ASSESSMENT OF ALTERNATIVE RESOURCE LOCATIONS & LEVEL OF REGIONAL DEMAND RELATING TO THE PROPOSED REPLACEMENT OF THE CHILTERN HARD ROCK QUARRY

CEMEX Australia Pty Ltd
Lincoln Causeway
WODONGA, VICTORIA, 3690

July 2009

FOREWARD

This document has been prepared to provide information requested by the Victorian Minister for Planning, Justin Madden MLC, in relation to an Environmental Effects Statement (EES) Referral made by CEMEX Australia with regard to the Company's proposed new quarry near Chiltern in northeastern Victoria. Written correspondence from the Minister for Planning dated 24 March 2009 (Ref. CMIN006460) was received in response to the Company's EES referral and included a request for a report that includes information on *"the availability of hard rock resources for relevant construction purposes that substantiates the proposed siting of the quarry, in the context of alternate resource locations and the level of regional demand"* (refer point i). This document aims to fully address this component of the information request.

This document has been written by Damon Bird (B.Sc. Hons) a qualified geologist and CEMEX'S Aggregates Reserves Development Manager. Mr. Bird has over 15 year's of professional geological experience in the minerals exploration, mining and quarrying industries, and managed the site selection process and the comprehensive resource assessment program that ultimately defined a high quality rock resource at the proposed new Chiltern Quarry site.

Damon Bird (B.Sc. Hons)
Aggregates Reserves Development Manager / Geologist
CEMEX Australia Pty Limited
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The existing Chiltern Quarry (**Figure 1**) which is operated by CEMEX Australia (CEMEX) is due to cease operation in November 2009 upon expiration of the Section 40 Ministerial Permit that currently allows the quarry to operate within the Chiltern - Mt Pilot National Park. Since quarry operations commenced in 1975 (prior to gazettal of the National Park), the quarry has crushed hornfels, a contact metamorphosed sedimentary rock, to produce a range of concrete, road pavement aggregates, and crushed rock products. Importantly, the quarry has been the major regional supplier of asphalt and bituminous sealing aggregates for building roads with superior wet-weather skid resistance properties. The high demand for Chiltern Quarry aggregates for these applications is a function of the geotechnical properties of the hornfels material, which is hard, durable and has frictional rating (skid-resistance) properties that are superior to other local and regional aggregate sources. The high demand for Chiltern aggregates is reflected in the extent of the quarry's market area, which is atypically large for a country quarry operation (refer **Figure 2**).

The imminent closure of the existing Chiltern Quarry operation will remove from the regional market the supply of high quality road building materials that will not be readily replaced by other existing aggregate suppliers, given the known quality characteristics of their resources. In an effort to maintain the supply of these materials to the market, CEMEX (formerly Readymix Holdings and later Rinker Australia) commenced an assessment in 2002 aimed at identifying alternative resource locations within the existing market area prospective for hornfels with similar geotechnical properties to the existing quarry. The assessment initially identified the following six locations (refer **Figure 3**) considered prospective for high quality hornfels:

- Area A – located at the contact of the *Beechworth Granite* and *Adaminaby Group* sediments at the western end of Skeleton Hill (400m to the west of the existing Chiltern Quarry and outside the Chiltern – Mt Pilot National Park).

- Area B – located at the contact of the *Beechworth Granite* and *Adaminaby Group* sediments approximately 9.5 kilometres by road south of Barnawartha, within northern part of the Indigo Valley.

- Area C – located at the contact of the *Beechworth Granite* and *Adaminaby Group* sediments approximately 15 kilometres by road south of Barnawartha, within the Indigo Valley.

- Areas D, E and F and are located to the southeast of Beechworth and south of Yackandandah and are associated with the intrusive contact zones between Devonian-aged granites and sedimentary rocks of the *Adaminaby Group*.

A number of additional localities occur where granite bodies are in faulted (rather than intrusive) contact with sedimentary rocks, however these were discounted from further assessment as faulted contacts tend to be characterised by highly fractured and altered rocks, they are not conducive to the production aggregate quality rock materials.

The assessment process focused on several aspects including rock resource, planning, vegetation cover, existing land use, accessibility, infrastructure and financial return. A detailed evaluation process followed which ultimately confirmed Area A as the only location that could meet the site selection parameters (refer **Table 1**).

Following the results of the assessment, CEMEX entered into access negotiations with the Area A landowner, and after the successful conclusion of these negotiations undertook a comprehensive resource assessment program (including diamond core drilling) on the site in 2007.

The resource assessment program was successful in defining a significant hornfels resource with quality characteristics similar to the existing Chiltern Quarry resource. Subject to obtaining a planning approval and work authority, development of a new quarry operation at Area A will guarantee the long-term supply of high quality materials to the region for use by the building and construction industry (including major infrastructure programs) and importantly for the creation of safe local roads. CEMEX believes that the stable historical market trend for high quality Chiltern hornfels aggregates will continue for the foreseeable future.

Figure 1 - Location of Existing Chiltern Quarry

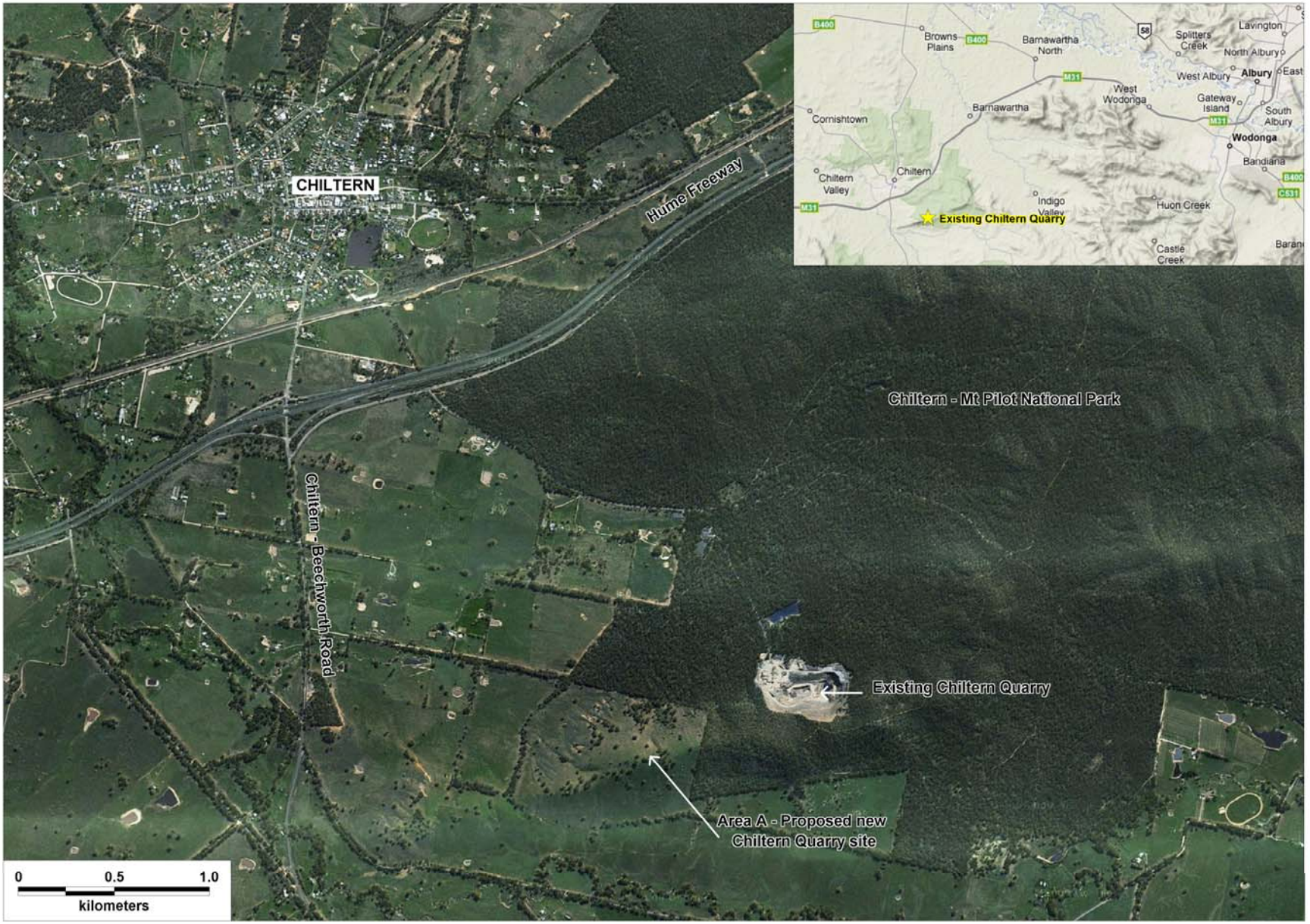

Figure 2 – Market Area for Existing Chiltern Quarry showing Historical Usage of Chiltern Quarry Hornfels Aggregates for Asphalt and Spray Seal Purposes

