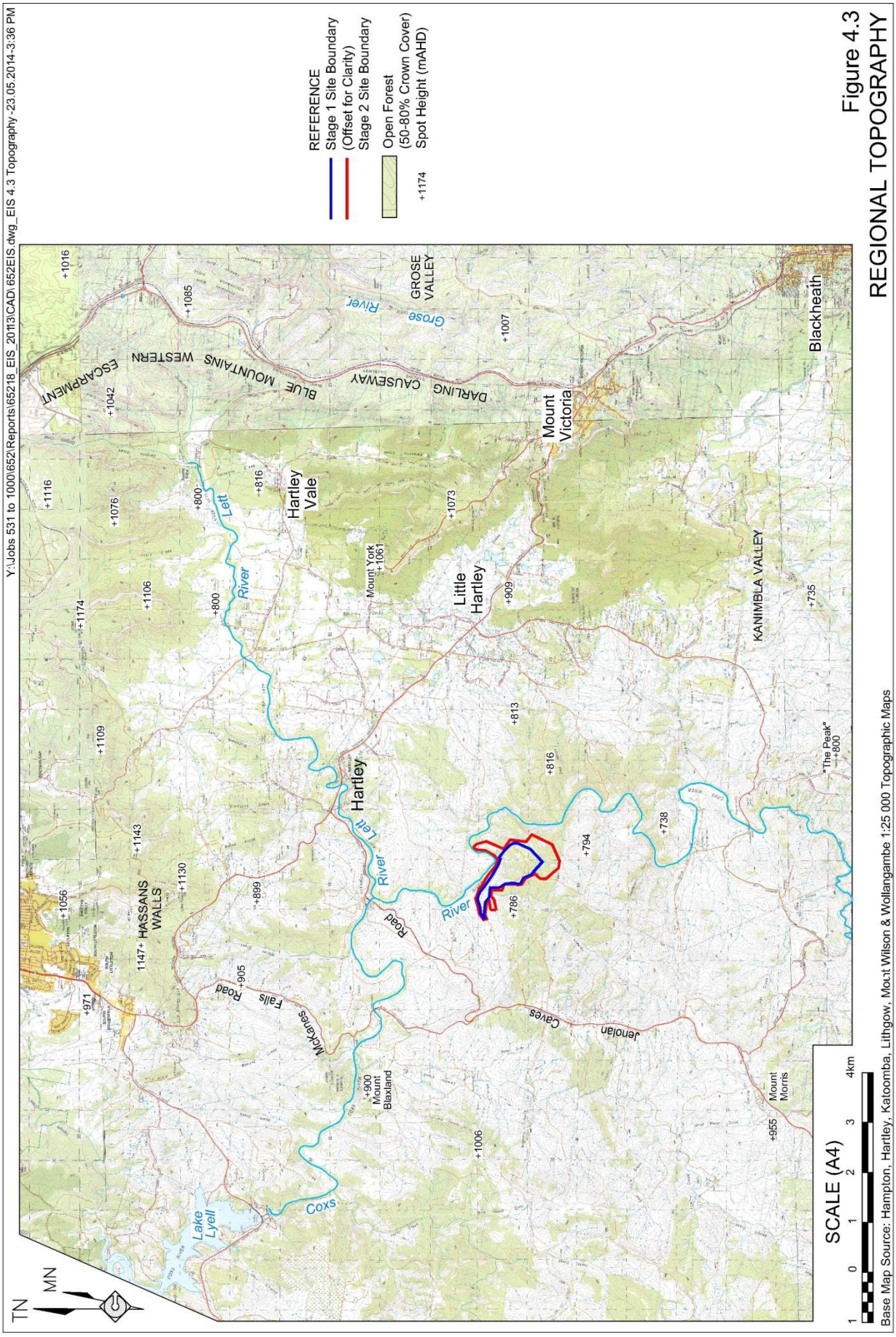


Figure 4.3
REGIONAL TOPOGRAPHY
REFERENCE
Stage 1 Site Boundary
(Offset for Clarity)
Stage 2 Site Boundary
Open Forest
(50-80% Crown Cover)
Spot Height (mAHD)
+1174
Y:\Jobs 531 to 1000\652\Reports\65218_EIS_2013\CAD\652EIS.dwg_EIS 4.3 Topography -23.05.2014-3:36 PM
GROSE VALLEY
Grose River
BLUE MOUNTAINS WESTERN ESCARPMENT
DARLING CAUSEWAY
Mount Victoria
Blackheath
Hartley Vale
Left River
Mount York
Little Hartley
KANIMBLA VALLEY
Hartley
HASSANS WALLS
Road
Falls
McKanes
Caves
Jenolan
"The Peak"
Mount Blaxland
Mount Morris
Lake Lyell
Coxs
TN
MN
SCALE (A4)
1 0 1 2 3 4km
Base Map Source: Hampton, Hartley, Katoomba, Lithgow, Mount Wilson & Wollangambe 1:25 000 Topographic Maps

Figure 4.4
LOCAL TOPOGRAPHY

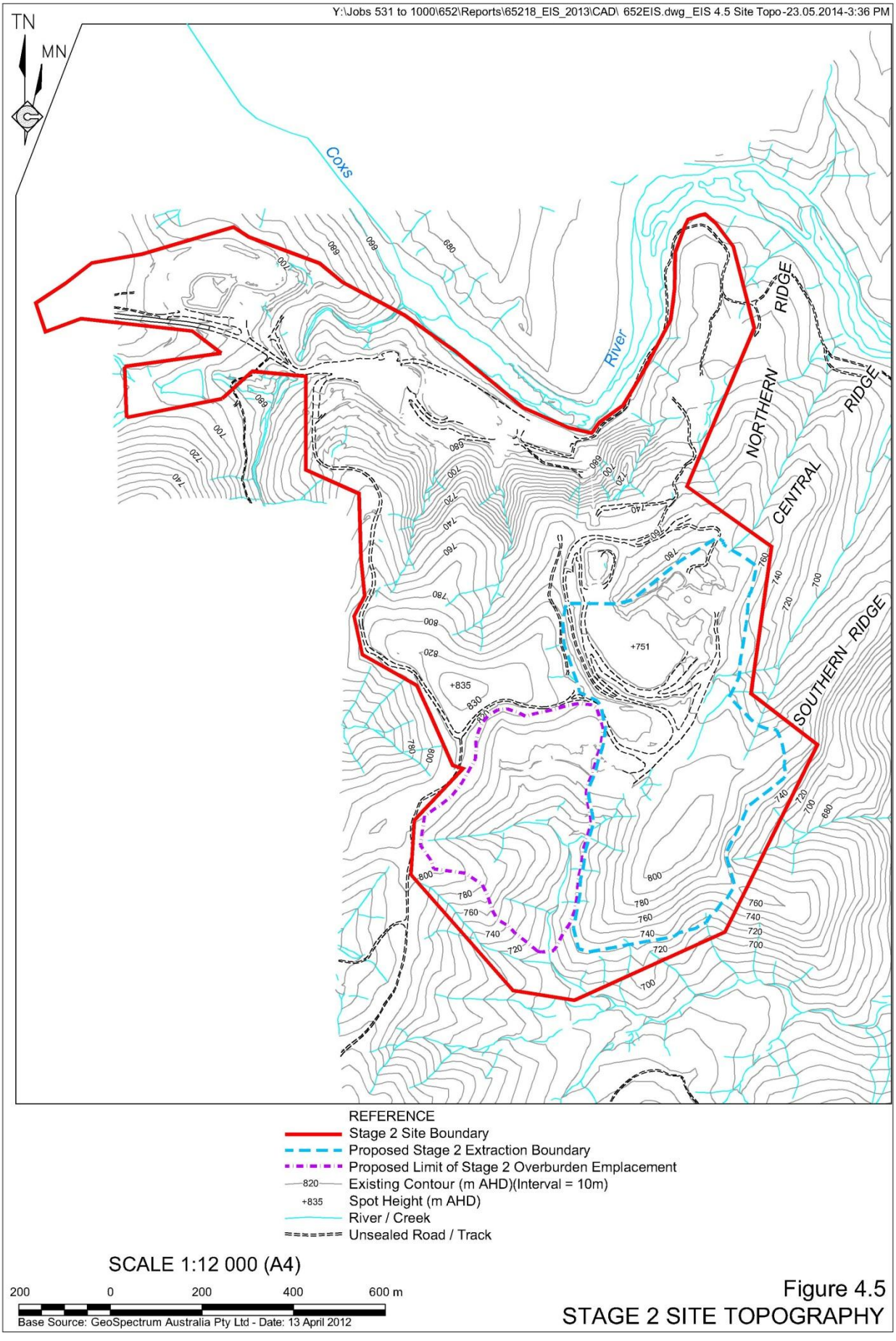


Figure 4.5
STAGE 2 SITE TOPOGRAPHY

The Yorkeys Creek stockpile area and Quarry Access Road are located on the cleared and undulating terrain to the west of the Coxs River and Yorkeys Creek.

4.2.2.2 Potential Impacts of the Proposal

The Proposal would modify the topography and landform by:

- removing sections of the Northern, Central and Southern Ridges to the northeast of the Stage 1 extraction area; and
- in-filling two small gullies to the south of the Stage 1 overburden emplacement.

Neither of these features represents a significant formation of natural, cultural or historic heritage. Given the competent nature of the local geology (igneous rock types of Lower to Middle Devonian in age interbedded with a range of metasediments of the Lambie Group), the potential for land slippage within the final extraction area is very low. Potential impacts as a consequence of the modified topography relate to:

- increased visibility of the modified landform (see Section 4.4.3); and
- drainage and sedimentation patterns (see Section 4.5.3).

Specific operational safeguards and management measures, followed by an assessment of impacts related to these parameters are considered in the sections noted above.

4.2.3 Land and Soil Capability

4.2.3.1 Soil Landscapes

The Stage 2 Site is located within the Mount Walker and Marrangaroo Soil Landscapes as mapped by the former Department of Land & Water Conservation incorporating the Soil Conservation Service of NSW (2002) (see **Figure 4.6**). Both the Stage 1 and 2 extraction areas and overburden emplacement are located on the Mount Walker Soil Landscape, which occurs on steep to very steep hills with narrow, rounded crests on the Lambie Group Metasediments. The secondary processing area and Yorkeys Creek stockpile area are located on the Marrangaroo Soil Landscape, which is mapped over rolling hills and narrow flat to rounded convex crests on Carboniferous granite. For the purpose of this assessment, there would be no additional disturbance to the soils within the Marrangaroo Soil Landscape.

SEEC (2014) provides further information on the common soil types of the two soil landscapes.

4.2.3.2 Soil Characteristics

4.2.3.2.1 Soils Testing and Analysis

Soil was sampled from two hand dug test pits within the proposed Stage 2 extraction area (at the site of previous exploration drill sites) (see **Figure 4.6**). As the landforms, vegetation and mapped soil landscape of the proposed Stage 2 overburden emplacement is consistent with that of the extraction area, SEEC (2014) determined it unnecessary to take separate samples, i.e. the soil observed within the extraction area would be representative of that within the overburden emplacement area.

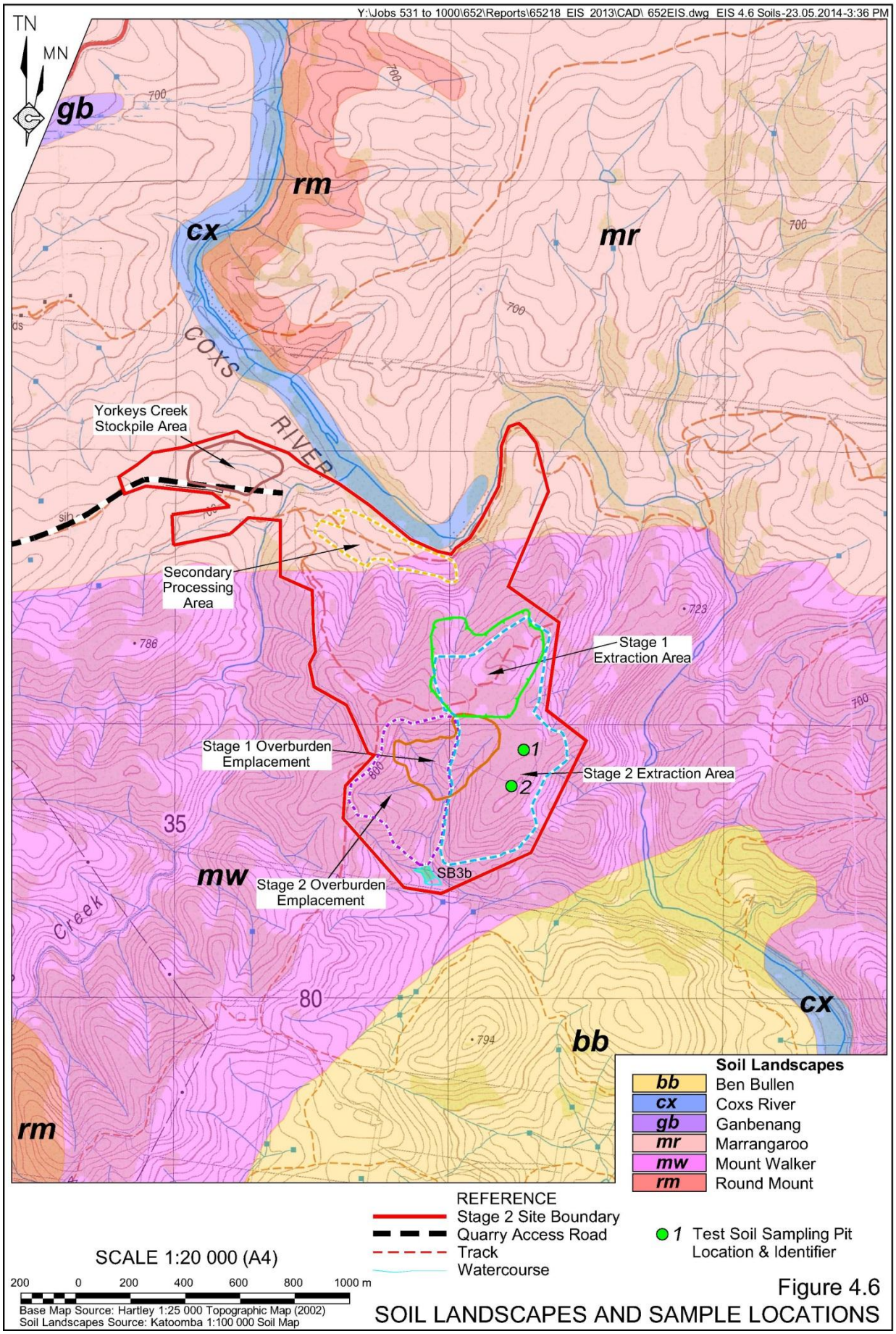


Figure 4.6
SOIL LANDSCAPES AND SAMPLE LOCATIONS

Samples of both topsoil and subsoil from each test pit were sent to the Scone Soil Laboratory of the NSW Department of Lands for analysis. The following provides a summary of the characteristics of the soil of the Stage 2 Site based on the inspection, in-field assessment and the laboratory results.

