



ABN: 89 124 780 276

Revised Preliminary Environmental Assessment

FOR THE

Kempfield Silver Project

October 2012

Prepared by:



R.W. CORKERY & CO. PTY. LIMITED

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MINERALS LIMITED

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Kempfield Silver Project

Revised Preliminary Environmental Assessment

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1. INTRODUCTION

1.1 SCOPE

Argent (Kempfield) Pty Ltd (“the Applicant”) proposes to construct and operate the Kempfield Silver Project (“the Project”) located approximately 7km west-northwest of Trunkey (referred to locally as Trunkey Creek) and 56km southwest of Bathurst (**Figure 1**). The Project would consist of two open cut complexes, a processing plant, a waste rock emplacement, a heap leach pad and associated infrastructure.

The Project is classified as a “State Significant Development” (SSD) under the *State Environmental Planning Policy (State and Regional Development) 2011* (State and Regional Development SEPP).

This *Revised Preliminary Environmental Assessment* has been prepared by R.W. Corkery & Co. Pty. Limited in support of an application by the Applicant for Development Consent for the Project. An initial *Preliminary Environmental Assessment* was prepared in October 2011 describing the Project as it was then understood. However, following further assessment during 2012, the Project was substantially redesigned. As a result, this document introduces the revised Project and provides information on the key environmental issues to be addressed in the design and assessment of the Project. The information provided will ultimately be incorporated into a comprehensive *Environmental Impact Statement* (EIS), to be prepared in accordance with the requirements of Division 4.1 in Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

This document has been prepared for circulation to the Department of Planning and Infrastructure, other relevant State government agencies, Bathurst Regional Council and the local community.

1.2 THE APPLICANT

The Applicant, Argent (Kempfield) Pty Ltd, is a subsidiary company of Argent Minerals Limited (Argent), which is a company listed on the Australian Stock Exchange. It has a portfolio of exploration assets in New South Wales, with the principal one being its Kempfield property near Trunkey Creek. Argent intends to become a significant producer of silver from this Project with additional by-product credits from lead, zinc and minor quantities of gold.

Argent is controlled by a board of four directors with significance experience in exploring and developing minerals projects in Australia and overseas

1.3 PROJECT SITE

The Project Site comprises an area of approximately 1437ha and incorporates all areas of Project-related activities. **Table 1** and **Figure 2** present land titles within the Project Site.