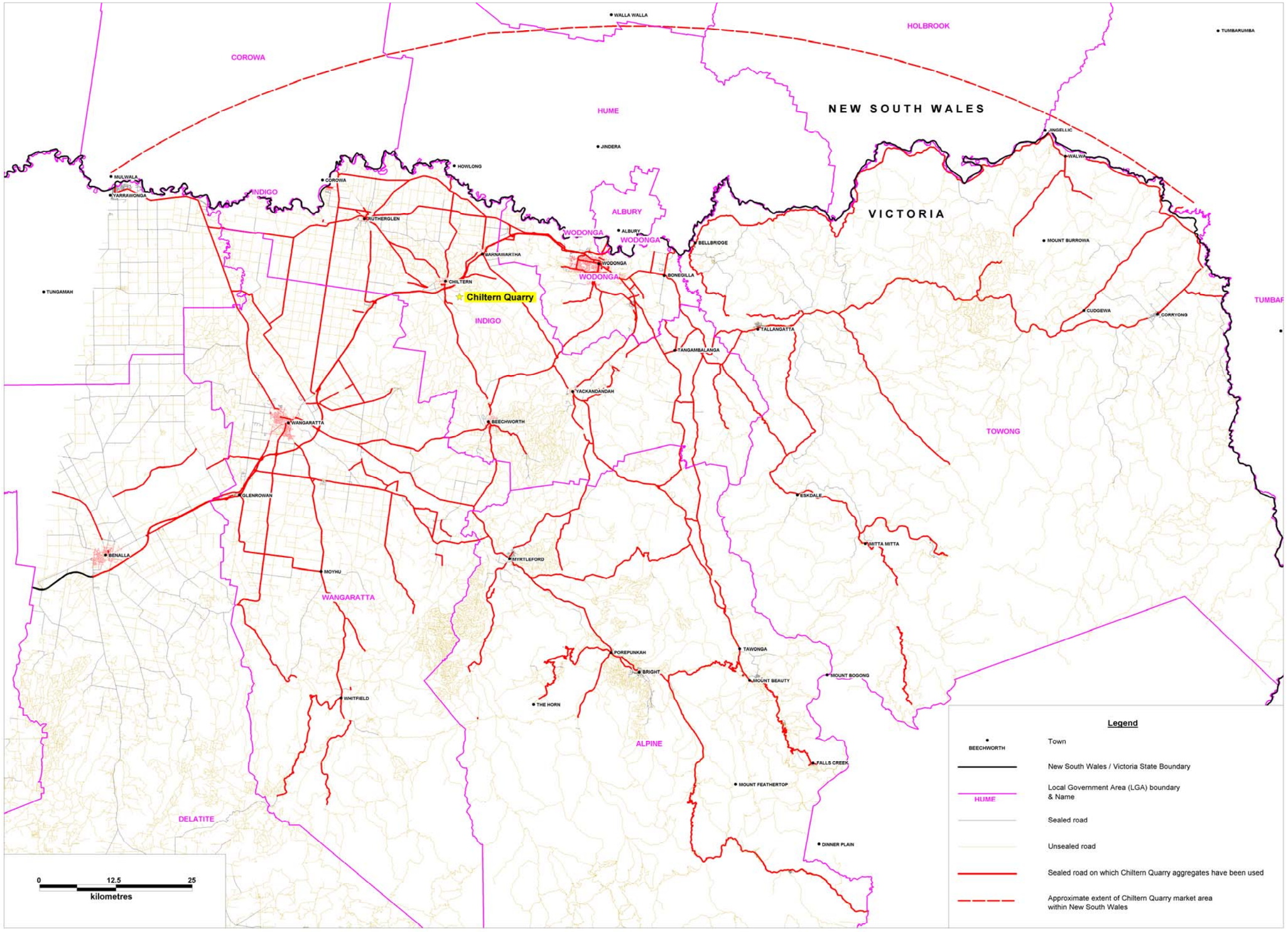

Figure 3 - Prospective Geological Environments Identified by Assessment

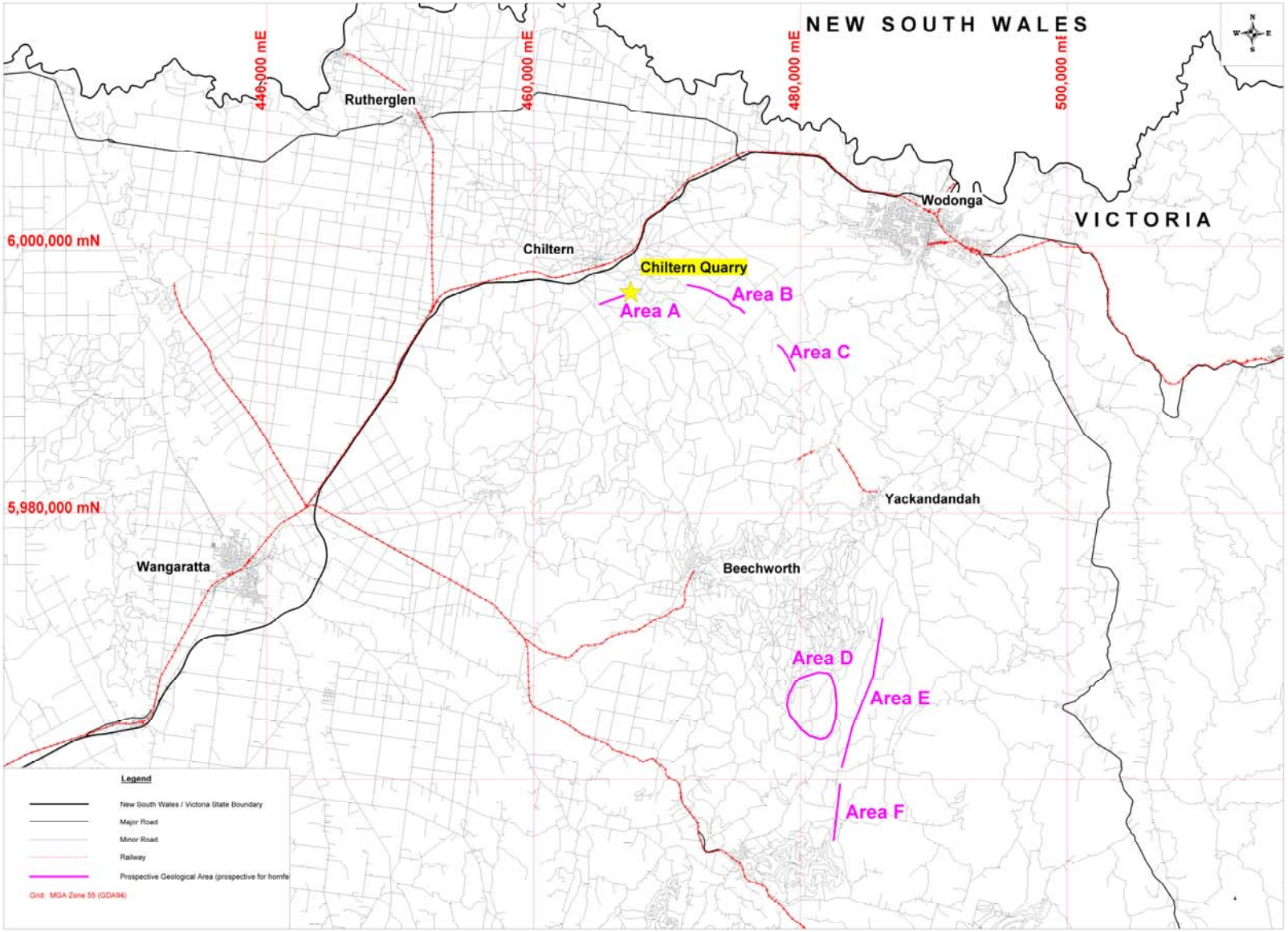

Table 1 – Key Constraints relating to Prospective Geological Areas

Prospective Geological Area	Land Zoning	Planning Overlay	Low Density Vegetation Cover	Infrastructure Costs	Favourable Land Tenure	Favourable Proximity w.r.t. Existing Houses	Project Viability	Comments
Area A	✓	✓	✓	✓	✓	✓	✓	Area A to the west of Chiltern – Mt Pilot National Park identified as the only viable location
Area B (north)	✓	✓	✓	✗	✓	✗	✗	Capital cost of off-site infrastructure and ecological / vegetation constraints would render a quarry project unviable in Area B
Area B (south)	✓	✓	✓	✗	✗	✗	✗	Capital cost of off-site infrastructure and unfavourable land tenure would render a quarry project unviable in Area B
Area C	✓ in part	✓	✗	✗	✗	✗	✗	Vegetation constraints, the capital cost of off-site infrastructure and unfavourable land tenure would render a quarry project unviable in Area C
Area D	✗	✓	✗	Not assessed given serious nature of vegetation constraints			✗	Notwithstanding vegetation, infrastructure, and cost constraints, quarry development in these areas would require quarry products to be transported directly through the villages of Yackandandah and/or Beechworth
Area E	✓ in part	✓	✗				✗	
Area F	✓ in part	✓	✗				✗	

✓ = no significant constraint ✗ = significant constraint

Plate 1: Oblique Aerial View East Towards Area A – Proposed New Chiltern Quarry Site

1.0 INTRODUCTION

This report summarises the objectives, methodology and results of investigations undertaken by CEMEX Australia Pty Ltd (formerly Readymix Holdings Pty Ltd, and later Rinker Australia Pty Ltd) geologists during 2004-2007 with the aim of identifying viable geological environments for replacement of the existing Chiltern Quarry which is due to close in late 2009. The existing quarry produces a wide range of concrete and road pavement aggregates and crushed rock materials that service a large part of the regional market demand for these materials. In addition, the quarry provides a valuable source of asphalt and spray seal aggregates that are characterised by exceptional wet weather skid-resistance properties that cannot be matched by other existing aggregate producers in the region. Consequently Chiltern aggregates are highly sought after by private and government contractors for road surfacing and maintenance purposes.

The expiration of the quarry's permit in 2009 will remove the supply of high quality quarry products from the local market unless an alternate supply of materials can be identified and permitted. If an alternate source cannot be established, materials to supply the market will need to be sourced from much greater distances, at greater cost to the market and with an increased carbon footprint.

The purpose of this report is to provide a general overview of CEMEX's approach to identifying alternative geological environments that lead to the ultimate selection of the preferred site for the new Chiltern Quarry (Area A at the western end of Skeleton Hill) and which is now the subject of a Work Authority and Planning Permit Application. An overview is also provided of the existing Chiltern Quarry, the products it produces, the market area, an explanation for the high demand for Chiltern Quarry aggregates for road building purposes and projected market demand.

With the exception of Figure 1, all figures referred to in the text are included at the back of the report.

2.0 EXISTING CHILTERN QUARRY

2.1 Background

The existing Chiltern Quarry is located within the Chiltern – Mt Pilot National Park, approximately 4 kilometres southeast of Chiltern township and 34 kilometres southwest of Wodonga, in northeastern Victoria (refer **Figure 1**). Access to the quarry from the Hume Freeway is via a two kilometre sealed road down the Chiltern-Beechworth Road, Lancashire Gap Road and then Crusher Road.

The quarry has been operating since 1975 prior to proclamation of the National Park in 2002 and is currently operated by CEMEX Australia Pty Ltd (CEMEX) under Work Authority 155, which covers an area of 12.65 hectares, in conjunction with a Section 40 Ministerial Consent from Parks Victoria which expires on the 29 November 2009. Extractable resources at the quarry are nearly exhausted and extraction operations are likely to cease during the third quarter of 2009, after which site rehabilitation activities will commence. In accordance with the National Park Management Strategy, the lease with Parks Victoria will not be renewed upon expiry and extraction must cease.

2.2 Quarry Geology

Chiltern Quarry extracts hornfelsed (contact metamorphosed) sedimentary rocks (sandstones and siltstone) of the Ordovician-aged *Adaminaby Group* that occur immediately adjacent to the contact with the Devonian-aged *Beechworth Granite*. The hornfels is cross-cut by occasional aplite to granite dyke rocks derived from the main granite body but these form a very minor constituent of the material extracted from the quarry. The hornfels occurs over a discrete 150-250 metre wide zone immediately adjacent to the granite, where heat and hydrothermal fluids associated with the granite resulted in the alteration and recrystallisation of the original sedimentary rocks to much harder rocks that are significantly more resistant to weathering. Consequently, the hornfels-granite contact at the quarry (and more regionally) is defined by elevated topography that can be attributed to the more resistant hornfels when compared with the less resistant surrounding granite and non-hornfelsed sedimentary rocks.