4.2.3.2.2 Physical Characteristics

Dimensions and Structure

A visual inspection confirmed the soils conform to the descriptions of the soil landscape mapping for the Mount Walker Soil Landscape with very gravelly, quartz-rich, shallow soils (Lithosol) encountered. The topsoil was found to be thin (<100mm), poorly defined and consisting of sandy loam with a small portion of coarse fragments derived from the parent rock. The subsoil layer is also relatively thin (600mm) above bedrock and consists of fine sandy loam to fine sandy clay loam with variable gravel content.

SEEC (2014) assessed the topsoils to be massive, i.e. without observable aggregation, while the subsoils were found to have a poor to moderate structure. The topsoil and subsoil were considered by SEEC (2014) to be sufficiently similar such that they could be stripped and managed as one unit, where soil stripping is practical.

Erosion Potential and Erosion Hazard

The results of K-Factor (sheet erosion) analyses of samples indicate moderate to high soil erodibility (0.025 to 0.034 for topsoils and 0.023 to 0.048 for subsoils).

The wind erodibility index for each sample also indicates moderate susceptibility to wind erosion.

Annual soil loss calculated using the Revised Universal Soil Loss Equation (RUSLE) (Landcom, 2004) suggests the soil loss class would be Class 5 (high) where the typical slope gradient approximates or exceeds 20% (SEEC, 2014). A Soil Loss Class of 5 dictates the need to implement specific erosion control practices between the months of December and February to reduce the erosion risk (see Section 4.2.3.5).

Soil Dispersibility

Emerson Aggregate Test testing and an analysis of the Exchangeable Sodium Percentage (ESP) were used to assess the dispersibility and sodicity of the soils. The results indicate the soils are not highly dispersible or sodic. However, based on the guidelines provided in Landcom (2004), soils in Test Pit 1 were dispersive enough to classify them as Type D and so this would be assumed for the design of sediment basins (refer to Section 4.5.4.2).

Soil Drainage and Water Holding Capacity

While the high gravel and sand content of the soils means they would have high permeability, the infiltration would be affected by the shallow bedrock. SEEC (2014) classified the soils as Hydrological Group D based on the guidelines provided in Landcom (2004).

Considering that up to two thirds of the soil mass can consist of rock fragments, the water-holding capacity of the soils is not high.

4.2.3.2.3 Chemical Characteristics

The results of the laboratory analysis are provided in SEEC (2014). In summary, the results indicate the following chemical characteristics.

- All soils samples were non-saline.
- All samples had a very low Cation Exchange Capacity (CEC).
- All samples had moderate base saturation.
- Topsoil samples were very strongly acidic while subsoils were moderate to strongly acidic.
- Topsoils were very high in organic matter and subsoils very low to moderate in organic matter.

SEEC (2014) provides a more comprehensive review of the test parameters and interpretation of the chemical results.

4.2.3.3 Land Capability

The land capability of those areas of the Stage 2 Site to be disturbed was assessed by SEEC (2014) against *The Land and Soil Capability Assessment Scheme (a general rural land evaluation system for New South Wales)* (OEH, 2012). SEEC (2014) assessed the Land and Soil Capability as Class 6 indicating severe limitations (including soil acidification and common rock outcropping) for a wide range of land uses with few management practices available to overcome them. Soil fertility is very low and, agriculturally, the land is suitable only for low productivity grazing (with limitations).

4.2.3.4 Potential Impacts of the Proposal

The soils of the Stage 2 Site are of poor quality and severely limited in potential use outside of limited grazing and nature conservation. Potential impacts from the Proposal include further reduction in soil quality as a result of poor management practices (associated with stripping, stockpiling and other handing procedures).

As the use of stockpiled soil in rehabilitation would be limited in the short to medium term, the soils would remain in stockpiles for several years. Degradation of the soils is also a possibility as a result of reduced aerobic function, modification to soil structure and erosion.

Finally, there is a potential for a reduction in soil quality upon reuse if there was inappropriate handling and placement of the soils or the use of inappropriate fertilisers.

4.2.3.5 Operational Safeguards and Controls

Vegetation clearing, soil stripping and stockpiling procedures have been discussed in Sections 2.5.3.1 and 2.5.3.2. A summary of these and other soil management procedures and safeguards which would be implemented are provided as follows.

Soil Stripping

- Available soil would be stripped to the depth where bedrock is encountered (600mm to 1 000mm) in all areas to be disturbed by extraction and overburden placement. No further mechanical blending of the soils would be undertaken as current practices indicate the removal process would be sufficient to blend the topsoil and subsoil layers.
- All soils would be handled as little as possible to minimise structural damage. This would be achieved by operator training and ensuring the areas for stripping and stockpiling are clearly identified.
- Unless unavoidable, soil stripping on land with slope gradients exceeding 20% would not be undertaken between December and February each year.
- If soil stripping is to be undertaken on land with slope gradients exceeding 20% between December and February, control practices would be nominated and implemented based on the particular conditions of the Stage 2 Site. These could include such measures as: immediately applying adequate ground cover; or reducing the slope length to half through the use of mulch berms.
- Soils would not be stripped or replaced during extremely wet or dry conditions.

Soil Stockpiling

- Machinery used for stripping operations would place their loads neatly and uniformly so the stockpile does not require further forming prior to establishment of vegetation cover.
- Driving of machinery on the soil stockpiles would be prohibited once the stockpiles are created to minimise compaction and further degradation of soil structure.
- Soil stockpiles would not exceed 2m in height.
- Stockpiles would be seeded and fertilised as soon as possible after emplacement, using a mix of sterile annual groundcover or native grasses.

Erosion and Sediment Control

- Upslope water diversion would direct overland surface water flow away from the soil stockpiles.
- Downslope sedimentation controls would be implemented as required, until such time as the surface of the soil stockpiles are appropriately stabilised using groundcover species or mulch.

Soil Inventory and Monitoring

- An inventory of available soil would be maintained to ensure a record of available soil materials is available for planned rehabilitation activities.
- Soil testing and chemical analysis would be completed prior to use in rehabilitation to confirm the quality of the stockpiled material and inform the use of any fertiliser to be applied to the rehabilitated areas.

4.2.3.6 Assessment of Impact

4.2.3.6.1 Soils

The management procedures set out in Section 4.2.3.5 for the soil resource have been designed to ensure the proper handling and management of soil stockpiles and to provide the maximum opportunity for successful rehabilitation of the Stage 2 Site. The practices have been developed based on the operating experience gained to date on the Stage 2 Site, which have been shown to be successful. Assuming the implementation of the proposed soil management measures, the impact associated with soil removal, storage and re-use is anticipated to be minimal.

4.2.3.6.2 Land Capability

Given the severe limitations on land use (Land Capability Class 6), the proposed soil management measures nominated in Section 4.2.3.5 and the rehabilitation procedures of Section 2.13.5, it is considered the final landform could be successfully rehabilitated to provide an equivalent land capability class.

4.2.4 Land Use

4.2.4.1 Existing Environment

The Stage 2 Site is situated on land zoned Rural (General) 1(a) under the Lithgow Local Environmental Plan (LEP), with the majority of land surrounding the Stage 2 Site also zoned for similar land use. In keeping with this zoning, the HPC-owned properties on which the Stage 2 Site is located and the larger properties to the south, west and north are operated as pastoral properties, are used primarily for cattle grazing, sheep grazing, cereal and fodder crops.

Land in the vicinity of the Stage 2 Site and the Quarry Access Road is currently used for minor grazing and short-term industrial machinery storage.

Other notable land uses of the local setting are as follows.

Conservation Areas

On Lot 31, DP1009967 and to the north of the Stage 2 Site is an area managed as part of a conservation agreement between HPC and OEH (National Parks & Wildlife Service) for the protection and conservation of habitat for the threatened *Eucalyptus pulverulenta*.

Also, and as a consequence of the steep terrain over significant portions of the HPC-owned properties, particularly to the south of the Coxs River, much of this land has severe limitations for agriculture (see also Section 4.2.2.3) and is managed primarily for passive biodiversity conservation (with occasional grazing for fuel management purposes).

Rural (Small Holdings)

Within and surrounding the villages of Hartley and Little Hartley to the north and northeast, along Coxs River Road to the east, and along Jenolan Caves Road to the west of the Stage 2 Site are smaller lots, many developed with residences under the Rural (Small Holdings) Zone 1(c) of the Lithgow LEP.

Recreation and Tourism

A camping ground used periodically by short-term campers (predominantly on weekends) is located adjacent to the Glenroy Bridge over the Coxs River. The camping ground is approximately 2.5km north of the Stage 2 Site. The Coxs River itself is used for various recreation activities such as fishing, hiking and camping, as well as for the amenity value it provides. It is important to note that access to the Coxs River is generally via private landholdings.

Bed & Breakfast style accommodation is also a feature of the local area, "The Peak at Mt Kanimbla" (26 Megalong Place, Kanimbla) approximately 6km (as the crow flies) from the Stage 2 Site being a notable example.

Jenolan Caves Road is also the primary route between Sydney (via the Great Western Highway) and the Jenolan Caves, a significant regional tourist feature.

Sydney Drinking Water Catchment

The Stage 2 Site is located within the Mid-Coxs River sub-catchment of the Warragamba Catchment, i.e. the upper reaches of the Sydney Drinking Water Catchment.

4.2.4.2 Potential Impacts of the Proposal

As the land to be disturbed as part of the Proposal is located on the lower class (Class 6) land of the HPC property, and the water required would be obtained under existing entitlements, the potential impact on agricultural land uses is negligible.

On the basis that the Proposal would not result in any significant change to the noise levels received or air quality at these locations (see Sections 4.7.6 and 4.8.7), the Proposal almost certainly would not impact on these land uses.

It is recognised that the Proposal requires the ongoing movement of heavy vehicles on Jenolan Caves Road. This could have a minor effect on the amenity of, or access to local and/or regional tourist / recreational features or facilities. As assessed in Section 4.3.6, however, when the level of traffic proposed and commitments made by the Applicant to effectively manage the transport fleet are considered objectively, this is unlikely to result in any great change to the current setting.

It is also noted that poor erosion and sediment control, or drainage management generally, on the Stage 2 Site could affect the water quality and aquatic environment of the Coxs River. This in turn could reduce the value of the Coxs River for recreational pursuits such as fishing, hiking and camping, or reduce the quality of water entering the Sydney drinking water supply. As assessed in Section 4.5.6, however, following the implementation of the proposed safeguards and controls, the likelihood of significant pollution to local waters which could impact on these land uses is very small.

Realistically, the only land use which could be significantly impacted by the Proposal would be the passive conservation undertaken on the HPC properties.

4.2.4.3 Operational Safeguards and Controls

Operational safeguards and controls focussed on reducing the impact of the Proposal on traffic, surface water, noise and air quality are described in Sections 4.3.5, 4.5.4, 4.7.4 and 4.8.5 respectively.

With respect to managing impacts on the passive biodiversity conservation which is a feature of the local setting, the Applicant has:

1. provided for the rehabilitation of the extraction area and overburden emplacement to a return to native vegetation (see Section 2.13.5); and
2. included a biodiversity offset strategy to compensate for the temporary loss in biodiversity attributable to the proposed quarry extension (see Section 2.14).

In order to ensure that those sections of the Stage 2 Site with a higher land capability are returned to agricultural use, the Applicant has provided for rehabilitation of the secondary processing area and Yorkeys Creek stockpile area back to agricultural land. As these areas form part of the existing Austen Quarry, there has been no classification of the pre-disturbance land capability. However, it is considered reasonable to achieve a land capability of Class 4 or better (i.e. land which provides for grazing, intermittent cultivation with specialised practices) reflecting the land use on other areas within of the HPC properties.

4.2.4.4 Assessment of Impact

On the basis that the Proposal would realistically only impact on the passive biodiversity conservation of the Stage 2 Site, and considering the proposed rehabilitation and biodiversity offset measures proposed to mitigate and compensate for this temporary impact, the impact of the Proposal on local land uses would be minimal.

An assessment of the impact of the Proposal on agricultural resources more generally is provided in Section 4.14.