2.3 Quarry Products and Market

Processed hornfels is used to produce a range of quarry products dominated by concrete, asphalt and spray seal aggregates. 25% to 35% of all sales are supplied for concrete production at CEMEX concrete plants, with the remainder supplied to local government, private contractors and other customers within a market area that extends over an area with an approximate radius of 100km around the Quarry. The market area (refer **Figure 2**) is largely defined by the extent to which asphalt and bituminous sealing aggregates are used on the regional road network and includes the Victorian Local Government Areas (LGA's) of Wodonga, Indigo, Wangaratta, Alpine, Delatite, Moira and Towong, as well as the New South Wales LGA's of Albury, Hume, Holbrook and Corowa. The more distant reaches of the market area are the towns of Milawa, Mt Hotham, Falls Creek and Corryong.

Approximately 50% of the aggregates produced from the quarry are used for asphalt production and bituminous sealing aggregates for road surfacing purposes on the local and regional road network. The high demand for aggregates for road surfacing applications is due to the unique geotechnical properties of the Chiltern hornfels which is hard and durable whilst at the same time having frictional rating (skid-resistance) properties that are superior to other local and regional aggregate sources. The superior friction rating properties of Chiltern hornfels are a direct function of the mineralogy and texture of the rock created by the geological hornfelsing process. Whereas with the majority of aggregate sources there is typically a strong inverse relationship between the properties of hardness and durability vs friction rating, in the case of Chiltern hornfels this relationship is less pronounced, making the hornfels a much preferred material for creating long-wearing road surfaces with good wet weather skid resistance properties.

Friction rating is defined in Victoria by the Polished Stone Value (PSV) test (RC374.01), and in the rest of Australia by the Polished Aggregate Friction Value (PAFV) test (AS1141.41/42). Both tests are similar and are a relative measure of the extent to which different types of roadstone in the road wearing surface will polish under traffic conditions, with the higher the PSV / PAFV number, the greater the friction rating (skid resistance) of the aggregate material. Chiltern hornfels aggregates consistently produce PSV values in the range of 58-60, and PAFV values in the range of 54-60, which is significantly higher than aggregates produced by other local quarries. **Table 2** presents a summary of the hardness, durability and friction rating properties of fresh (unweathered) and unaltered hornfels from the existing Chiltern Quarry, along with a summary of critical specification requirements relating to the use of hornfels for various applications.

TABLE 2
Durability, Hardness and Friction Rating Values for Fresh (unweathered) and unaltered Hornfels from the Existing Chiltern Quarry

Quarry	Rock Type	DURABILITY Degradation Factor ≥40 = Sound 20-39 = Marginal ≤20 = Unsound	HARDNESS Los Angeles (LA) Value	FRICTION RATING Polished Stone Value (PSV)
Existing Chiltern Quarry	Hornfels (metamorphic)	≥40	9	58

Specifications	Application	Degradation Factor	Los Angeles (LA) Value	Polished Stone Value (PSV)
VicRoads 407, 417 – Asphalt	Type T, Type H or V	≤5% unsound; ≤10% marginal + unsound	≤ 25	≥ 54
VicRoads 831 – Sealing aggregate for sprayed bituminous surfacing	Class A Class B Class C	≤10% marginal + unsound ≤15% marginal + unsound ≤20% marginal + unsound	≤ 20 ≤ 25 ≤ 30	≥ 54 ≥ 54 ≥ 54
Concrete		≤10% marginal + unsound	≤ 30	N/A
Crushed Rock	Class 1 Class 2 Class 3	≤10% marginal + unsound ≤10% marginal + unsound ≤20% marginal + unsound	N/A	N/A

2.4 Projected Market Demand

The market demand for Chiltern Quarry aggregates is evidenced by the steady and consistent production and sales history of the existing quarry site. Over the past fifteen (15) years customers in the region (including VicRoads (Vic), RTA (NSW), several Councils and private road, construction and building companies) have purchased on average approximately 250,000 tonnes per annum of Chiltern aggregates. As mentioned previously, Chiltern aggregates are sought after by road construction companies due to their superior properties and sales forecasts and economic indicators suggest that demand for Chiltern quarry products for road construction and maintenance will remain at similar levels.

Periodically, large infra-structure projects are undertaken in the region that result in increased demand for Chiltern Quarry products – e.g. the recent Albury-Wodonga Bypass and Hume Freeway Duplication projects. These large infrastructure projects have historically increased quarry production by up to 50%. To cater for future infrastructure projects in the region throughout the life of the proposed New Chiltern Quarry, it is envisaged that aggregate production may increase to 400,000 tonnes per annum.

2.5 Requirements for Replacement Quarry

CEMEX requirements for a replacement quarry site to the existing Chiltern Quarry were:

1. the site be capable of supplying high durability and high wet-weather skid-resistance aggregates for road surfacing applications to service the existing market area;
2. the site be capable of meeting the other product requirements of existing clients as well as projected market demands;
3. the site have a high probability of meeting the planning and environmental approval requirements; and
4. the site be economically viable.

The economic viability of a new quarry site is determined in accordance with CEMEX parameters that aim to provide sufficient return to shareholders to warrant the investment of capital funds. The economic viability of any new quarry site is influenced by site-specific cost variables associated with land acquisition or leasing, quarry extraction, site infrastructure (e.g. processing plant), access to major roads, upgrading of the road network, provision of power and water supply, provision of native vegetation offsets, etc.

3.0 METHODOLOGY

The methodology employed for assessing alternative opportunities for the location of a new quarry involved the systematic staged assessment of available geological, planning and environmental information within an area termed the 'Investigation Area' (**Figure 4**) centred on the existing Chiltern Quarry market area. The majority of the staged assessment was undertaken by CEMEX resource and development geologists, with assessment of area-specific infrastructure costs undertaken by local CEMEX business management.

The staged assessment commenced with the identification of all likely geological environments considered prospective for a hornfels resource, followed by the high-level review of planning, environmental and infrastructure constraints likely to influence whether a quarry could be feasibly developed at any of the identified locations. Reconnaissance ground investigations were subsequently conducted from publicly accessible vantage points (e.g. laneways, roads) at several of the 'less-constrained' locations, and several environmental consulting firms were commissioned to inspect and/or provide preliminary

advice on potential environmental and planning constraints (including ecology) in relation to those locations that progressed further through the assessment process.

The general structure of the staged assessment was as follows.

- **Stage 1:** Preliminary assessment of regional geological information to define prospective geological areas – principally hornfels or basalt environments.

- **Stage 2:** Evaluation of local planning scheme data (zoning and planning overlays) to determine where extractive industries development was prohibited, and those prospective geological areas to be excluded from further assessment.

- **Stage 3:** High-level evaluation of environmental constraints potentially capable of precluding development. This stage of the assessment involved:

    - Initial review of moderate to high density tree coverage using aerial photography and Landsat imagery, given the high potential for sensitive vegetation habitat.
    - Commissioning of environmental consultancy Biosis Research to undertake a preliminary flora and fauna assessment of two areas (Areas A and B) that progressed further through the assessment process. The results of this assessment were reported in the document titled *"Preliminary flora and fauna assessment of Readymix Chiltern quarry development options, Chiltern Victoria"* – Biosis Research, April 2005 {hard copy report issued June 2005).

- **Tollgate 1:** Prospective geological areas with unfavourable planning and /or environmental constraints were excluded from further assessment.

- **Stage 4:** Identification of infrastructure works and costs associated with the provision of road access, power supply, and water to prospective geological areas. This stage also covered the review of land ownership so that land acquisition / lease opportunities could be assessed along with any cost constraints.

- **Stage 5:** Review of financial viability of establishing a new quarry.

- **Tollgate 2:** Prospective geological areas deemed financially uneconomic due to unfavourable infrastructure cost constraints or land tenure status were excluded from further assessment.

Given that only a single Area (Area A) remained unconstrained at the end of the assessment, the normal process of preferentially ranking prospective sites was made redundant. In light of this outcome, the following consultants were commissioned to provide independent advice in relation to a possible new quarry located at Area A:

- Golder Associates were commissioned to undertake a preliminary assessment of potential water management, visual amenity and landscape value issues relating to the requirements of the Indigo Planning Scheme that would need to be considered should a quarry development be proposed for Area A. The results of this preliminary assessment were presented in the document titled *"Preliminary Assessment of Water and Visual Amenity Issues Chiltern Quarry Development"* – Golder Associates, 25 May 2005.

- Umwelt Environmental Consultants were commissioned to provide independent advice on potential community and environmental constraints and opportunities relating to Area A, as well as issues to be considered in planning an approval path for a quarry development proposed for Area A. Umwelt's advice was provided as a letter document dated 21 March 2006.

As part of the initial stages of CEMEX's Community / Stakeholder engagement program, discussions were initiated in 2005 with the relevant local Council officers to determine Council's views towards a conceptual quarry development at the Area A site; to understand the planning / approvals process; and to determine whether Council wished to be the Approval Authority (i.e. Planning Permit process vs. Environmental Effects Statement process).

In early 2007 CEMEX commenced land access negotiations with the landowner of Area A, and subsequently undertook a comprehensive resource assessment program (including extensive ground-based geological and drilling programs) between April and November 2007.

The results of the staged assessment are presented in **Section 4**, whereas as a summary of the resource assessment program results are presented in **Section 5**.

4.0 ASSESSMENT RESULTS

The results of the assessment process are summarised in **Table 3**.

4.1 Stage 1 Results

Stage 1 of the assessment involved the review of regional geological data including the Victoria 1:1,000,000 geology map sheet (**Figure 5**) and geophysical data, and the Wangaratta 1:250,000 geology map sheet data published by the Geological Survey of Victoria. This high-level review identified only six prospective geological areas (Areas A to F), all of which are located on geological contacts where granite bodies have intruded sedimentary units. All six areas are considered prospective for hornfels similar to that which occurs at the existing Chiltern Quarry (**Figure 6**). A number of additional localities occur within the Investigation Area where granite bodies are in contact with sedimentary rocks however the contact zones at these localities are defined by major faults. Given that these types of contacts tend to be characterised by highly fractured and altered rocks, they are not considered to be prospective for aggregate quality rock materials.

Areas A, B and C are located along the same geological contact as the existing Chiltern Quarry where the *Beechworth Granite* is in direct contact with sedimentary rocks of the *Adaminaby Group*. Area A is located to the west of the existing Chiltern Quarry outside of the Chiltern – Mt Pilot National Park. This area is associated with a prominent ridgeline (Skeleton Hill) that parallels the granite contact and was believed to be indicative of the presence of weathering-resistant hornfels. Areas B and C are located to the east of the Chiltern – Mt Pilot National Park within the Indigo Valley. Areas B and C are effectively part of the same geological contact zone but are shown on the regional geology as being separated by alluvial cover material in an area of relative low relief. Although the northern part of Area B adjacent to the National Park is also mapped as alluvium, the elevated topography of this area in the vicinity of Cheesley Hill is indicative of more resistant, possibly hornfelsed rocks, in the inferred position of the granite contact and is therefore also considered prospective for hornfels. Areas A, B and C are all located within Indigo Local Government Area (LGA). Areas D, E and F are located to the south of Beechworth in the southern part of the Investigation Area and are associated with the contact zones between Devonian-aged granites and sedimentary rocks of the *Adaminaby Group*. Areas D and E straddle the Indigo and Alpine LGA's, whereas Area F is located entirely within the Alpine LGA. There were no areas identified within the Investigation Area that are prospective for basalt resources.

Table 3

Staged Approach to Identification of Prospective Geological Areas and a Preferred Replacement Site to Chiltern Quarry

Stage	Objective	Input Data	Source	Output Data	Figure / Table Reference	Results / Comments
Stage 1 - Preliminary Geological Assessment	Identify areas prospective for either hornfels or basalt resources	Victoria 1:1,000,000 Geology Data (**Figure 5**); Wangaratta 1:250,000 Geology Sheet; Regional Geophysics	Geological Survey of Victoria	Map of prospective geological areas	**Figure 3**	Prospective geological areas for hornfels are limited to the intact (i.e. unfaulted) intrusive hornfels contact between the Beechworth Granite and Adaminaby Group in the north (Areas A-C) and between undifferentiated Devonian granitic rocks and the Adaminaby Group in the south (Areas D-F). Faulted contacts were avoided as they typically result in fractured and altered rock unsuitable for high quality aggregate production. No basalt resource areas were identified.
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Stage 2 - Planning Constraints	Identify areas where land zoning precludes / permits extractive industries - includes identification of National Parks and Crown Reserves	Land Zoning Data - Indigo, Wodonga, Wangaratta (part of), Alpine (part of) LGA's	Vicmap	Map of prospective geological areas with respect to land zoning	**Figure 6**	Extractive Industries is a permissible land use with Approval for Area A (in part and outside Chiltern - Mt Pilot National Park), B, C (in part), E (in part) and F (in part) where Rural Zone (RUZ) applies. Area D is for the majority zoned Public Conservation and Resource Zone (PCRZ) and is associated with the Mount Stanley Scenic Reserve. Area F is also largely PCRZ, with only minor exposure to the Rural Zone. None of the Areas are affected by planning overlays.
	Identify areas where planning overlays preclude / permit extractive industries	Planning Overlay Data - Indigo, Wodonga, Wangaratta (part of), Alpine (part of) LGA's	Vicmap	Map of prospective geological areas with respect planning overlays	**Figure 7**	
↓						
Stage 3 - High-level Vegetation Assessment	Identify areas of moderate to high density tree cover likely to preclude development given vegetation offset requirements	Landsat Imagery (2004 Mosaic) - 300m pixel resolution; Regional orthophotography	Geoscience Australia	Map of prospective geological areas with respect to landsat imagery (highlights medium to high density vegetation cover)	**Figure 8** **Figure 10**	Area C contains significant exposure to medium density tree cover. Areas D, E and F are all associated with high density tree growth.
	Biosis Research - commissioned to undertake preliminary flora and fauna assessment over Areas A and B to determine whether any significant constraints	Review of pre-existing information in FIS and AVW databases; online review of the *EPBC 1999* database; the review of extant and pre-1750 EVC mapping by the DSE; ground reconnaissance	Biosis Research	*"Preliminary flora and fauna assessment of Readymix Chiltern quarry development options, Chiltern Victoria"* – Biosis Research, April 2005	**N/A**	Assessment confirmed Areas A and B largely cleared of trees although native vegetation likely to exist in some areas; contained remnant trees likely to provide habitat for some nationally significant fauna species; and offsets for any vegetation losses could probably be achieved on-site. Biosis recommended that either Area A or B could be worth pursuing, although a full flora and fauna assessment would be required to identify sensitive areas and determine offset requirements for Net Gain in accordance with the Victoria Native Vegetation Management Framework.
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Tollgate 1	**Status of Prospective Geological Areas after consideration of Planning and Vegetation Constraints** **Area A reduced to exclude National Park. Area B maintained. Area C dubious from vegetation perspecitve. Areas D, E and F excluded due to land zoning and vegetation constraints.**					
↓						
Stage 4 - Infrastructure and Land Tenure Constraints	Identify key infrastructure constraints and costs relating to prospective geological areas	Internal Company assessment	N/A	N/A	**Table 4**	The critical site specific infrastructure costs for Areas A, B and C relate to the and upgrading of the local road network for transportation of quarry products and the provision of three-phase power to each site. The infrastructure cost constraints for Area A are significant, whereas for Area B they are substantial mainly due to the length and extent of road upgrade works required to meet acceptable standards. Critically, a susbtantial amount of native vegetation exists within the two road easements (Cheesleys Road and Masons Gap Road) that would need to be removed to upgrade these roads to acceptable standards for heavy vehicle use. Clearing of this substantial vegetation would greatly increase the vegetation offset requirements (when compared with Area A) and would require Council and DSE approval.
	Identify land ownership status of prospective geological areas to determine constraints on landowner negotiations and potential acqusition / lease costs	Internal Company assessment of Vicmap land title information	N/A	Map illustrating landownership for prospective geological areas	**Figure 9**	Area A unconstrained by landownership. Single landholder owns 221.3 hectares, covering the entire resource target area and sufficient adjacent land for direct vehicle access onto Chiltern-Beechworth Road. The location of the nearest residences are sufficiently far enough removed from the resource target area (i.e. conceptual pit) to achieve compliance with relevant noise, dust, air-blast and blast vibration criteria. Area B is constrained by landownership with the resource target area passing through 5 different properties. A conceptual pit located on any of these properties is likely to impact significantly on 3 to 4 adjacent properties, with at least 2 residences occurring within 400m of the preferred pit site on the largest of the landholdings.
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Stage 5 - Financial Viability	Determine financial viability of prospective geological environments in context of Stage 4 outcomes	Internal Company assessment				With the exception of Area A to the east of the existing Chiltern Quarry (outside Chiltern - Mt Pilot National Park), the cost to upgrade the existing road network to an acceptable standard and provide power to Areas B and C renders them unviable.
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Tollgate 2	**Status of Prospective Geological Areas after consideration of Project Viability** **Area A maintained. Areas B excluded from further assessment due to high infrastructure costs and/or unfavourable land ownership. Area C excluded from further assessment due to high infrastructure costs and vegetation constraints.**					
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Stage 6 - Preliminary Site Selection	Selection of a preferred geological area based on the outcomes of Stage 5, and selection of a specific site within the area	Internal Company assessment				Given the results of Stages 1 to 5, the only possible site occurs at Area A to the immediate east of the existing Chiltern Quarry and the Chiltern - Mt Pilot National Park.

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Preliminary Discussions with Indigo Shire Council - September 2005

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Preliminary Environmental Opportunities and Constraints Analysis
Umwelt Australia Pty Ltd - Environmental Consultants - March 2006

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Land Access Negotiations - Early 2007

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Commence Resource Assessment Work Program - July 2007

4.2 Stage 2 Results

Stage 2 of the assessment involved the review of planning scheme zoning and planning overlay information which was obtained in digital format directly from Vicmap. The review confirmed that although no planning overlays impact on the six prospective geological areas, planning zone constraints associated with the Public Conservation Resource Zone (PCRZ) apply to Area C (in part), Area D (majority), Area E (in part) and Area F (in part) (refer **Figures 7 and 8**). 'Extractive Industries' is a prohibitied land use under the PCRZ classification and those parts of each Area where the PCRZ classification applies were excluded from further assessment. As Area D was associated with the heavily timbered Mount Stanley Scenic Reserve, it was discounted immediately from further assessment.

4.3 Stage 3 Results

The Stage 3 review of vegetation cover was based on a review of the 2004 300m-pixel Landsat mosaic image obtained from Geoscience Australia (**Figure 9**). Areas E and F were found to be heavily vegetated and as a result were also excluded from any further assessment. The Landsat imagery suggested that Area C may be heavily vegetated, and a subsequent review of publicly available orthophotography followed by ground reconnaissance confirmed that there is a substantial amount of medium density vegetation cover which would be problematic from an ecological perspective. The only prospective areas not discounted from further investigation were Area A and Area B.

Biosis Research were subsequently commissioned to undertake a preliminary flora and fauna assessment over Areas A and B to determine whether any significant constraints were likely to exist that would limit opportunities for the development of a new quarry. The assessment involved the following components:

1. Literature and Database Review – comprising a review of pre-existing information in the Flora Information System (FIS) and Atlas of Victorian Wildlife (AVW) databases; the online review of the *Environment Protection and Biodiversity Conservation Act 1999* database; the review of extant and pre-1750 Ecological Vegetation Community (EVC) mapping within the study area by the Department of Sustainability and Environment (DSE) and their bioregional conservation status;

2. Field Survey – a field investigation was conducted on the 20 April 2005 during which a brief indicative list of vascular plants was prepared for each site; and

3. Defining Significant Species and Communities – listing of the conservation significance of flora and fauna.

The assessment confirmed that both Areas A and B:

- were largely cleared of trees although native vegetation was likely to exist in some areas, including the northern flank of the hill at Area A;
- contained remnant trees that were likely to provide habitat for some nationally significant fauna species, and
- offsets for any vegetation losses could probably be achieved on-site

In addition, with the exception of sensitive vegetation along Black Dog Creek, the southern flank of the hill at Area A appeared to be more modified than the northern flank and was less likely to have Net Gain implications.

The recommendations of the Biosis assessment were that either Area A or B could be worth pursuing, although a full flora and fauna assessment would be required to identify sensitive areas and determine offset requirements for Net Gain in accordance with the Victoria Native Vegetation Management Framework. It was also recommended that the C*reekline Grassy Woodland Community* that occurs along Black Dog Creek (south of Area A) be avoided as it is listed as Endangered in the Northern Inland Slopes Bioregion.

It is worth noting that the Biosis assessment did not examine the potential impacts of necessary road upgrade works on old growth native vegetation within the existing road easements, which (as summarised in Section 4.4) is likely to be significant for Area B.

4.4 Stage 4 Results

The Stage 4 assessment of infrastructure constraints for Areas A and B was aimed at generating an understanding of the relative costs of establishing the necessary infrastructure to each Area. The assessment considered (1) the likely nature and indicative cost of upgrading the local road network to Council and/or VicRoads standards to enable the transportation of quarry products by heavy vehicle from each Area; and (2) the likely route and indicative cost of establishing 22kV three-phase power to both Areas based on the nearest ‘access’ point.

The Stage 4 assessment confirmed that significant cost would be associated with undertaking the required road works and establishing a power supply to each Area, with the higher costs relating to Area B exceeding the project viability rating. **Table 4** provides a summary of the infrastructure constraints and associated cost estimates for Areas A and B.

Table 4 – Infrastructure Constraints relating to Prospective Geological Areas

Prospective Geological Area	Power Supply Distance to link with 22kV three-phase power	Road Upgrade Works Required Nature of Required Off-site Road Upgrade Works
Area A	km	Upgrade of intersection of Chiltern-Beechworth Road and Black Dog Creek Road, including shoulder widening
Area B	km	Upgrade of intersection of Masons Gap or Cheesleys Road with Indigo Creek Road, including shoulder widening. Upgrade Cheesleys Road or Masons Gap Road from single land unsealed road to dual lane (7m wide) pavement over estimated distance of 3-4 kilometres to likely site entrance point.