4.2.5 Extractive Material Resources

Section 2.4 describes the geology of the Stage 1 and Stage 2 extraction areas and exploration methods and processes undertaken to determine the size and quality of the resource. Section 2.4 also describes the intended final products of the quarry. The resources defined within the Stage 2 extraction area have been assessed to be comparable to the resources within the Stage 1 extraction area. Hence, the Applicant proposes to continue to produce the same range of quality products.

4.3 TRAFFIC AND TRANSPORTATION

4.3.1 Introduction

The DGRs issued for the Proposal identified "*Traffic and Transport*" as a key issue, requiring that the "*EIS include:*

- *accurate predictions of the road and rail traffic generated by the construction and operation of the development;*
- *an assessment of potential traffic impacts on the safety and efficiency of the road network; and*
- *a detailed description of the measures that would be implemented to maintain and/or improve the capacity, efficiency and safety of the road and rail networks in the surrounding area over the life of the development.*

The DGRs also made reference to the need to take into account two RTA documents entitled "Guide to Traffic Generating Developments" (RTA, 2002) and the "Road Design Guide"[1].

Additional matters for consideration in preparing the EIS were also provided in the correspondence attached to the DGRs from the NSW Roads and Maritime Services (RMS) Division of Resources & Energy (DRE), Lithgow City Council (LCC) and Blue Mountains City Council (BMCC). The additional matters are outlined as follows.

RMS

- Consider the potential impacts to the safety and efficiency of the classified road network.
- The EIS should include a Traffic Impact Assessment (TIA) that takes into account the key issues relevant to the scale of this proposal as set out in *Table 2.1* of the Roads and Traffic Authority "Guide to Traffic Generating Developments".
- The impact of the proposed development on the surrounding road network.
- The number and type of vehicles required to service the quarry.
- Details of existing and proposed access conditions.
- Intersection sight distances.
- Impact on Transport (i.e. School Bus Routes).
- Road traffic noise and dust generation.
- Considerations for mining & extractive industries under Clause 16(1) of the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007; and
- The TIA should consider the Austroads "Checklist for Traffic Impact Assessments" that is *Appendix A* of the Guide to Traffic Management Part 12: Traffic Impacts of Development 2009 (provided with the agency submission accompanying the DGRs).

[1] The Road Design Guide has been superseded by the Austroads "Guide to Road Design" series and RMS Supplements.

DRE
- Document route(s) used to transport quarry products to market.

LCC
- Consider the need for upgrades to the Glenroy Bridge based on the total number of trucks expected to use the bridge each day.

BMCC
- Consider the risks associated with heavy truck transport of materials as they cross the Blue Mountains.
- Consider rail transport as an alternative transportation method of materials.

Based upon the risk analysis undertaken for the Proposal (Section 3.3.1 and **Table 3.9**), the potential impacts relating to traffic and transport-related issues and their risk rankings (in parentheses) after the adoption of the existing mitigation measures are as follows.

- Ongoing truck traffic and possible congestion noticed by other motorists (medium).
- Deterioration of the road surface (low).
- Ongoing truck traffic influencing business owners and tourist facility operators throughout the Blue Mountains (low).
- Ongoing truck traffic (noise and vehicle emissions) noticed by residents living adjacent to or near the Great Western Highway (moderate).
- Periodic death or injury to native animals crossing the transport route (moderate).

A road transport assessment for the Proposal was undertaken by GTA Consultants (NSW) Pty Ltd. The assessment is presented as Part 1 of the *Specialist Consultants Studies Compendium* and is referred to hereafter as "GTA Consultants (2014)".

Both the road traffic assessment and the EIS have been prepared with reliance placed upon the Applicant's considerable experience with its existing transport operations. The Applicant is mindful that the transportation of quarry products to its concrete plants and customers is fundamental to the success of its entire business. As a consequence of this importance, the Applicant has placed and will continue to place emphasis upon the safe and efficient delivery of its quarry products with least impacts upon other motorists, road users and roadside residents and businesses.

It is noted that the Austen Quarry is fully constructed and operational and hence there will be no requirements for any construction or site establishment phase.

This section provides a summary of the report prepared by GTA Consultants (2014), concentrating on those matters raised in the DGRs and accompanying documentation raised by various government agencies and throughout the community consultation program. It is noted that the request by Blue Mountains City Council for the EIS to "consider rail transport as an alternative transportation method of materials" has been specifically addressed in Section 2.15.6 of the EIS. A consolidated list of the identified requirements relating to traffic and transportation, and where each is addressed, is presented in **Appendix 3**. GTA Consultants (2014) also incorporates tabulated requirements nominated by the RMS and where they are addressed in the Traffic Impact Assessment. The EIS incorporates the key requirements nominated by RMS. Matters relating to road traffic noise and dust generation are addressed in Sections 4.9 to 4.10 respectively.

4.3.2 Existing Road Transport Environment

4.3.2.1 Introduction

The components of the existing road transport environment currently used by heavy and light vehicles travelling to and from the Austen Quarry are described in this subsection. Also detailed is the existing contribution that the traffic to and from the Austen Quarry makes to the road transport environment.

4.3.2.2 Road Network

The road network used by heavy and light vehicles travelling to and from the Austen Quarry is displayed in **Figure 4.7**. For the purposes of this document, the road network is described as either "local" i.e. from Mount Victoria to Lithgow or "regional" i.e. from Emu Plains to Mount Victoria. These descriptors relate to the spread of the Applicant's customers and trucks on the road network, not the designation of the roads within any formal road hierarchy.

The key road servicing the Austen Quarry is the Great Western Highway, a State highway that provides access between Sydney (at Railway Square) and Bathurst. The highway coincides with many other named roads between Railway Square and Lapstone in the Lower Blue Mountains, however, is designated as the "Great Western Highway" or "A32" through the entire Blue Mountains Local Government Area. Vehicles travelling from Lapstone to Hartley traverse approximately 70km of the Great Western Highway.

Access from the Great Western Highway to the Quarry Access Road near Hartley is via Jenolan Caves Road, also designated a State road or "253". This road intersects with the Great Western Highway approximately 11km west-northwest of Mount Victoria and 12km southeast of Lithgow and provides access to both Jenolan Caves and Oberon. The intersection of Jenolan Caves Road with the Great Western Highway (and Blackmans Creek Road) is a four-way priority-controlled intersection with priority for highway traffic. A left-turn deceleration lane and a right-turn bay are provided on the Great Western Highway for vehicles turning into Jenolan Caves Road. Vehicles travelling from the Great Western Highway traverse approximately 4.3km of Jenolan Caves Road to the quarry entrance.

Access from Jenolan Caves Road to the product stockpile areas within the Austen Quarry is achieved via the 3.1km Quarry Access Road commencing at the quarry entrance. This is a private road constructed specifically to provide access from the quarry to the main road network. The intersection between the Quarry Access Road and Jenolan Caves Road has already been widened to provide an auxiliary right turn (AUR) treatment and auxiliary left turn (AUL) treatment which allow through traffic on Jenolan Caves Road to pass vehicles slowing to turn right or left into the quarry.

4.3.2.3 Road Conditions

Great Western Highway

The section of the Great Western Highway used by vehicles travelling between the Austen Quarry and the Sydney metropolitan area comprises mainly divided roads with two travel lanes in each direction between Lapstone and Katoomba. **Figure 4.8** displays the alignment of the Great Western Highway between Hartley and Emu Plains.

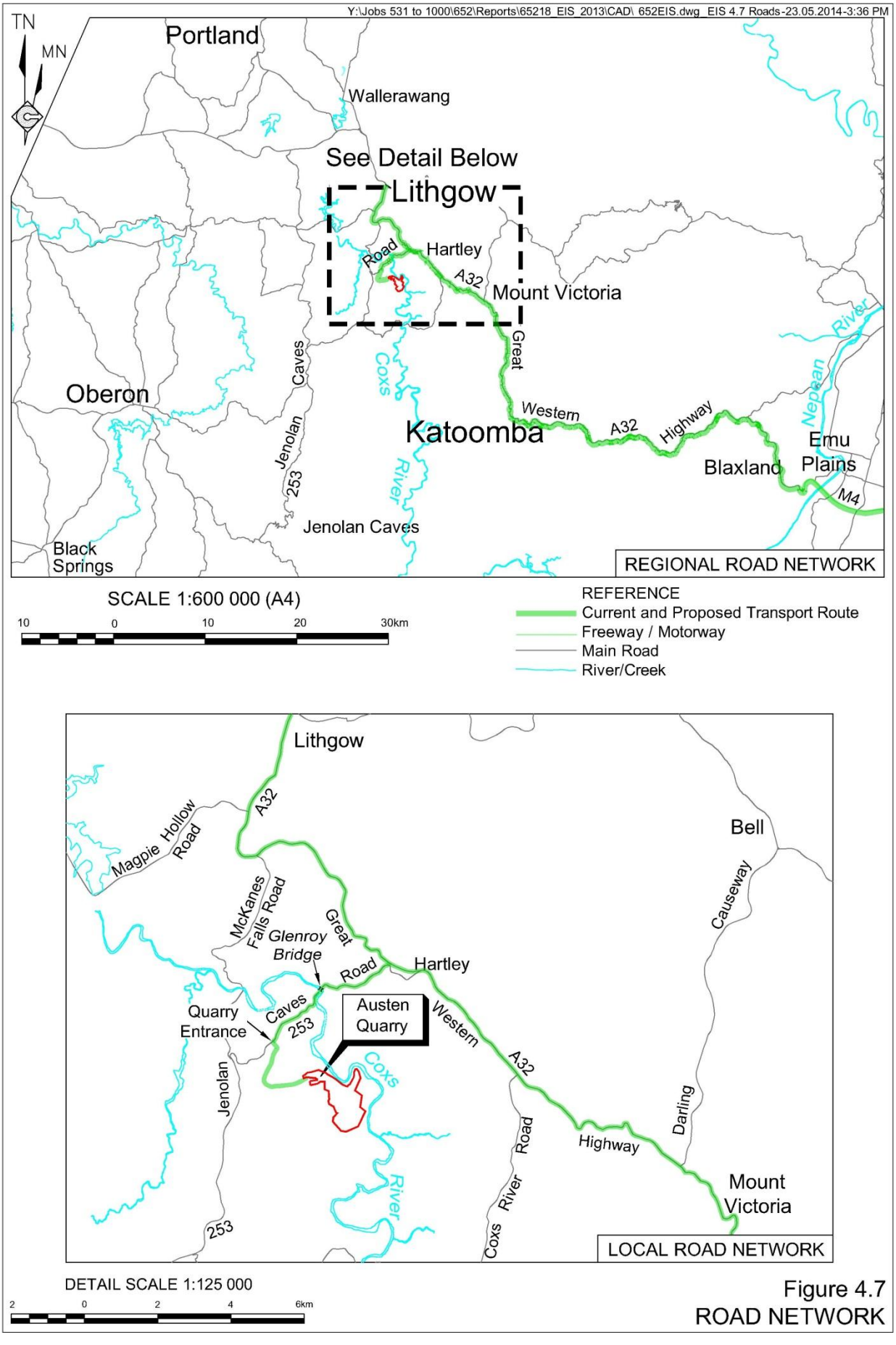


Figure 4.7
ROAD NETWORK

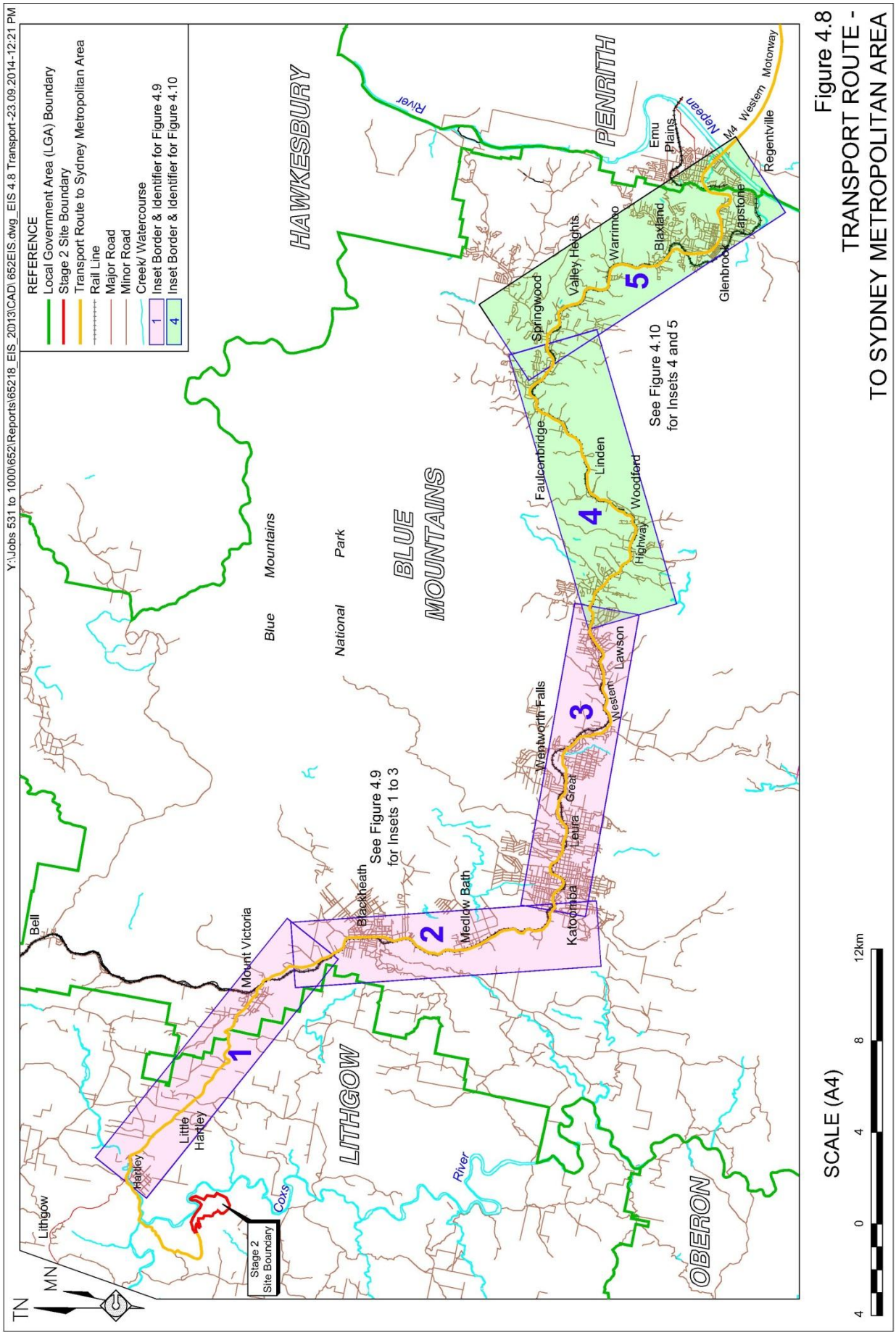


Figure 4.8
TRANSPORT ROUTE - TO SYDNEY METROPOLITAN AREA

The upgrading of the final 7.7km of the 43km of the highway between Lapstone and Katoomba is due to be completed by approximately 2016. The dual lane sections of the highway completed to date have been constructed to a high standard specifically to cater for the heavy vehicles that travel through the Blue Mountains. The proposed upgrades of the Great Western Highway between Katoomba and Lithgow are discussed further in Section 4.2.3.2.

The section of the Great Western Highway between Katoomba and Hartley is predominantly single lane in each direction with various slow vehicle passing lanes strategically placed in those areas with considerable topographic relief. The road pavement on this section of the highway is typically 9m wide, providing 3.5m wide travel lanes and 1m sealed shoulders. This section of the highway is marked with both centre lines and edge lines.

Figures 4.9 and **4.10** display the speed and related zones along the Great Western Highway through the Blue Mountains. Speed zones regularly change through the Blue Mountains with a total of 36 changes, including the eight defined school zones applicable from 8:00am to 9:30am and 2:30pm to 4:00pm on school days.

A summary of the speed zones is as follows.

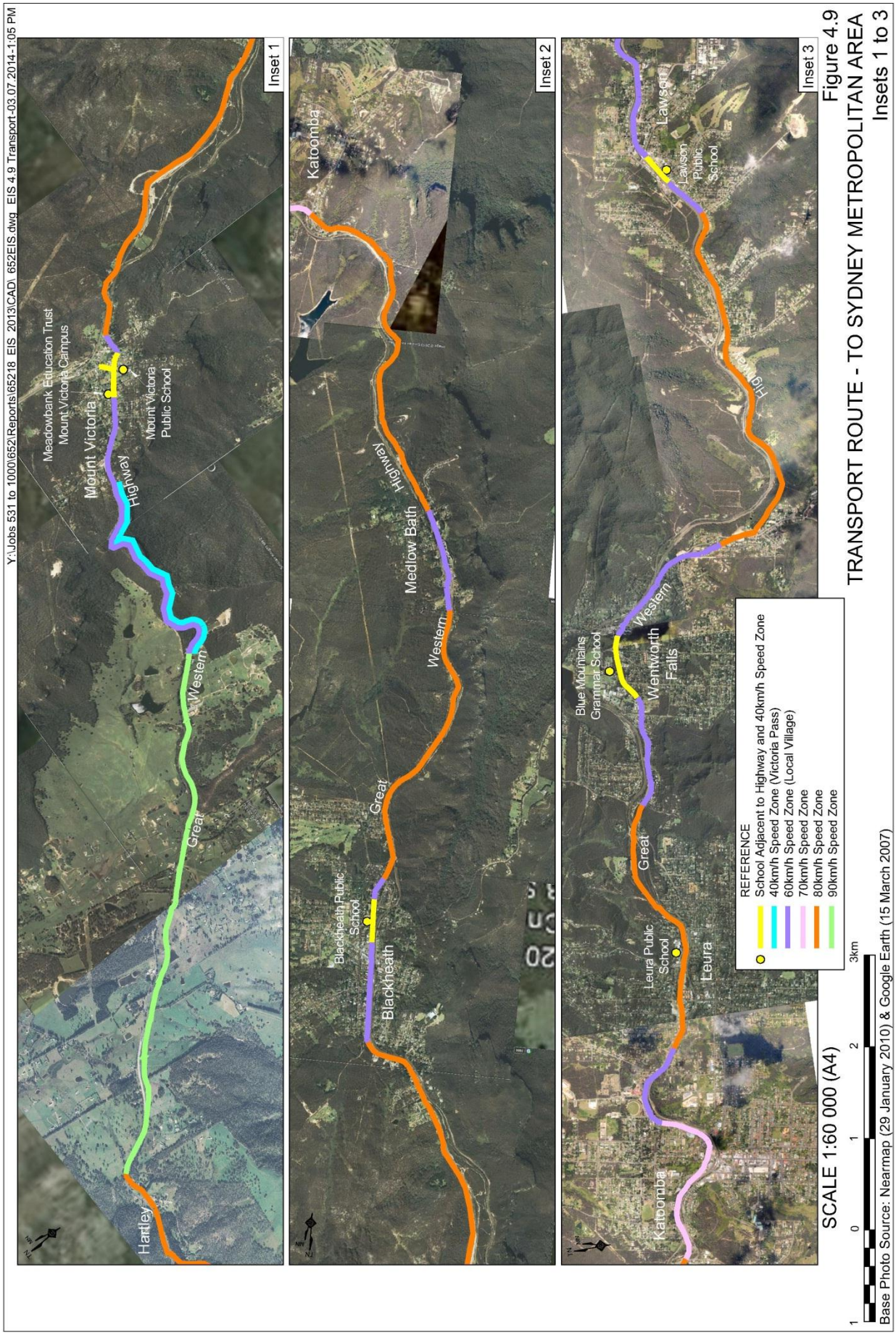
- 40km/h – 3.8km (8 School Zones).
- 40km/h – 7.7km (Current Road Works).
- 60km/h – 25.0km (Includes all school zones / all vehicles).
  19.8km (Includes all school zones / heavy vehicles).
- 70km/h – 8.9km (two sections).
- 80km/h – 30.8km (ten sections).

Two sections of the Great Western Highway have 60km/h speed restrictions for heavy vehicles when travelling eastwards through the Blue Mountains, namely at Linden/Faulconbridge (1.8km) and east of Glenbrook (3.4km).

The section of the Great Western Highway used by vehicles travelling to and from the Austen Quarry from Lithgow comprises mainly a single travel lane in each direction with various passing lanes both up and down River Lett Hill. Sections of the highway on River Lett Hill also have centre dividing concrete jersey kerbs. The pavement along this section of the highway is in excellent condition as most of it has recently been upgraded. The pavement is typically approximately 9m wide with 3.5m wide travel lanes and centre and edge line markings. The section of the highway from the top of River Lett Hill to east of Lithgow is referred to as the "Forty Bends".

Jenolan Caves Road

The 4.3km section of Jenolan Caves Road between the Great Western Highway and the Quarry Access Road comprises a single travel lane in each direction with a sealed width of approximately 6.5m, sealed shoulders of variable width and marked centre lines and edge lines. The condition of the road pavement along the section of Jenolan Caves Road between the Great Western Highway and the Quarry Access Road is very good. Jenolan Caves Road crosses the Coxs River approximately 2.2km south of the Great Western Highway over the Glenroy Bridge. The approaches to the northern and southern sides of the bridge were upgraded (funded by Hy-Tec) in late 2012 to remove general depressions between the bridge deck and its approaches that were contributing to impact noise as vehicles entered onto and departed from the bridge.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Inset 1
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Inset 3
Meadowbank Education Trust Mount Victoria Campus
Mount Victoria
Mount Victoria Public School
Highway
Western
Great
Hartley
Katoomba
Medlow Bath
Blackheath Public School
Blackheath
Lawson
Lawson Public School
Blue Mountains Grammar School
Wentworth Falls
Leura Public School
Leura
REFERENCE
School Adjacent to Highway and 40km/h Speed Zone
40km/h Speed Zone (Victoria Pass)
60km/h Speed Zone (Local Village)
70km/h Speed Zone
80km/h Speed Zone
90km/h Speed Zone
SCALE 1:60 000 (A4)
3km
Base Photo Source: Nearmap (29 January 2010) & Google Earth (15 March 2007)
Figure 4.9
TRANSPORT ROUTE - TO SYDNEY METROPOLITAN AREA
Insets 1 to 3

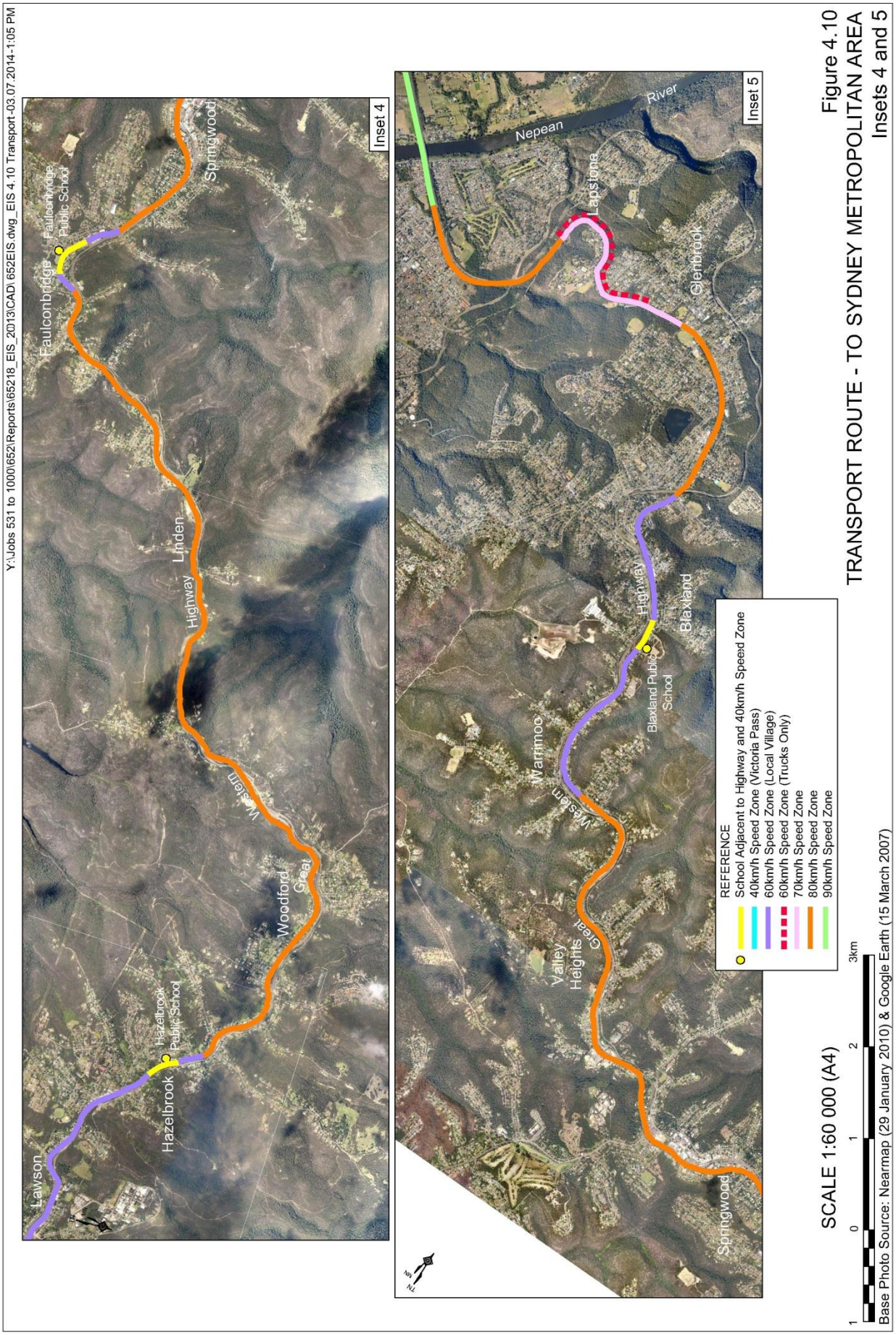


Figure 4.10
TRANSPORT ROUTE - TO SYDNEY METROPOLITAN AREA
Insets 4 and 5

There are no passing lanes along Jenolan Caves Road between the Great Western Highway and the quarry entrance as there are numerous bends and either hilly or vegetated land adjoining the road thereby limiting visibility for motorists. The sign-posted speed limit along the full length of Jenolan Caves Road between the Great Western Highway and the quarry entrance is 80km/h, with lower advisory speeds at selected locations.

Quarry Access Road

The 3.1km Quarry Access Road has a single travel lane in each direction with a sealed width of approximately 10m. The road is marked with both centre lines and edge lines. The road is in a good condition with only a couple of sections where the pavement requires periodic maintenance. The Quarry Access Road is fenced for most of its length to prevent stock from the adjoining pastures crossing the road. The signposted speed limit on the Quarry Access Road is 80km/h.