In addition to the high cost of widening and upgrading either Masons Gap Road or Cheesleys Road to an acceptable standard, significant existing old-growth vegetation (including many large old trees) exists within each road easement and on either side of the existing unsealed pavements. Clearing of this vegetation to achieve the required upgraded road design would substantially increase the impact of any new proposed quarry development on native vegetation, and potentially on associated fauna habitat (refer **Plates 2** and **3**).

The Stage 4 assessment of landownership was undertaken for land parcels in the immediate vicinity of Areas A, B (and C), with a view to confirming (1) whether any substantial single-owner landholdings exist that could accommodate all key elements of a quarry operation (i.e. pit, processing plant, stockpile areas, weighbridge and office) - given the range of difficulties and cost implications typically associated with dealing with multiple landowners, the Company preference was to identify sites where land ownership dealings were unlikely to render a project unviable; and (2) the degree to which a quarry development in each Area may impact on surrounding landowners and residences.

Plate 2: View of native vegetation within Cheesleys Road easement

Plate 3: View of native vegetation within Masons Gap Road easement

Figure 10 illustrates the contrasting landownership status for Areas A, B and C. Land parcels coloured light-grey are owned by different landholders, whereas land parcels coloured otherwise are owned by the same individual landowner.

The landownership assessment confirmed that a single landowner controlled all of Area A (at the western end of Skeleton Hill) and that this landholding covered an area of 221.3ha – sufficient for the establishment of all on-site infrastructure components and capable of providing direct access to the Chiltern-Beechworth Road. The location of Area A at the eastern end of the landholding and adjacent to the National Park was considered acceptable given the relative isolation with respect to the nearest existing residence (located over 500 metres from any likely pit). The available buffer between the postulated pit and nearest residences, the minimal tree cover and proximity to infrastructure, enabled this site to progress through the selection process.

The review of landownership for Area B confirmed that the northern 40% of Area B occurs on two large properties owned by two different landowners, with the greater part of the Area associated with a single landholding that covers the length of Cheesley Hill. While the size of landholdings in this northern area is favourable, the existing road network would require substantial improvements and the widespread removal of native vegetation from within the existing road easements as previously discussed. In contrast, the southern 60% of this prospective geological area extends over 5 different properties, and a conceptual pit located on any one of these five properties would impact significantly on at least 3 to 4 of the surrounding properties. The preferred location of a quarry in this southern area would need to be on the largest of the landholdings, but this would still directly impact on two existing residences that occur within 400m of the preferred location of the conceptual pit.

4.5 Stage 5 Results

The Stage 5 assessment of financial viability confirmed that a new quarry development located at Area A would require substantial capital investment in infrastructure in relation to road upgrade works and the provision of power and water. However, the cost of these infrastructure works would not render the project unviable.

In contrast, infrastructure costs alone for a new quarry development at Area B would render any development at this location unviable.

4.6 Conclusions from Assessment

Table 1 provides a summary of the planning, infrastructure and related cost constraints that apply to each of the six prospective geological areas identified during the staged assessment of alternate quarry sites capable of replacing the existing Chiltern Quarry. The assessment confirmed that only a quarry operation located at Area A would:

1. (subject to confirmation of resource quality) have a high probability of providing the appropriate geological resource materials to continue supplying high quality asphalt and bituminous sealing aggregates with superior wet weather skid resistance properties for local road building purposes;

2. comply with the zoning and planning overlay constraints attached to the relevant local LEP;

3. be capable of complying with environmental and planning constraints;

4. minimize to an acceptable and manageable level the impact on native vegetation;

5. be capable of minimizing the impact on nearest existing residences; and

6. be economically viable from CEMEX'S investment criteria.

Two consultancies were subsequently engaged to provide planning and environmental advice relating to a proposed quarry development at Area A. Golder Associates were commissioned in 2005 to undertake a preliminary assessment of potential water management as well as visual amenity and landscape value issues that would need to be considered should a quarry development be proposed for Area A. At that point in time, a replacement quarry with a configuration similar to the existing Chiltern Quarry was considered likely, and as such, Golder Associates focused on a conceptual development located on either the northern or southern sides of the hill at Area A (Sites 2 and 3, respectively). The Golder Associates report confirmed that there were no groundwater restrictions anticipated with respect to either Sites 2 or 3, with development on the southern flank of the hill likely to provide the best option of securing access to water from Black Dog Creek or groundwater from the flanking alluvial deposits. The report also confirmed that a quarry development at Area A that only resulted in removal of the northern or southern flank of the hill was likely to impact significantly on landscape values and visual amenity.

Following receipt of the advice from Golder Associates, CEMEX geologists commenced conceptual quarry design work to determine whether a quarry excavation that involved the partial removal of the ridge crest (rather than just the northern or southern flanks of the hill) followed by deepening of the quarry within the core of the hill, was both operationally achievable and capable of minimizing the impact on landscape values and visual amenity. Several design iterations were undertaken and resulted in a conceptual design that appeared to achieve both objectives.

Umwelt Environmental Consultants were subsequently commissioned to provide independent advice on potential environmental constraints and opportunities relating to the conceptual quarry development at Area A, as well as issues to be considered in planning an approval path. The Umwelt report identified a range of key, but potentially manageable issues that would need to be addressed relating to community consultation, noise and air quality impacts, visual impacts, water management, flora and fauna and roads and traffic.

At the completion of the staged assessment and following independent planning and environmental advice, and following initial discussions with Council in the second half of 2005, CEMEX commenced negotiations with the landowner of Area A in early 2007 aimed at securing site access to undertake ground-based investigations to determine whether the appropriate quality hornfels materials existed at the location. Land access negotiations were completed during mid-2007, and groundwork commenced in July 2007. The nature and key results of the resource assessment program are summarised in **Section 5**.

5.0 SUMMARY OF RESOURCE ASSESSMENT PROGRAM AND KEY FINDINGS FOR 'AREA A'

5.1 Summary of Resource Assessment Program

The CEMEX resource assessment program at Area A was conducted between July 2007 and February 2008, and focused on the geological assessment of the ridgeline to the immediate east of the National Park (western end of Skeleton Hill) where the overall topographic character of this location indicated the likely presence of good quality hornfels. The extent of the assessment was determined from preliminary pit design work that provided an indication of the likely footprint of a conceptual quarry that would provide access to and enable extraction of sufficient resource materials. In addition, the footprint was manipulated to minimize the impacts on the few old-growth trees that remain on the ridgeline.

The resource assessment program involved the following site-based and off-site activities.

On-site Activities

- Detailed geological and structural mapping of surface geology to define key variations in rock type; the location of the granite-hornfels contact; bedding orientations within hornfelsed sedimentary units; and the location of key structures (faults and shears) and any apparent displacements.

- Diamond core drilling program involving the completion of nine angled and oriented holes for a total of 1306m of drilling. Drill-holes ranged in depth between 120m and 170m, and all core was logged for logged by an experienced geologist (consultant) for lithology (rock type), alteration, veining and structure.

- Preliminary geological interpretation, modeling and follow-up geological and structural mapping to refine any geological interpretation.

Off-site Activities

- Petrographic studies of selected core samples to aid geological interpretation.

- Geological interpretation and 3D modeling of all data to produce a robust geological / resource model for the site.

- Geotechnical testing of diamond core to enable assessment of the suitability of site resources against the relevant asphalt and concrete aggregate specifications and to assist conceptual staging of quarry extraction at the site

- Detailed staged design work for quarry extraction to determine how extraction of the resource could be optimized and to ensure that extraction staging was operationally feasible.

5.2 Key Findings

The resource assessment program confirmed that a high quality hornfels resource exists at the western end of Skeleton Hill, which unlike the resource at the existing Chiltern Quarry (which is largely confined to the northern flank of the ridge), extends to the southern flank of the ridgeline. The geometry of this hornfels resource is preferential to the existing site as it supports the development of a quarry extraction operation that would largely be confined to

within the core of the ridge once the top of the ridge had been removed, whilst minimizing the amount of granite that would need to be extracted.

Not only is the hornfels at Area A visually similar to that at the existing Chiltern Quarry, but geotechnical testing of drill-core confirmed that its geotechnical properties, and therefore quality, are very similar. **Table 5** compares the hardness and friction rating values for fresh unaltered hornfels from both Area A and the existing Chiltern Quarry.

TABLE 5

Durability, Hardness and Friction Rating Values for Fresh (unweathered) and Unaltered Hornfels from Area A and the Existing Chiltern Quarry

Quarry	Rock Type	DURABILITY Degradation Factor >40 = Sound 20-39 = Marginal <20 = Unsound	HARDNESS Los Angeles (LA) Value	FRICTION RATING Polished Stone Value (PSV)
Area A (Proposed New Chiltern Quarry)	Hornfels (metamorphic)	≥40	15	58
Existing Chiltern Quarry	Hornfels (metamorphic)	≥40	9	58

Consequently, the key resource objectives for a replacement site – namely (i) the site be capable of supplying high durability and high wet-weather skid-resistance aggregates for road surfacing applications to service the existing market area; and (ii) the site be capable of meeting the other product requirements of existing clients as well as projected market demands – would be achieved from a quarry development located at the Area A site.