4.3.2.4 Traffic Volumes, Composition and Road Capacity

Great Western Highway

The Great Western Highway provides the major road freight, tourist and commercial link between Sydney and the central west and western New South Wales. Vehicles travelling through the Blue Mountains comprise light vehicles, motor bikes, vans, 4WDs, cars with caravans, buses, coaches and trucks of varying configurations including B-doubles. The Great Western Highway also serves local community trips, local freight and industry and tourist trips. These vehicles comprise light vehicles, 4WDs, vans, mini-buses, school buses, delivery or service vehicles and trucks of varying configurations.

RMS has published little recent data about traffic types and volumes travelling along the Great Western Highway through the Blue Mountains. GTA Consultants (2014) has reviewed a range of traffic counts on the Great Western Highway collected by RMS between Blackheath and Faulconbridge between 2009 and 2013. These counts together with traffic volumes assembled by Evans and Peck (2012) between Forty Bends and Mt Victoria has enabled GTA Consultants to assemble a profile of daily total and heavy vehicle traffic through the Blue Mountains for 2015, i.e. comparable to existing traffic levels. **Table 4.2** lists the estimated total traffic volumes and heavy vehicles travelling along the Great Western Highway between Little Hartley and Faulconbridge in 2015.

Table 4.2 also records the estimated proportion that trucks travelling to and from the Austen Quarry account for in terms of total traffic and heavy vehicles, i.e. based on the current average (which is assumed to include truck movements from the Austen Quarry) and maximum traffic movements (which would include additional truck movements from the Austen Quarry). It is noted that the Austen Quarry trucks typically account for less than 1% of total traffic travelling through the Blue Mountains and between 4.4% and 8.8% of the heavy vehicles.

Table 4.2
Estimated Daily Traffic Volumes on Great Western Highway in 2015

Location	Vehicles/Day	Heavy Vehicles/Day (Av = 12%)	Austen Quarry Trucks[x1]			
			Total Vehicles		Heavy Vehicles	
			% Average Day	% Maximum Day	% Average Day	% Maximum Day
Little Hartley	11 100	1 333	1.42	2.54	11.85	19.52
Victoria Pass	14 900	1 788	1.06	1.06	8.84	14.88
Blackheath	17 990	2 159	0.88	0.88	7.32	12.47
Medlow Bath	19 750	2 370	0.80	0.80	6.67	11.41
Leura	28 600	3 432	0.55	0.55	4.60	8.01
Wentworth Falls East	30 070	3 608	0.53	0.53	4.38	7.63
Bullaburra	26 520	3 182	0.60	0.60	4.97	8.61
Lawson	28 900	3 468	0.55	0.55	4.56	7.93
Woodford	28 510	3 421	0.55	0.55	4.62	8.03
Faulconbridge	28 690	3 443	0.55	0.55	4.59	7.98
x1 Average Daily Truck Trips = 166 / Maximum Daily Truck Trips = 288						
2015 Traffic Source: Modified after GTA Consultants (2014) – Tables 4.2 and 4.3						

Jenolan Caves Road

Data on traffic volumes on Jenolan Caves Road to the north and south of the Quarry Access Road was collected through tube traffic counts between Friday, 8 March 2013 and Thursday, 21 March 2013. **Table 4.3** lists the recorded daily traffic volumes at both locations. GTA Consultants (2014) note that data recorded on Saturday, 9 March 2013 and Sunday, 10 March 2013 was uncharacteristically high due to a local event, "the Six Foot Track Marathon" that finished at Jenolan Caves and hosted 800 entrants as well as spectators. As the results indicate a level of usage well in excess of the non-event weekend, the assessment of Saturday conditions on Jenolan Caves Road by GTA Consultants (2014) did not include the data collected on Jenolan Caves Road on 9 and 10 March 2013.

The data collected in March 2013 also established the average weekday daily traffic composition. **Table 4.4** lists the recorded traffic composition, i.e. distinguishing between:

- light vehicles (motor cycles, cars, vans, 4WDs or utilities (including those towing a trailer or caravan);
- single unit "rigid" trucks and buses (with two or four axles); and
- articulated vehicles such as semi-trailers, rigid trucks, B-doubles and road trains.

The data in **Table 4.4** indicates that the rigid and articulated heavy vehicles on Jenolan Caves Road account for approximately 21% of the total traffic travelling south of the quarry entrance and 30% north of the quarry entrance on an average weekday, i.e. the trucks arriving and departing from the quarry at that time increased the percentage of heavy vehicles in the total traffic by 9%. It is understood that the heavy vehicle traffic recorded south of the quarry entrance is attributable to a range of timber-related industries in Oberon and two quarries near Oberon, namely the Oberon Quarry (Oberon Quarries) and Oberon White Granite Quarry (Mudgee Stone Company). The recorded traffic data for the sites on Jenolan Caves Road indicate that trucks travel on this section of road 24hrs per day seven days per week.

Table 4.3
Surveyed Daily Two Way Traffic Levels on Jenolan Caves Road and the Quarry Access Road (vehicles/day)

Day and Date	Jenolan Caves Road North of Quarry Access Road	Jenolan Caves Road South of Quarry Access Road	Quarry Access Road
Friday 8 March	1 432	1 233	232
Saturday 9 March	1 964	1 866	108
Sunday 10 March	1 815	1 766	18
Monday 11 March	1 132	1 087	266
Tuesday 12 March	1 077	852	231
Wednesday 13 March	1 087	824	224
Thursday 14 March	1 052	895	240
Friday 15 March	1 301	1 096	258
Saturday 16 March	1 332	1 267	132
Sunday 17 March	1 389	1 456	11
Monday 18 March	1 169	862	285
Tuesday 19 March	1 201	814	303
Wednesday 20 March	1 165	849	272
Thursday 21 March	1 186	947	246
Average Weekday	**1 180**	**946**	**256**
Average Day	**1 307**	**1 130**	**202**

Source: GTA Consultants (2014) – Table 3.4

Table 4.4
Surveyed Average Weekday Daily Traffic Composition on Jenolan Caves Road and Quarry Access Road (March 2013)

	Jenolan Caves Road north of Austen Quarry		Jenolan Caves Road south of Austen Quarry		Quarry Access Road	
Vehicles per Weekday	**No.**	**%**	**No.**	**%**	**No.**	**%**
Light	823	69.8	748	79.1	85	33.5
Rigid	70	5.9	53	5.6	16	6.3
Articulated	286	24.3	145	15.3	153	60.2
Vehicles per Saturday						
Light	1 480	89.8	1 470	93.8	40	33.3
Rigid	76	4.6	70	4.5	0	0.0
Articulated	92	5.6	26	1.7	80	66.7

Source: Modified after GTA Consultants (2014) – Table 3.5.

Quarry Access Road

Table 4.4 recorded an average of 256 vehicles per day travelling on the Quarry Access Road on the weekdays during the recording period in March 2013. Approximately two-thirds of the vehicles on the Quarry Access Road were heavy vehicles. A separate review of weighbridge data from the quarry office suggests that truck movements recorded arriving and leaving the quarry have periodically approached 300 per day. On those days, heavy vehicles would account for 75% to 80% of total traffic on the Quarry Access Road.

GTA Consultants (2014) also collected data which shows that the busiest hours for heavy vehicle movements on the Quarry Access Road were between 5:00am and 6:00am and 5:00pm and 6:00pm. These busiest hours did not coincide with the busiest hours on Jenolan Caves Road which typically occurred late morning and between 4:00pm and 5:00pm.

Road Capacity

The capacity of a road is defined as the maximum hourly rate at which vehicles can reasonably be expected to traverse a point or uniform section of a lane or roadway during a given time period under the prevailing roadway, traffic and control conditions. The capacity of a single traffic lane will be affected by factors such as the pavement width and restricted lateral clearances, the presence of heavy vehicles and grades.

Level of Service (LOS) is defined as a qualitative measure describing the operational conditions within a traffic stream as perceived by drivers and/or passengers. A LOS definition generally describes these conditions in terms of factors such as speed and travel time, freedom to manoeuvre, traffic interruptions, comfort, convenience and safety. LOS A provides the best traffic conditions, with no restriction on desired travel speed or overtaking. LOS B, C and D describe progressively worse traffic conditions. LOS E occurs when traffic conditions are at or close to capacity, and there is virtually no freedom to select desired speeds or to manoeuvre in the traffic stream. The service flow rate for LOS E is taken as the capacity of a lane or roadway.

GTA Consultants (2014) established that the LOS for Jenolan Caves Road and the Quarry Access Road was "A" for both the AM and PM weekday peak periods. A Level of Service "B" was calculated for Jenolan Caves Road on a Saturday reflecting the higher volume of background traffic on weekends, which is unrelated to the Austen Quarry.

4.3.2.5 Intersection Operations and Performance

Two key intersections are relevant to the Proposal, i.e. those where turning movements are undertaken by quarry traffic, namely:

i) Quarry Access Road/Jenolan Caves Road; and

ii) Jenolan Caves Road /Great Western Highway/Blackmans Creek Road.

Beyond these intersections, vehicles travelling to and from the Austen Quarry are effectively on the Great Western Highway where no turning movements are required.

For vehicles entering Jenolan Caves Road from the Quarry Access Road, the available sight distance is approximately 200m to the north and south. For vehicles entering the Great Western Highway from Jenolan Caves Road, the available sight distance is approximately 200m to the west and 400m to the east.

GTA Consultants (2014) undertook intersection turning movement surveys for 2.5 hours on a morning and an afternoon at each of the two intersections on 29 May 2013 which identified the busiest hours (for all traffic) and the proportion of turning traffic and direction. Two-way traffic volumes on the intersection approaches are displayed in **Table 4.5**.

Table 4.5
Weekday Peak Hour Two Way Traffic at Intersection Approaches (vehicles/hour)

Intersection and Approach	AM Peak Hour	PM Peak Hour
Jenolan Caves Road and Great Western Highway	7:30-8:30am	4:00-5:00pm
Blackmans Creek Road (North)	9	6
Great Western Highway (East)	527	618
Jenolan Caves Road (South)	58	79
Great Western Highway (West)	482	553
Jenolan Caves Road and Quarry Access Road	8:45-9:45am	4:15-5:15pm
Jenolan Caves Road (North)	77	73
Quarry Access Road (South)	19	18
Jenolan Caves Road (South)	60	61
Source: GTA Consultants (2014) – Table 3.8		

During the entire 2.5 hour morning survey periods, the quarry generated a total of 20 inbound and 15 outbound trips. During the entire 2.5 hour evening survey period, the quarry generated a total of 15 inbound and 26 outbound trips. A small number of these trips may have been generated by the lessee of the adjacent land, whose vehicles also use the Quarry Access Road.

Throughout the survey period, all heavy vehicle movements in and out of the Quarry Access Road were to and from the north. Approximately 82% of light vehicles generated by the Austen Quarry travelled to and from the north, and 18% of light vehicles travelled to and from the south.

GTA Consultants (2014) undertook an analysis of the operating performance of both intersections using *SIDRA Intersection* (SIDRA), a computer-based modelling package which calculates intersection performance characteristics including the degree of saturation, average delays and levels of service.

Both intersections operate at a satisfactory level of service with the highest average delays being approximately 35 seconds per vehicle and 29 seconds per vehicle for vehicles turning right from Jenolan Caves Road onto the Great Western Highway during the morning and evening peak hours respectively. A significant portion of the delay is that associated with physically negotiating the turn rather than the delay waiting for a gap in the traffic.

Further details of the results of the SIDRA analysis are provided in GTA Consultants (2014).

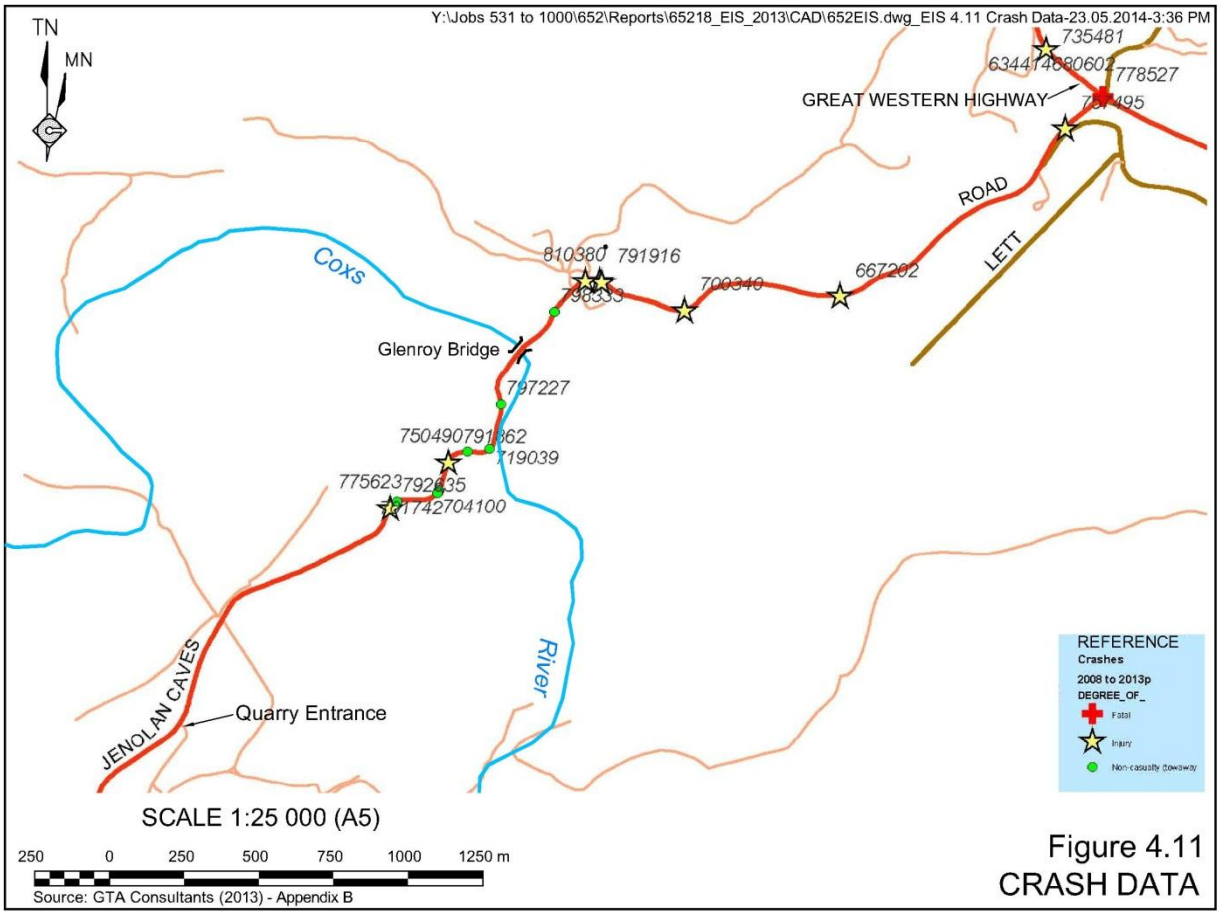
4.3.2.6 Road Safety

Jenolan Caves Road

An appreciation of the safety record of Jenolan Caves Road between the quarry entrance and the Great Western Highway has been established through reference to validated crash data reported to Police and recorded by the RMS.

Figure 4.11 displays the locations of 19 crashes that occurred along Jenolan Caves Road during the period 2008 to 2013 between the quarry entrance and the Great Western Highway.

The majority of crashes involved a single vehicle leaving the road and typically striking an object such as an embankment or fence. Speed was a contributing factor in all of these crash types, and all occurred on bends on Jenolan Caves Road. Half of the reported crashes of this type occurred on a wet road surface.



The two crashes between vehicles travelling in opposing directions were each head-on crashes which involved a car (or similar) and semitrailer, one of which was fatal and occurred at the intersection with the Great Western Highway. In each of these cases, the records suggest that the car (rather than the semitrailer) was travelling on the incorrect side of the road.

Great Western Highway

Validated crash data reported to Police and recorded by the RMS for the 5 year period from 1 July 2008 to 30 June 2013 recorded a total of 1327 crashes on the Great Wester Highway between Lapstone and Lithgow. Of these crashes, approximately 70% were either:

- single vehicles which lost control and left the roadway (39%); or
- intersection-type crashes (32%).

Approximately 12% of all crashes on the Great Western Highway involved a rigid or articulated truck. GTA Consultants (2014) provide further commentary on the crash statistics through the Blue Mountains.

Austen Quarry Traffic

The Applicant has maintained records of accidents/incidents involving heavy vehicles travelling to and from the Austen Quarry since 2005. These records show that over that period, only one accident has occurred involving a truck travelling from the quarry. As noted above, the accident was a result of the car involved travelling on the wrong side of the road.

4.3.2.7 School Bus Services

School bus routes for both primary and secondary school students are located along the Great Western Highway to transport children between Lithgow, Hartley and the Blue Mountains. A single bus route uses Jenolan Caves Road in the vicinity of the Quarry however this bus does not stop between the quarry entrance and the Great Western Highway. Bus services are operated by the Blue Mountains Bus Company and Lithgow Bus Lines. Operations managers of both companies were contacted to determine general routes, peak travel times and other relevant information.

The majority of school bus services in the Blue Mountains are operated by the Blue Mountains Bus Company that provides buses between Mount Victoria and schools in Orchard Hills and Kingswood. Buses use the Great Western Highway for pick-up and drop-off for the length of the journey except for the west-bound journey between Lawson and Linden where buses leave the highway. Lithgow Bus Lines operates most of the school bus routes in Lithgow and surrounding areas such as Hartley and Hampton. The Great Western Highway is used for routes between Lithgow and Hartley as well as routes to the Blue Mountains. A summary of peak times and bus numbers is provided in **Table 4.6**.

Both operators utilise designated stops along all routes, though many of these consist of household driveways. Neither operator has received complaints from parents or reports from bus drivers regarding child safety in relation to existing heavy truck traffic. Both operators indicated that the continuing road improvements would be of benefit to their operations once completed but highlighted their frustration at the removal of key bus stops. The Blue Mountains Bus Company also highlighted the effectiveness of speed limiting heavy vehicles in the Blue Mountains in maintaining safety. Both companies indicated that heavy truck transport was not limiting their operations and not creating safety concerns for students.

Table 4.6
Bus Services and Peak Hours in Blue Mountains and Lithgow

Bus Operator	Number of Buses	AM Peak Period	PM Peak Period
Blue Mountains Bus Company	AM Peak - 61 PM Peak - 64	7:00-8:30am	2:45-5:30pm
Lithgow Bus Lines	6	7:00-9:00am	3:00-5:00pm
Source: Blue Mountains Bus Company and Lithgow Bus Lines			

4.3.3 Future Road Transport Environment

4.3.3.1 Introduction

Throughout the life of the Proposal, the road network used by vehicles travelling to and from the Austen Quarry will continue to be upgraded and traffic levels from all other sources will continue to increase. This section reviews the documented proposed improvements to the road network and projected traffic movements unrelated to the Proposal. It is noteworthy that a number of the proposed road improvements between Mount Victoria and Lithgow will themselves be destinations for quarry products from the Austen Quarry.

4.3.3.2 Road Network

The road network currently used for vehicles to travel to and from the Austen Quarry would continue to be used for the life of the Proposal, i.e. until at least 2050. During the coming years, the RMS has two sets of planned road works along the Great Western Highway between Mount Victoria and Lithgow.

A range of upgrade works are planned to enable the design speed of the highway to be increased to 90kph and to improve safety at nine intersections with the highway, including the Jenolan Caves Road intersection. The proposed upgrade work at this intersection outlined in RMS (2013) would comprise the following works.

- Retain existing turning lanes.
- Westbound traffic limited to one lane at the intersection.
- Increase the length of the right turn bay into Jenolan Caves Road.
- Tie into vertical levels of highway.
- Adjust the vertical level of Jenolan Caves Road to match the level of the highway.
- Widen shoulders northwest of intersection.

A range of other upgrades are proposed along the highway to improve safety for all vehicles.

In the longer term, the RMS proposes to upgrade the Great Western Highway from Mount Victoria to Lithgow to a standard similar to the current standard of the highway east of Katoomba (Mount Victoria to Lithgow Alliance, 2013) with two travel lanes in each direction and a separating median. **Figure 4.12** displays the concept design for this section of road, as at April 2013. As part of the upgrade, RMS proposes to construct a bypass at River Lett Hill (to the south of the existing alignment) including safer access to Jenolan Caves Road and Blackmans Creek Road via an interchange.

It remains RMS's long term objective to also upgrade the Great Western Highway from Katoomba to Mount Victoria in the same manner thereby improving safety for all motorists using the highway.

4.3.3.3 Traffic Volumes and Composition

It is envisaged that the composition of traffic travelling on both Jenolan Caves Road and the Great Western Highway will remain comparable to the existing composition. However, RMS forecasts the traffic levels will increase typically at an average of 2% per year.

Great Western Highway

Table 4.7 displays the forecast traffic volumes on the Great Western Highway between Mount Victoria and Lithgow for a range of years up to 2035.

Table 4.8 displays the forecast traffic levels on the Great Western Highway between Blackheath and Faulconbridge at 5-yearly intervals up to 2035.

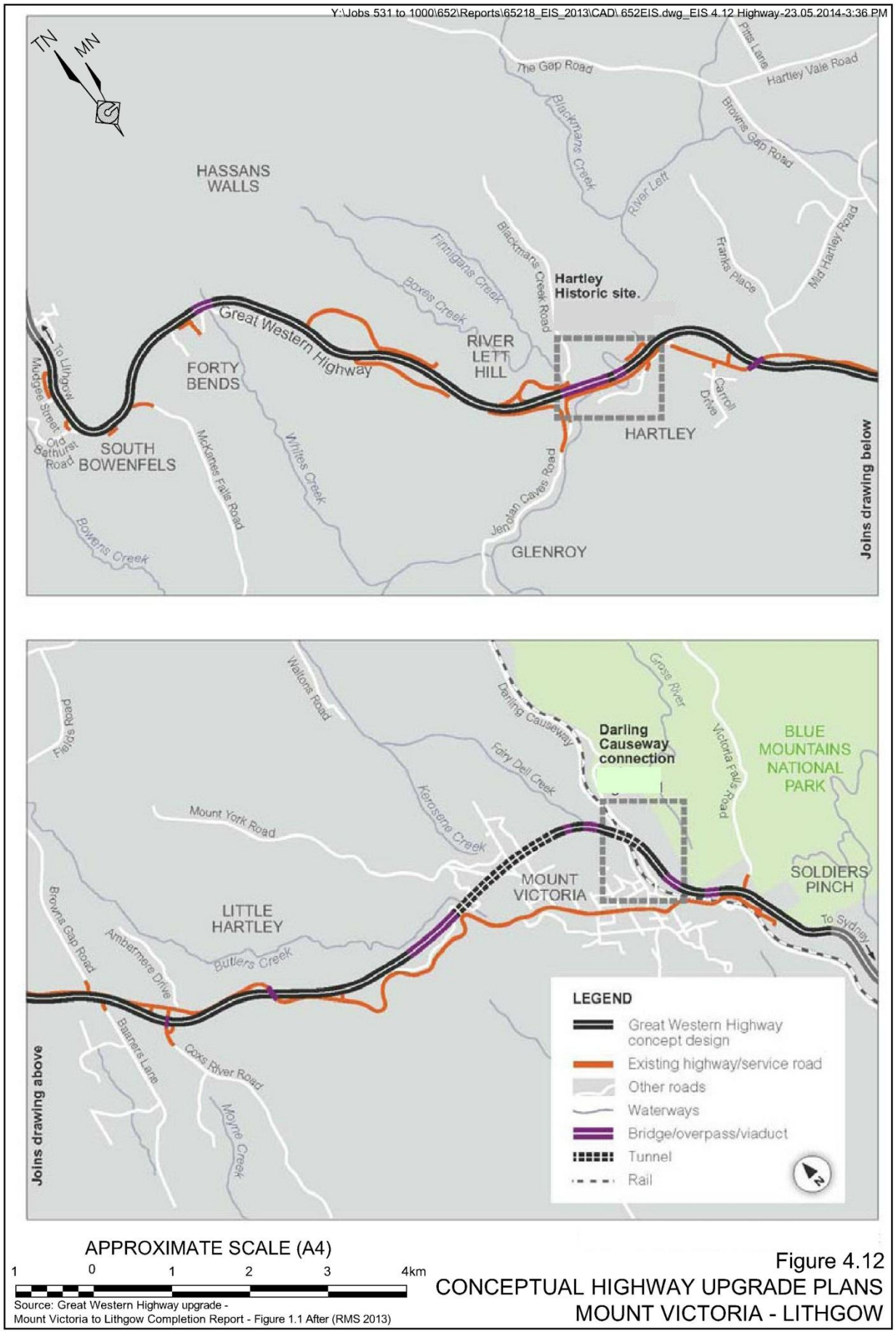


Figure 4.12
CONCEPTUAL HIGHWAY UPGRADE PLANS
MOUNT VICTORIA - LITHGOW

Table 4.7
Forecast Traffic Volumes on the Great Western Highway – Mount Victoria to Lithgow

Location	2011[AB]	2013	2015[A]	2020	2025[A]	2035[A]
Daily (vehicles/day)						
Forty Bends	7 900	8 150	8 400	9 150	9 900	11 800
Hartley	8 800	9 100	9 400	10 250	11 100	13 200
Little Hartley	10 400	10 750	11 100	12 100	12 100	15 600
Victoria Pass	14 000	14 450	14 900	16 250	17 600	21 000
AM Peak (vehicles/hour)						
Forty Bends	480	490	500	550	590	710
Hartley	530	550	560	610	660	790
Little Hartley	630	650	660	720	780	940
Victoria Pass	850	870	890	970	1 050	1 260
PM Peak (vehicles/hour)						
Forty Bends	650	680	700	770	830	980
Hartley	720	750	780	860	930	1 100
Little Hartley	860	900	930	1 020	1 100	1 300
Victoria Pass	1 150	1 200	1 240	1 360	1 480	1 740
A RMS daily forecasts B RMS peak hourly forecasts						
Source: GTS Consultants (2014) – Table 4.2						

Table 4.8
General Traffic Forecasts on Great Western Highway Through the Blue Mountains

Location	2015	2020	2025	2030	2035
Daily (vehicles/day)					
Blackheath* (99.231)	17 990	19 590	21 200	22 810	24 410
Medlow Bath* (99.913)	19 750	21 580	23 410	25 240	27 070
Leura* (99.042)	28 600	31 150	33 700	36 260	38 810
Wentworth Falls East	30 070	32 850	35 630	38 410	41 190
Bullaburra* (99.043)	23 460	25 670	27 880	30 090	32 310
Bullaburra	26 520	29 000	31 480	33 960	36 450
Lawson	28 900	31 340	33 810	36 280	38 750
Woodford-Hazelbrook	28 510	31 020	33 530	36 040	38 550
Faulconbridge* (99.914)	28 690	31 440	34 200	36 960	39 720
Peak Hourly (vehicles/hour)					
Blackheath* (99.231)	1 800	1 960	2 120	2 280	2 440
Medlow Bath* (99.913)	1 980	2 160	2 340	2 520	2 710
Leura* (99.042)	2 860	3 120	3 370	3 630	3 880
Wentworth Falls East	2 400	2 620	2 860	3 080	3 300
Bullaburra* (99.043)	2 350	2 570	2 790	3 010	3 230
Bullaburra	2 650	2 900	3 150	3 400	3 650
Lawson	2 280	2 480	2 680	2 860	3 060
Woodford-Hazelbrook	2 280	2 480	2 680	2 880	3 080
Faulconbridge* (99.914)	2 870	3 140	3 420	3 700	3 970
* 2% per annum growth on previously recorded levels					
Source: Modified after GTA Consultants (2014) – Table 4.3					

GTA Consultants (2014) notes that it is assumed the projected levels in both **Tables 4.7** and **4.8** reflect the current average level of production at the Austen Quarry and not the currently approved and proposed ongoing maximum production level at the quarry.