Figure 4 – Investigation Area for the Identification of a Replacement Quarry

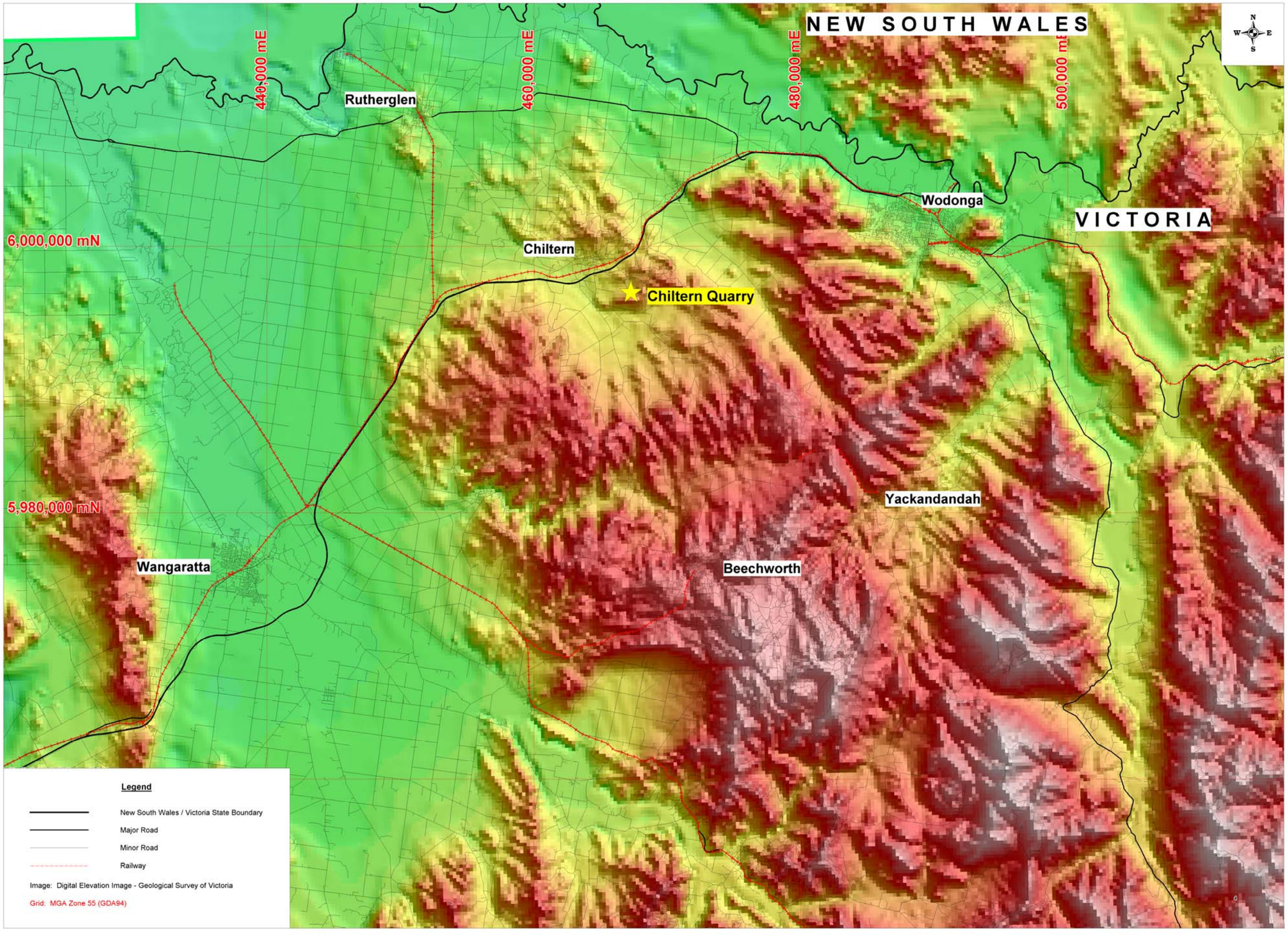
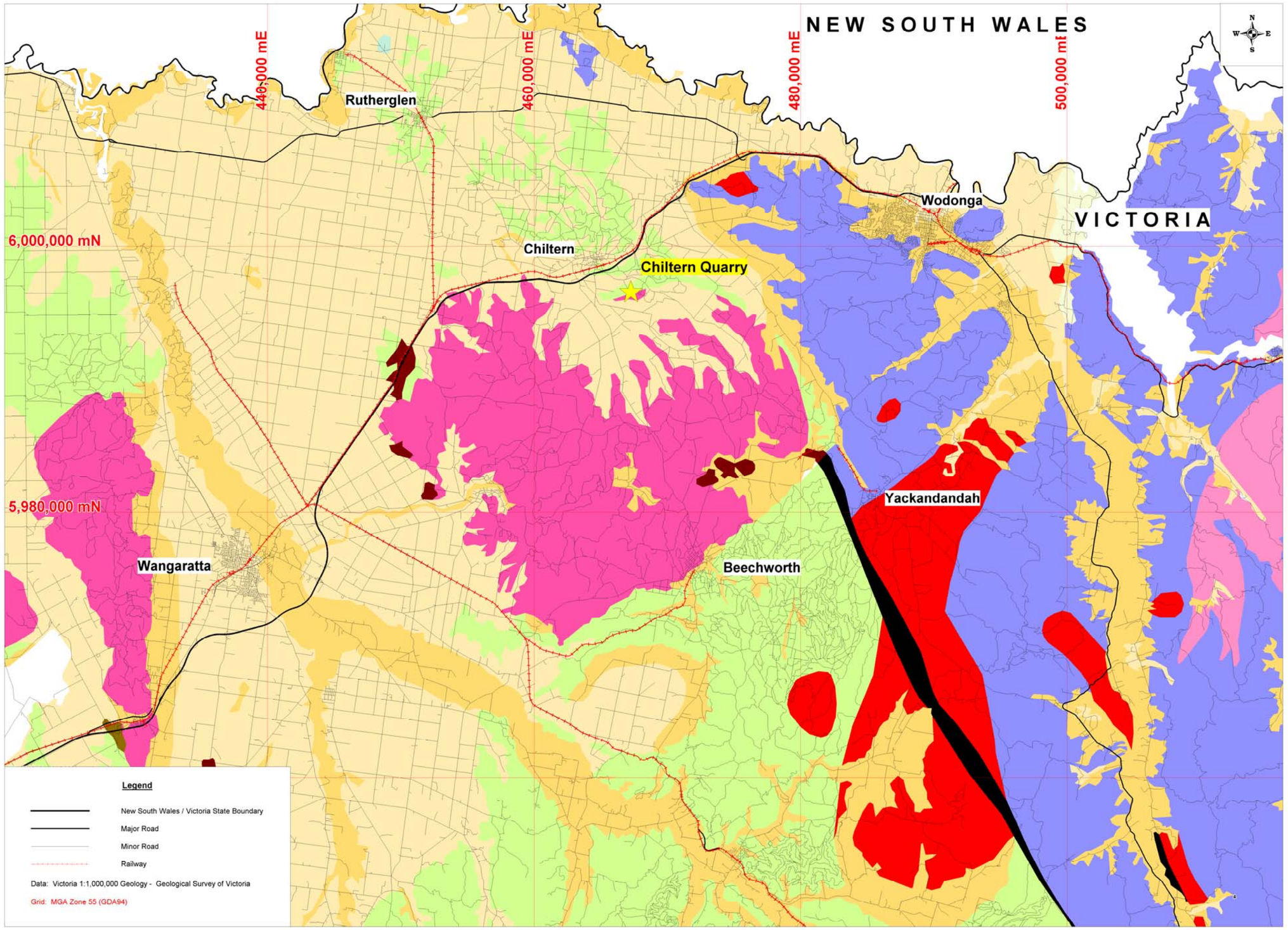


Figure 5 – Regional Geological Setting of Investigation Area (Geology Legend on Page 28)



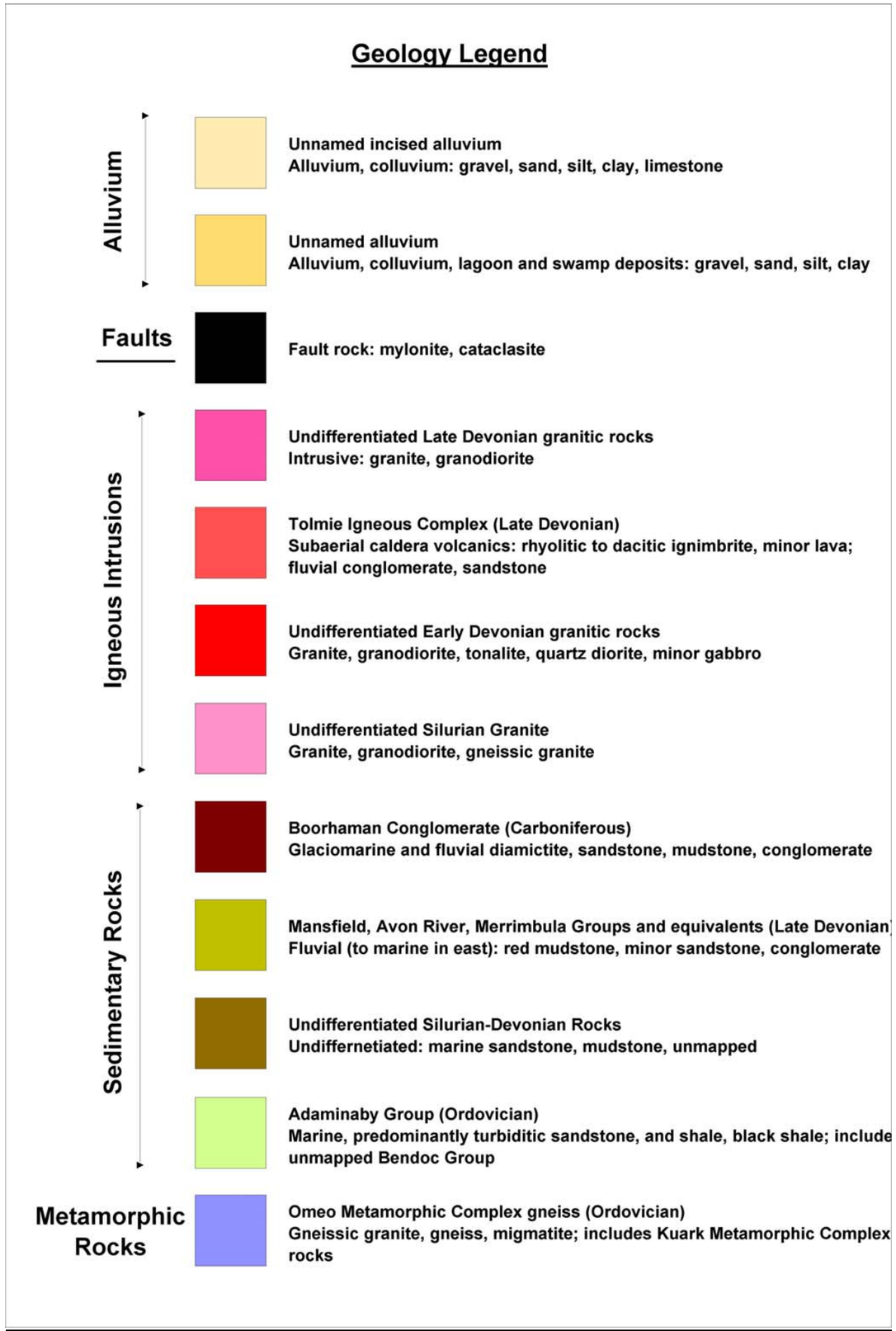
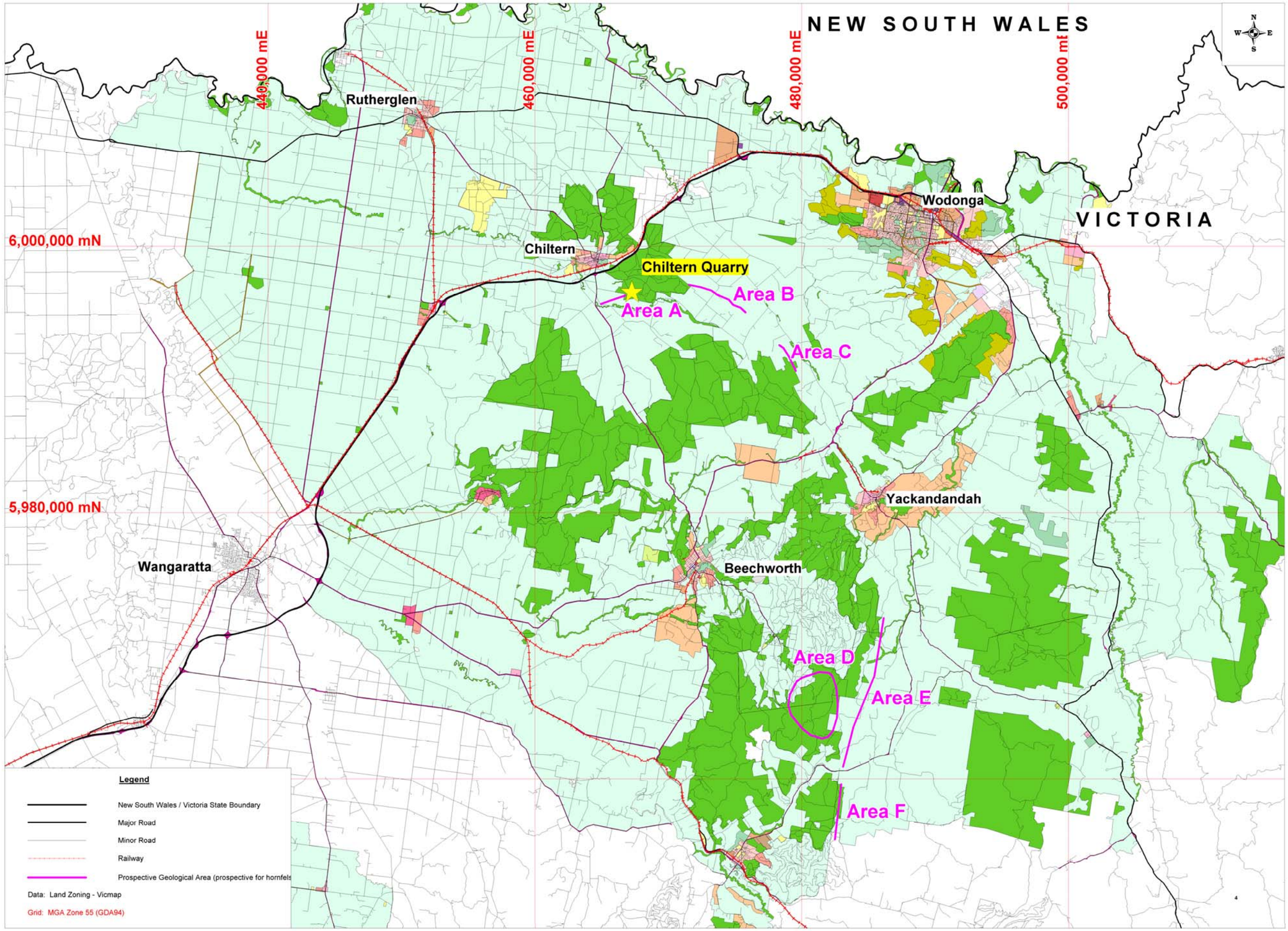

Geology Legend
Alluvium
Unnamed incised alluvium
Alluvium, colluvium: gravel, sand, silt, clay, limestone
Unnamed alluvium
Alluvium, colluvium, lagoon and swamp deposits: gravel, sand, silt, clay
Faults
Fault rock: mylonite, cataclasite
Igneous Intrusions
Undifferentiated Late Devonian granitic rocks
Intrusive: granite, granodiorite
Tolmie Igneous Complex (Late Devonian)
Subaerial caldera volcanics: rhyolitic to dacitic ignimbrite, minor lava;
fluvial conglomerate, sandstone
Undifferentiated Early Devonian granitic rocks
Granite, granodiorite, tonalite, quartz diorite, minor gabbro
Undifferentiated Silurian Granite
Granite, granodiorite, gneissic granite
Sedimentary Rocks
Boorhaman Conglomerate (Carboniferous)
Glaciomarine and fluvial diamictite, sandstone, mudstone, conglomerate
Mansfield, Avon River, Merrimbula Groups and equivalents (Late Devonian)
Fluvial (to marine in east): red mudstone, minor sandstone, conglomerate
Undifferentiated Silurian-Devonian Rocks
Undiffernetiated: marine sandstone, mudstone, unmapped
Adaminaby Group (Ordovician)
Marine, predominantly turbiditic sandstone, and shale, black shale; include
unmapped Bendoc Group
Metamorphic Rocks
Omeo Metamorphic Complex gneiss (Ordovician)
Gneissic granite, gneiss, migmatite; includes Kuark Metamorphic Complex
rocks

Figure 6 – Prospective Geological Environments with respect to Planning Scheme Zones **(Planning Legend on Page 30)**




Legend
Planning Scheme Zones
Business Zone
B1Z
B2Z
B3Z
B4Z
B5Z
Comprehensive Development Zone
CDZ1
Environmental Rural Zone
ERZ
Green Wedge Zone
GWZ; GWZ1, 2, 3, 4, 5
Green Wedge A Zone
GWAZ1, 2, 4, 5, 6
Industrial Zone
IN1Z
IN2Z
IN3Z
Low Density Residential Zone
LDRZ
Mixed Use Zone
MUZ
Public Park and Recreation Zone
PPRZ
Public Conservation and Resource Zone
PCRZ
Public Use Zone
PUZ1, 2, 3, 5, 6, 7
PUZ4
Residential Zone
R1Z
R2Z
Rural Conservation Zone
RCZ; RCZ1, 2, 3
Road Zone
RDZ1
RDZ2
Rural Living Zone
RLZ; RLZ2
Rural Zone
RUZ; RUZ1, 4, 6
Special Use Zone
SUZ1, 2, 3, 4
Township Zone
TZ
Urban Floodway Zone
UFZ
Denotes Extractive Industries Prohibited

Figure 7 – Prospective Geological Environments with respect to Planning Overlays

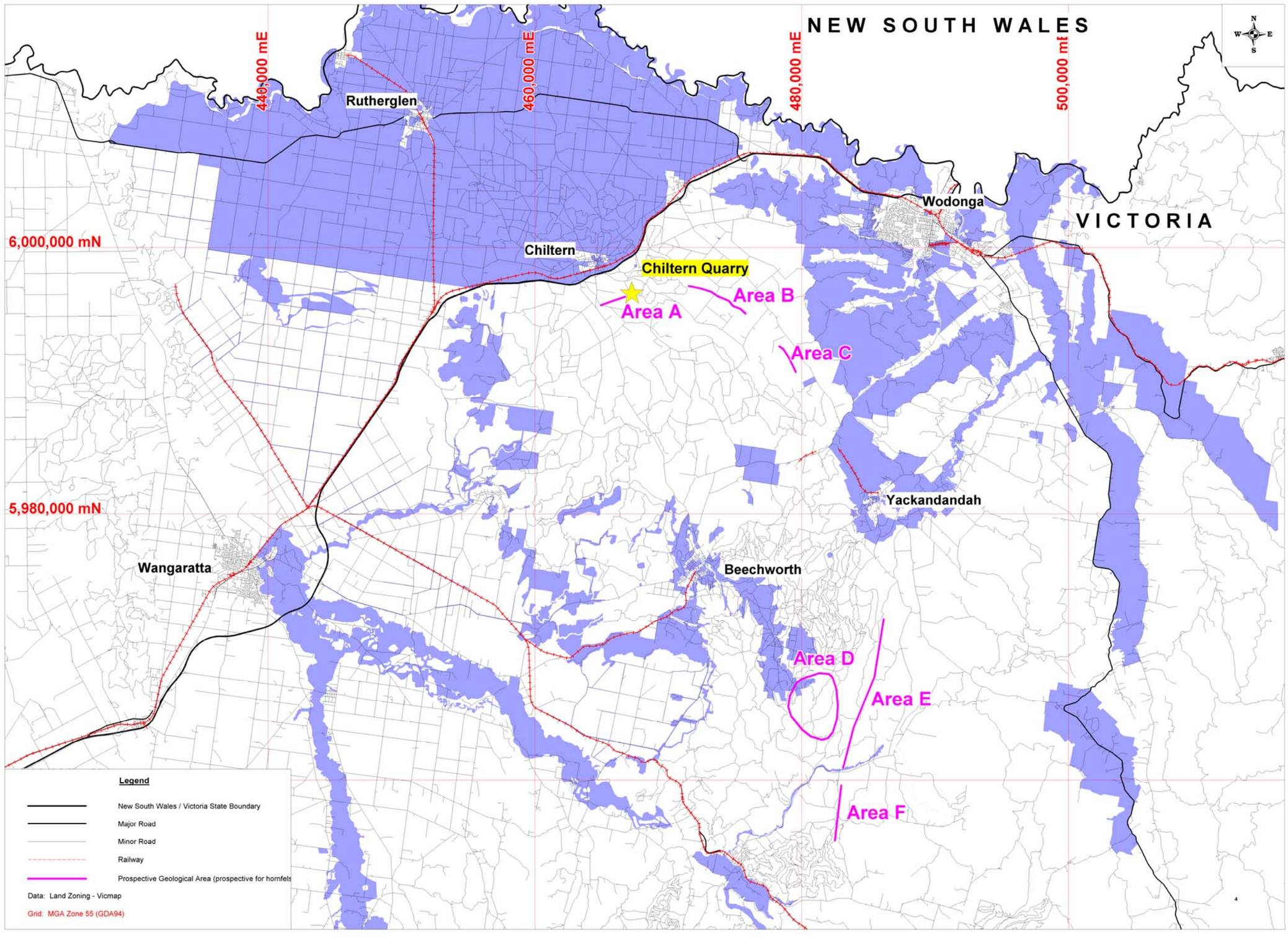


Figure 8 – Prospective Geological Environments with respect to Areas of Medium to High Density Vegetation Cover