The increase in light vehicle trips related to the movement of the on-site workforce are assumed to be included in the background forecasts presented by RMS in **Table 4.8**.

4.3.4 Austen Quarry Traffic Generation

Products are despatched between 5.00am and 10.00pm Monday to Friday, and between 5:00am and 3:00pm on Saturdays, public holidays excluded. At its current production rate of 750 000tpa of quarry products, Austen Quarry generates an average of approximately 83 truck loads or 166 truck trips per weekday, up to a maximum of approximately 150 truck loads or 300 truck trips per weekday (a trip is a one way movement, so an unladen truck arriving at the quarry and departing laden from the quarry generates two trips).

As discussed in Section 2.8.3, the ongoing despatch of the current upper approved level of 1.1 million tpa would involve one of two scenarios on weekdays.

Scenario 1: **Predominantly Sydney Customers** (95% to Sydney / 5% local).
Average: 125 loads / 250 trips per weekday.
Maximum: 180 loads / 360 trips per weekday.

Scenario 2: **Sydney Customers and Local Road Works** (70% to Sydney / 30% local).
Average: 150 loads / 300 trips per weekday.
Maximum: 250 loads / 500 trips per weekday.

The corresponding number of loads and trips or movements for these scenarios are as follows.

Trips through the Blue Mountains

Scenario 1: 119 loads / 238 trips or movements on an average week day.
171 loads / 342 trips or movements on a peak week day.

Scenario 2: 105 loads / 210 trips or movements on an average week day.
170 loads / 340 trips or movements on a peak week day.

Trips for Local Deliveries

Scenario 1: 6 loads / 12 trips or movements on an average week day or Saturday.
9 loads / 18 trips or movements on a peak week day or Saturday.

Scenario 2: 45 loads / 90 trips or movements on an average week day.
80 loads / 160 trips or movements on a peak week day.

The level of truck traffic on a Saturday travelling through the Blue Mountains would typically be approximately 60% of the weekday traffic levels, i.e. 74 loads on an average Saturday and 105 loads on a busy Saturday. It is noteworthy that local deliveries to road construction projects would be minimal of a Saturday.

Light Vehicle Trips to and from the Austen Quarry

- 64 trips on a week day.
- 50 trips on a Saturday.

It is most likely that Scenario 1 would be the most common occurrence, except for those days when local projects are supplied, e.g. to supply RMS road works between Lithgow and Mount Victoria. In reality, there may only be two or three periods until 2050 when this level of local traffic would occur. On the days when local RMS road works are being supplied, it is highly unlikely that maximum traffic levels through the Blue Mountains would be achieved.

During the short-term campaigns to supply local RMS road works, when smaller capacity rigid trucks of (average) 15t capacity dominate trips to and from the quarry, a maximum of 25 truck loads or 50 trips or movements per hour could occur. For deliveries to the Sydney metropolitan area, when the dominant vehicle types entering and exiting the quarry are truck and dog trailer combinations or 19m B-Doubles, a maximum of 20 truck loads or 40 trips or movements per hour could occur.

The proposed average product transport distribution is indicated on **Figure 2.7**, i.e. approximately 95% of despatched products would be transported along the Great Western Highway to the east of Jenolan Caves Road, and 5% transported along the Great Western Highway to the west of Jenolan Caves Road. This distribution would vary when RMS road works or other local projects are being undertaken to the west of Jenolan Caves Road. It is anticipated that during these periods the proportion of product trucks from the quarry may reach approximately 30% to the west and 70% to the east. When RMS local road works are being undertaken between Hartley and Mount Victoria, the higher levels of product truck movements may also occur over that section of the Great Western Highway. As noted above, deliveries to supply to RMS road works projects would use smaller capacity rigid trucks. The majority of these deliveries would generally be completed by 11:00am.

It is Hy-Tec's intention to increase production and despatch of quarry products during the period to March 2020 to the level currently approved, i.e. 1.1 Mtpa. Beyond March 2020 to March 2050, the Applicant intends to maintain production between the current level of 750 000tpa and 1.1Mtpa. The actual level of product despatch would reflect the prevailing buoyancy in the building and construction industries together with substantial State and local government infrastructure projects. The traffic assessment assumes despatch of the maximum 1.1Mtpa beyond March 2020.

4.3.5 Management and Mitigation Measures

The Applicant proposes to continue to manage the transportation of the quarry products to its concrete batching plants and customers in a manner that causes least impact to other motorists and road-side residents and businesses.

Central to the Applicant's management of product transportation is the Company's "Chain of Responsibility: Driver – Vehicle Checks". The Applicant has developed the standard which applies at all of its quarries and involves all relevant personnel from managers through to drivers. Any person who is involved in consigning, packing, loading, despatching and/or driving any of the quarry products is required to undertake their tasks in accordance with the

standard. It similarly applies to a business which controls the use of a commercial vehicle and receiving goods or freight. An important component of the Standard is a Driver Fatigue Manual.

Each truck driver (and their representative contracting company) is required to sign the documentation acknowledging the Applicant's expectation of them and the intention to undertake random checks of both the driver's and vehicle's records.

The Applicant's expectation of drivers (and contractors) transporting its products from the Austen Quarry cover a whole range of issues relating to:

- the driver's compliance with all road laws, on-site requirements, alertness, driving behaviour, response to other motorists and the use of all relevant equipment e.g. truck covers; and
- the truck's compliance with all relevant laws and guidelines with respect to safety checks, noise levels and emissions.

Given the trucks delivering quarry products for the Austen Quarry enter directly onto a State road (Jenolan Caves Road) and then join the Great Western Highway, also a State road, the maintenance of both roads is funded by the State Government which draws funds from truck registrations and fuel levies.

There is no requirement for the Applicant to fund any road maintenance activities on public roads. The Applicant's discussions with Lithgow City Council regarding the need for further upgrade works on the Glenroy Bridge over the Coxs River established that no further works are required. The Council's enquiry followed the Applicant's agreement to fund the removal of raised sections at the northern and southern approaches to the Glenroy Bridge caused by the misalignment of the bridge deck and its approaches. This work was completed in late 2012 and has noticeably reduced impact noise when trucks leave the bridge when travelling both southwards and northwards.

GTA Consultants (2014) recommends that the delays for vehicles turning right onto the Great Western Highway be re-assessed at two-yearly intervals beyond 2020 to establish whether there is a need to restrict the number of departing trucks during the morning and afternoon peak periods on the surrounding road network. The Applicant is committed to this monitoring recognising that both RMS's short-term and long-term plans for upgrading the intersection may maintain an acceptable Level of Service at that time.

The Applicant recognises that from time to time, incidents may occur involving a truck travelling to or from the Austen Quarry that attract a complaint. The Applicant encourages any motorist/resident to record the registration number of the offending truck and report it to the Applicant via its complaint/Head Office line 02 9647 2866. Each complainant can be assured that each complaint will be thoroughly investigated and assessed in accordance to its Chain of Responsibility Standard.

4.3.6 Assessment of Road Traffic Impacts

4.3.6.1 Introduction

The assessment of road traffic impacts relating to the Proposal relies considerably upon the experience gained to date and the current performance of the product transportation system. The assessment focuses upon the impacts of the vehicles travelling to and from the Austen Quarry beyond 2020 and the performance of the intersection between Jenolan Caves Road and the Great Western Highway.

The quarry-related data relied upon for the assessment of impacts is as set out in Section 4.3.4, noting that the nominated traffic volumes relate to the despatch of 1.1Mtpa of products and therefore is the most conservative as the quantity of products despatched in a number of years would be less than 1.1Mtpa.

4.3.6.2 Traffic Volumes

Jenolan Caves Road

Daily traffic volumes to the north of the quarry entrance are projected to be approximately 1 800 and 2 000 vehicles per day on weekdays and Saturdays respectively in 2035.

Table 4.9 summarises the predicted hourly traffic levels on Jenolan Caves Road on a peak day in 2035 incorporating both predicted background growth in non-Austen Quarry-related traffic and Austen Quarry-related traffic. This information identifies that the total weekday and Saturday peak hourly traffic volumes would respectively remain below 150 and 220 vehicles per hour on Jenolan Caves Road north of the quarry entrance in 2035.

It is noted that the number of product trucks travelling along Jenolan Caves Road on most days of the year would be below those nominated in **Table 4.9** with average levels typically between approximately 60% and 70% of the maximum levels.

The time required for truck loading and processing via the weighbridge provides for a natural staggering of exiting vehicles. This would minimise the potential for convoying of truck movements between the Austen Quarry and the Great Western Highway.

Great Western Highway

The product trucks travelling to and from the Austen Quarry through the Blue Mountains would remain comparable in number to those already approved to use the highway. This fact together with predicted background growth in other traffic would result in the proportion of quarry-related traffic decreasing over time. For example, **Table 4.10** displays the reduction in the total vehicles and heavy vehicles on an average day for the Years 2015, 2025 and 2035. As an example, the Austen Quarry product trucks would account for 0.47% of the overall traffic at Leura in 2025 and 0.41% in 2035.

Table 4.9
Peak Day Hourly Traffic 2035 – Jenolan Caves Road (vehicles/hour)

	Jenolan Caves Road North of Quarry Access Road						Jenolan Caves Road South of Quarry Access Road					
	Light		Heavy		Total		Light		Heavy		Total	
	Quarry	Total	Quarry	Total	Quarry	Total	Quarry	Total	Quarry	Total	Quarry	Total
Weekday												
5:00 to 6:00	6	23	31	43	37	66	1	20	0	10	1	30
10:00 to 11:00	1	79	38	62	39	140	0	83	0	32	0	115
11:00 to 12:00	2	83	27	55	29	138	0	76	0	25	0	102
16:00 to 17:00	3	107	24	38	27	144	1	103	0	17	1	120
17:00 to 18:00	8	90	20	25	28	116	2	82	0	9	2	90
Weekday Total*	52	1 165	370	639	422	1 804	12	1 072	0	286	12	1 357
Saturday												
5:00 to 6:00	8	17	33	39	41	57	2	11	0	9	2	20
11:00 to 12:00	6	152	35	59	41	211	1	171	0	12	1	183
12:00 to 13:00	4	133	17	22	21	155	1	138	0	9	1	147
14:00 to 15:00	1	154	1	9	2	163	0	148	0	7	0	156
Saturday Total*	41	1 697	210	309	251	2 007	9	1 701	0	122	9	1 823

Austen Quarry operating at 1.1Mtpa, peak expected to occur approximately 5 times per year.

Note *: vehicles / day

Source: GTA Consultants (2014) – Modified after Tables 4.8 & 5.1.

Table 4.10
Proportion of Austen Quarry Trucks travelling on the Great Western Highway through the Blue Mountains

Location	2015		2025		2035	
	Total Vehicles %	Heavy Vehicles %	Total Vehicles %	Heavy Vehicles %	Total Vehicles %	Heavy Vehicles %
Blackheath	0.88	7.32	0.75	6.21	0.65	5.39
Medlow Bath	0.80	6.67	0.67	5.62	0.58	4.86
Leura	0.55	4.60	0.47	3.91	0.41	3.39
Wentworth Falls East	0.53	4.38	0.44	3.70	0.38	3.20
Bullaburra	0.60	4.97	0.50	4.18	0.43	3.61
Lawson	0.55	4.56	0.47	3.89	0.41	3.40
Woodford-Hazelbrook	0.55	4.62	0.47	3.93	0.41	3.42
Faulconbridge	0.55	4.59	0.46	3.85	0.40	3.31

Source: **Table 4.2** and based on forecast traffic levels in **Table 4.8** with 12% heavy vehicles.

The potential for convoyed entry onto the Great Western Highway would be minimised by the natural staggering of exiting trucks from the Austen Quarry. Once on the Great Western Highway, the pre-existing flow of traffic would dictate the separation distance between trucks. It is worthy of note that, even at maximum production, trucks from the Austen Quarry would represents less than 0.9% of all vehicle movements across the Blue Mountains (see **Table 4.10**). This combined with the numerous dual lane sections of the Great Western Highway would provide for the natural management of truck spacing.

4.3.6.3 Intersection Performance

The key intersection assessed for the Proposal is the Great Western Highway/Jenolan Caves Road intersection. GTA Consultants (2014) re-assessed the performance of the intersection using SIDRA assuming the continued peak day operation at the Austen Quarry and the projected overall 2035 traffic volumes.

The average delay for vehicles turning right onto the Great Western Highway during the morning peak hour would be approximately 76 seconds per vehicle, a level considered to be unacceptable. The average delay during the afternoon peak period would be 53 seconds per vehicle. This assessment relates to the current morning and afternoon peak hour delays/vehicle of 35 seconds and 29 seconds respectively.