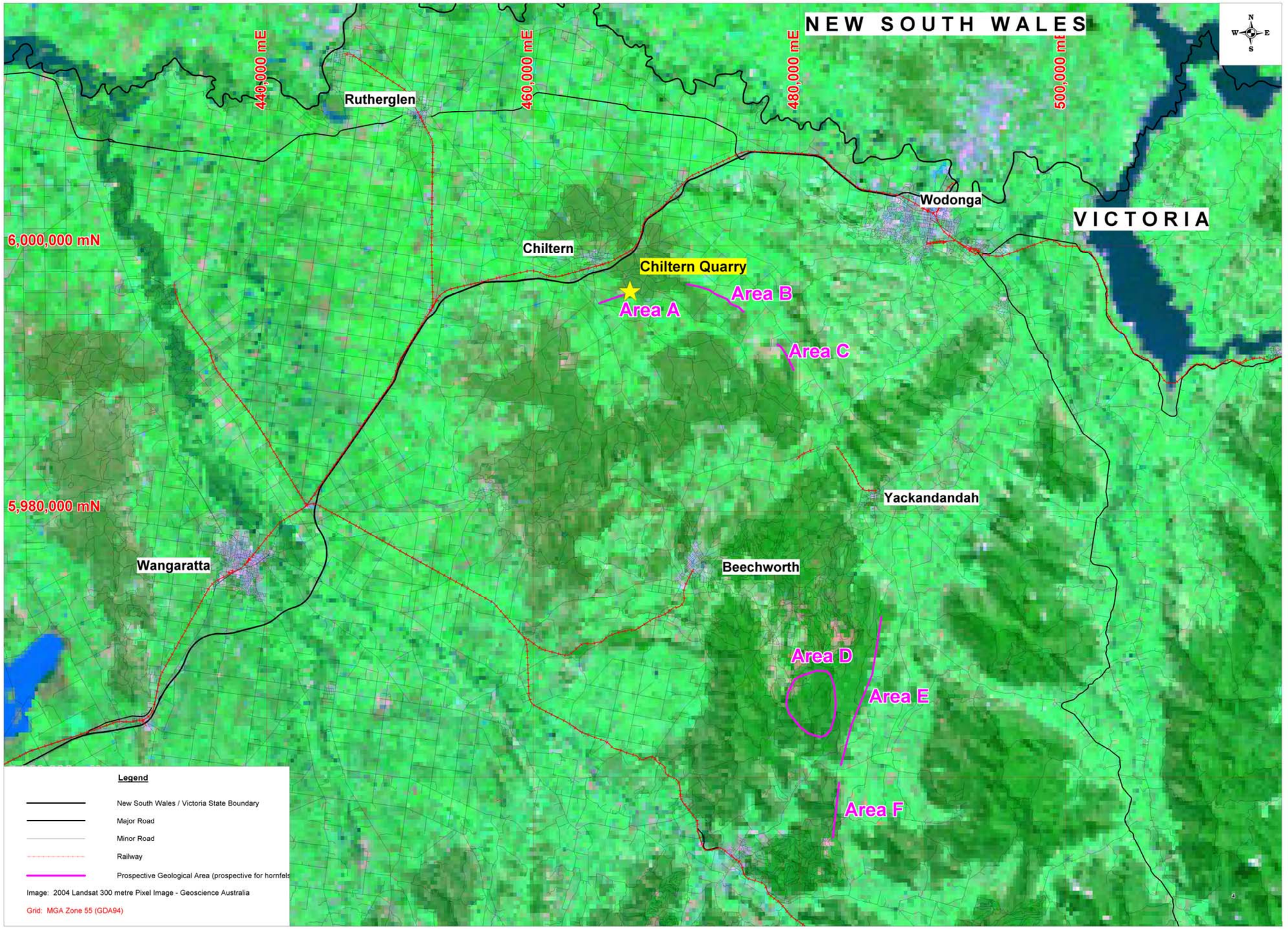


Figure 9 – Land Ownership for Areas A to C

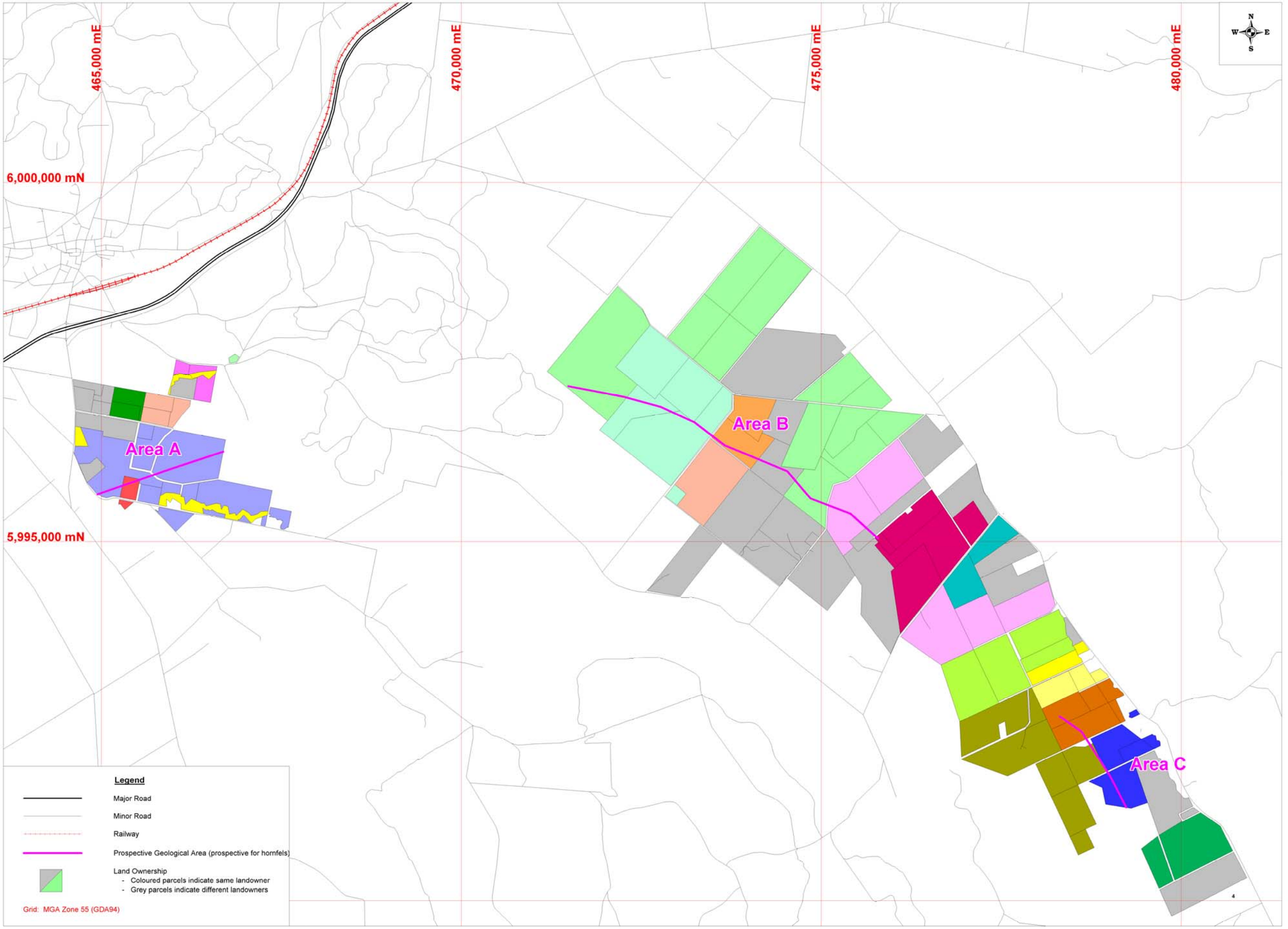
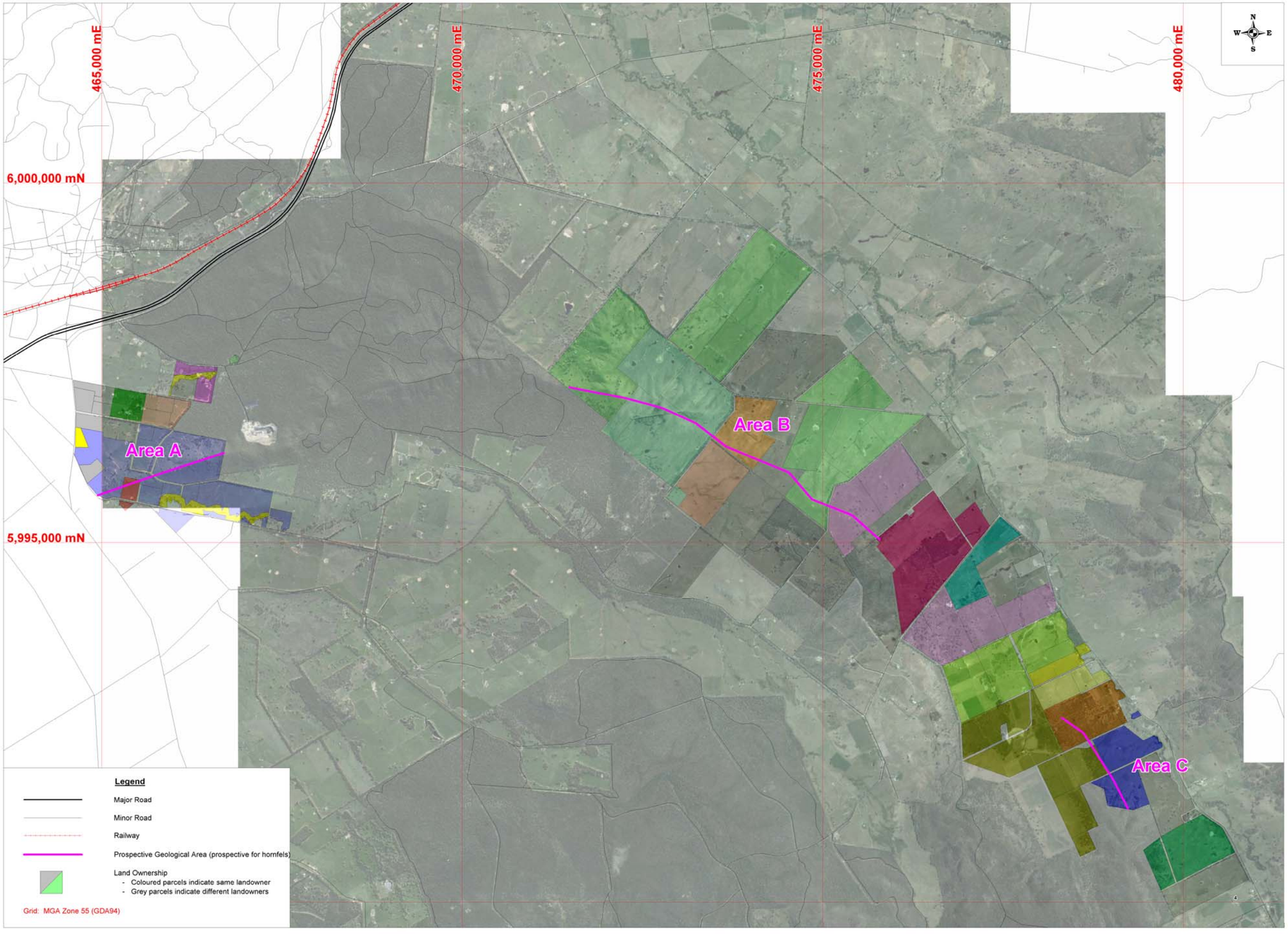


Figure 10 – Aerial Photography for Areas A to C


465,000 mE
470,000 mE
475,000 mE
480,000 mE
6,000,000 mN
5,995,000 mN
N
W
E
S
Area A
Area B
Area C
Legend
Major Road
Minor Road
Railway
Prospective Geological Area (prospective for hornfels)
Land Ownership
- Coloured parcels indicate same landowner
- Grey parcels indicate different landowners
Grid: MGA Zone 55 (GDA94)