It is recognised that this assessment has assumed no upgrade to the intersection, a feature that is highly unlikely given the plans of RMS outlined in Section 4.3.3.2.

4.3.6.4 Road Capacity

Jenolan Caves Road

GTA Consultants (2014) assessed that the level of service experienced on Jenolan Caves Road in 2035 would not change from the current level as a result of the background growth in traffic levels and the maximum quarry-related traffic. This would apply for the scenarios when products are destined largely to Sydney or during periods of local upgrades on the Great Western Highway.

Great Western Highway

Based on the Austroads (2013) guide and the forecast peak hourly volumes, indicative Levels of Service along the Great Western Highway are presented in **Table 4.11**.

Table 4.11
Indicative Future Peak Day Levels of Service on the Great Western Highway 2035

Location	Total Vehicles per Hour	Number of Lanes	Speed Limit	Level of Service
Forty Bends	980	3	80	A
Hartley	1 110	3	90	A
Little Hartley	1 310	3	90	A
Victoria Pass	1 750	3	60	B
Leura	3 890	4	80	C
Wentworth Falls East	3 310	4	70	B
Bullaburra	3 660	4	80	B
Lawson	3 070	4	80	B
Woodford-Hazelbrook	3 090	4	80	B
Faulconbridge	3 980	4	70	C
Austen Quarry operating at 1.1Mtpa, peak day expected to occur approximately 5 times per year. Levels of Service from Table 4.4 of Austroads (2013)				
Source: GTA Consultants (2014) – Table 5.7				

The results demonstrate that with continued operation at the Austen Quarry, peak day activity at the quarry would result in Levels of Service C on the Great Western Highway in 2035. Level of Service C reflects an acceptable level of comfort and convenience within the zone of stable traffic flow, with drivers restricted to some extent in their freedom to select their desired speed and manoeuvre within the traffic stream.

4.3.6.5 Pedestrians, Cyclists and School Buses

The Proposal is not expected to generate any additional demand for pedestrian or cyclist activity. The number of pedestrians walking along or across Jenolan Caves Road in the vicinity of the quarry would remain negligible. Furthermore, the number of product trucks travelling to and from the Austen Quarry would remain comparable in number to those currently approved to use the transport route. Importantly, no increase in the exposure of cyclists to heavy vehicle traffic along the transportation route would occur as a result of the Proposal. While not directly related to the Proposal, it is noted that pedestrians and cyclists are likely to benefit from the completed and planned upgrade work along the Great Western Highway that includes elements such as over or underpass crossings, off-road shared paths and widened road shoulders. On the basis of the preceding, no additional specific facilities are warranted.

The number of truck trips generated by the Austen Quarry on a peak day, once spread over the operating hours of the quarry and taking into account The Applicant's management of despatch times to avoid peak traffic periods on the Great Western Highway, would have a negligible effect on the delays experienced by pedestrians crossing the Great Western Highway through the villages within the Blue Mountains. Most of the highway pedestrian crossing locations occur at key intersections or at existing traffic lights.

The Applicant's management of despatch times and avoidance of peak traffic periods would also minimise the potential interaction between quarry traffic and school buses.

4.3.6.6 Road Safety

The Proposal would result in the ongoing use of the Great Western Highway, primarily through the Blue Mountains to and from the east of the Jenolan Caves Road intersection. This is the most appropriate route for such vehicles, being the major arterial route used carrying freight between Sydney and western NSW. The ongoing upgrading program for the Great Western Highway is progressively improving the route to meet the current and future road transport demands along it, with the various upgrades aiming to improve traffic flow and reduce the risk of crashes. The design of all road works take into consideration the specific needs of heavy vehicles, such as their slower acceleration and braking capabilities.

The Applicant's Road Truck Traffic Management Plan aims to maximise the safety of road users both inside the Quarry and on public roads, and continued compliance with that Plan will reduce the risk of incidents associated with the quarry trucks.

4.3.6.7 Conclusion

The comprehensive traffic assessment undertaken for the Proposal has established that the product trucks travelling to and from the Austen Quarry can be accommodated on both Jenolan Caves Road and the Great Western Highway. The volume of Austen Quarry trucks compared

with overall traffic levels would diminish throughout the life of the quarry. Importantly, the adoption of the Applicant's Chain of Responsibility for product transportation would continue to minimise the adverse impacts on other motorists and roadside residents and businesses.

4.4 VISIBILITY

4.4.1 Introduction

The DGRs issued for the Proposal identified "*Visual*" as a key issue requiring that the "*EIS include a detailed assessment of the:*

- *changing landforms on the site during the various stages of the development;*
- *potential visual impacts of the development on private landowners in the surrounding area as well as key vantage points in the public domain, including Hassans Wall Lookout.*
- *a detailed description of the measures that would be implemented to minimise the visual impacts of the development.*

Additional matters for consideration in preparing the EIS were also provided in the correspondence attached to the DGRs from the DTIRIS - Resources and Energy Department and Blue Mountains City Council requesting that visual impacts and proposed mitigation measures be assessed particularly for vantage points on the Blue Mountains Escarpment.

Based on the risk analysis undertaken for the Proposal (Section 3.3.1 and **Table 3.9**), the potential impacts relating to visual amenity and their risk rankings (in parenthesis) after the adoption of pre-existing or standard mitigation measures are as follows.

- Increased visibility of the quarry from local residences resulting in decreased visual amenity of local setting (medium risk).
- Increased visibility of the quarry from local roads resulting in decreased visual amenity of the LGA as a whole (medium risk).
- Increased visibility of the quarry from local lookouts within Lithgow City LGA (Hassans Walls, Second Lookout and others off Hassans Walls Road) resulting in:
  - reduced aesthetic value of lookouts (high risk); or
  - reduced patronage of local lookouts and reduction in local tourism (high risk).
- Increased visibility of the quarry from local lookouts within Blue Mountains City LGA (Mt York, Bardens Lookout and others) resulting in:
  - reduced aesthetic value of lookouts (high risk); or
  - reduced patronage of local lookouts and reduction in local tourism (high risk).

A review of the attributed risk levels, following the adoption of the recommended operational safeguards and controls, is provided in Section 6.2.1 and **Table 6.1**.

The visual impact assessment for the Proposal was undertaken by Mr Alex Irwin of R.W. Corkery and Co with assistance from Messrs Lee Attard and Darryl Thiedeke of Hy-Tec Industries, and Messrs Rod Huntley and Luke Twigg of Groundwork Plus. This subsection of the EIS provides a summary of the visual impact assessment, concentrating on those matters raised in the DGRs and submissions to the DGRs provided by various government agencies. A consolidated list of the identified requirements and where each is addressed is presented in **Appendix 3**.

4.4.2 The Existing Visual Landscape

4.4.2.1 Local Setting

The Stage 2 Site is dominated by the forested ridges aligned in a generally northeast-southwest axis between the Coxs River in the east and Jenolan Caves Road in the west. These ridges are visible from the Blue Mountains Escarpment to the east (notably from Mt York and Mt York Road) and north (notably the Hassans Walls and other lookouts on Hassans Walls Road), as well as the Great Western Highway (Between Mt Victoria Pass and River Lett Hill) and other local roads.

4.4.2.2 Identification of Vantage Points

Based on an initial desktop review of the 1:25 000 topographic map sequence below, potential vantage points with direct line of sight views of the current and/or proposed quarry disturbance were identified.

MEADOW FLAT 8831-II-S	**LITHGOW** **8931-III-S**	WOLLANGAMBE 8931-II-S
TARANA 8830-I-N	**HARTLEY** **8930-IV-N**	**MOUNT WILSON** **8930-I-N**
OBERON 8830-I-S	**HAMPTON** **8930-IV-S**	**KATOOMBA** **8930-I-S**

Line of sight was determined by generating a series of virtual line between the potential vantage points and the quarry and excluding points where intervening topography exceeds or comes to within 10m of this virtual line. Potential vantage points were considered to be roads, areas of residential development, lookouts or potential walking tracks. Inaccessible escarpment areas were excluded. To confirm the visibility of the quarry from the vantage points identified by desktop review, a field inspection was completed on Friday, 20 September 2013. **Figure 4.13** identifies the locations inspected and highlights those which currently have, or are considered likely to have in the future, views of the Stage 2 Site.

4.4.2.3 Visibility Zones

4.4.2.3.1 Identification of Zones

The following provides a summary of the visibility of the Stage 2 Site from the accessible vantage points identified as discussed in Section 4.4.2.2. The various locations have been grouped into visibility zones based on orientation from the Stage 2 Site, proximity to the Stage 2 Site and/or general setting (see **Figure 4.13**).

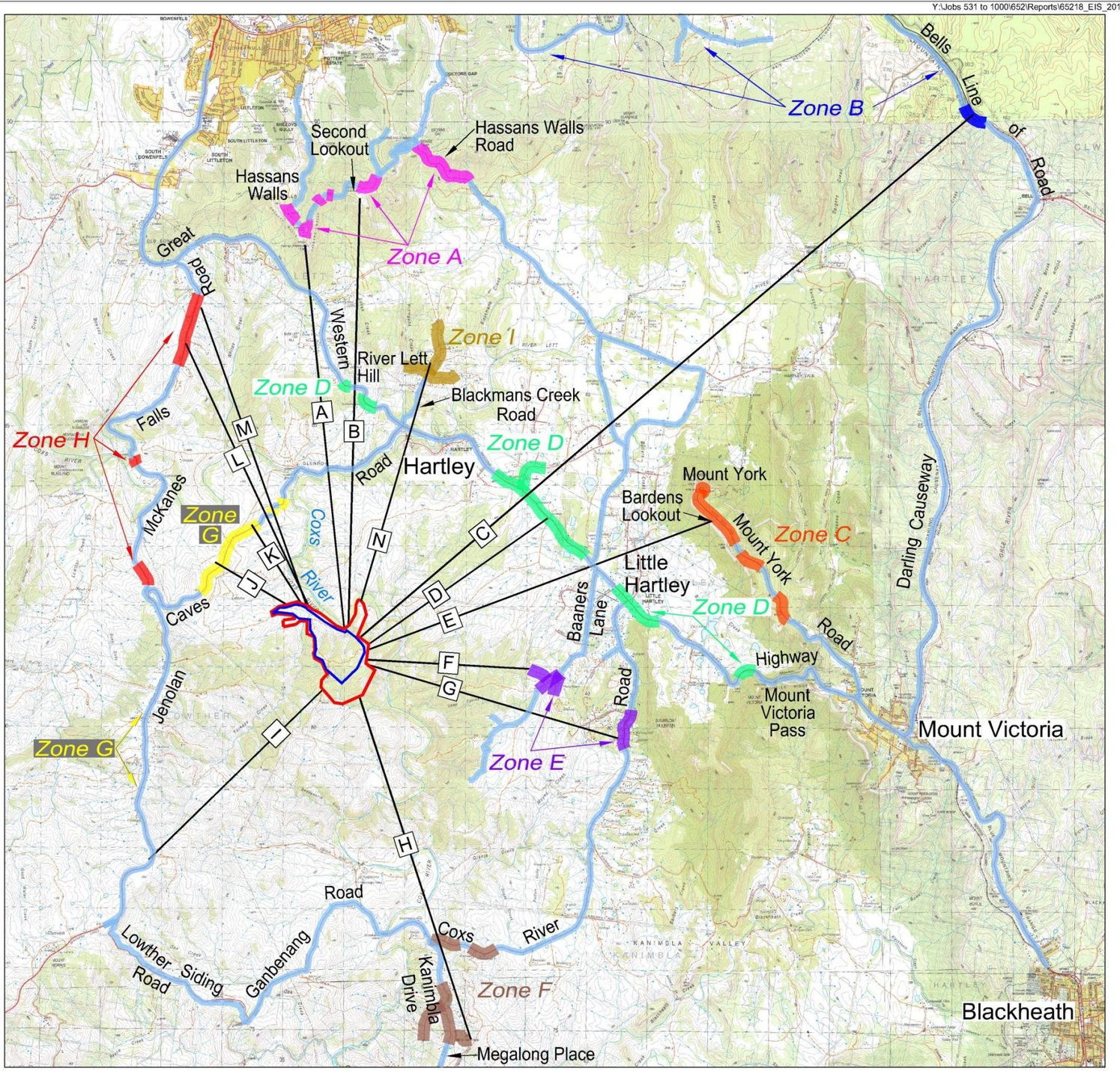
TN
MN

REFERENCE
- Stage 1 Site Boundary
- Stage 2 Site Boundary
- Open Forest (50-80% crown cover)
- Inspection Circuit
- B — Cross Sectional View (See Figures 4.14 - 4.24)

Zones of Visual Impact (Vantage Points with View of the Stage 2 Site)

- A — Hassans Walls, Second Lookout & Hassans Walls Road
- B — Bells Line of Road
- C — Mount York & Mount York Road
- D — Great Western Highway
- E — Little Hartley (Roads and Residences)
- F — Kanimbla (Coxs River Road/ Kanimbla Drive/Megalong Place)
- G — Jenolan Caves Road
- H — McKanes Falls Road
- I — Blackmans Creek Road

Notes 1: View of the Stage 2 Site may be of undisturbed area or obscured by intervening vegetation
2: Section lines through Stage 2 Site Boundary are not shown on this figure for clarity



SCALE 1:75 000 (A3)
1 0 1 2 3 4km

Base Map Source: Hampton, Hartley, Katoomba, Lithgow, Mount Wilson & Wollangambe 1:25 000 Topographic Maps

Figure 4.13
VISUAL IMPACT ZONES SURROUNDING THE AUSTEN QUARRY

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