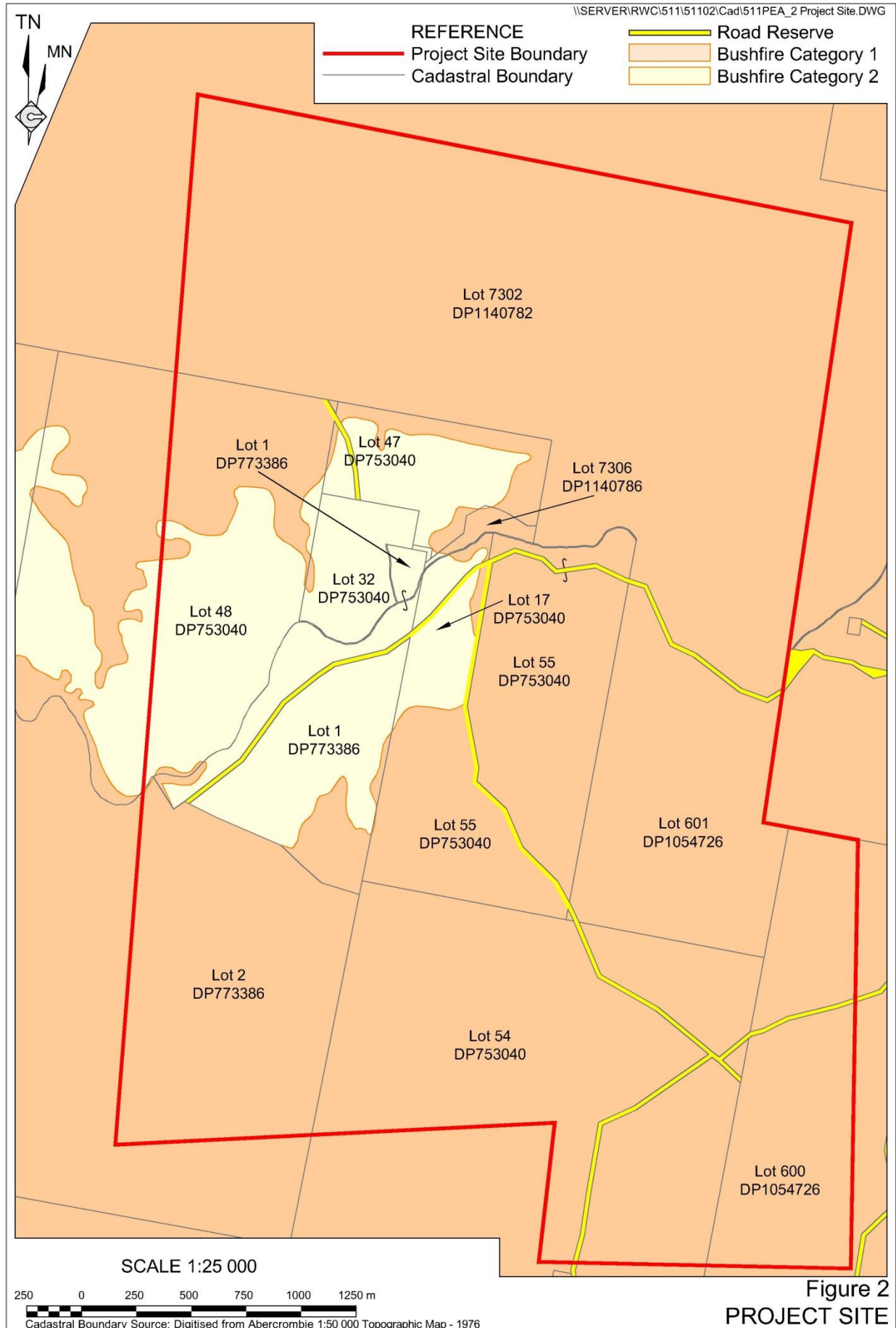


Table 1
Project Site

Lot	DP	Lot	DP
17	753040	Part 600	1054726
32	753040	601	1054726
47	753040	1	773386
Part 48	753040	Part 2	773386
Part 54	753040	Part 7302	1140782
55	753040	7306	1140786

Source: Land and Property Information Authority

1.4 MANAGEMENT OF INVESTIGATIONS

The preparation of this document has been undertaken by Mr Mitchell Bland (B.Sc(Hons), MEcon Geol, LLB (Hons)), Principal Environmental Consultant and Ms Kay Oxley (BSc Applied Science, M Env Sc), Senior Environmental Consultant, both with R. W. Corkery & Co Pty. Limited.

Professional staff within Argent (Kempfield) Pty Ltd assisted with the preparation of this document including, but was not limited to:

- Mr David Busch (B Eng, B.Sc, MAusIMM) – Managing Director;
- Mr Kerry McHugh (B.Com (Hons)) – Chairman;
- Mr Derek White (BE (Mining)(UofQ), FAusIMM, CP (Man)) – Project Manager; and
- Mr Brian Horspool (BEng(Elect)(Hons)(NSWIT), GradDipEd(Tech)(ITATE) – Site Manager.

The following specialist consultancies have been commissioned to undertake an initial assessment of the existing environment and identify potential constraints for the Project. A summary of the results of those initial assessments is presented Section 6 of this document.

- Flora – Anne Clements & Associates Pty Limited.
 - Dr Anne Clements (M Sc.Ph.D).
- Fauna – Biodiversity Monitoring Services.
 - Dr Martin Denny (BSc (Hons) PhD FRZS).
- Aquatic Ecology – Cardno.
 - Dr Peggy O'Donnell (PhD BSc BA)
- Heritage – OzArk Environmental & Heritage Management Pty Ltd.
 - Dr Jodie Benton (BA (Hons) PhD).
- Noise and blasting – Spectrum Acoustics,
 - Mr Neil Pennington (PhD, B.Sc (Physics), B.Math (Hons)).



- Air quality and greenhouse gasses – Environ Australia Pty Ltd.
 - Mr Scott Fishwick (BSc (Atmospheric Science)).
- Surface and Groundwater – Aquaterra.
 - Ms Katarina David (BSc (Hons) Geology, MSc (Hydrogeology)) and Mr Nathan Heinrich ((BEng (Ag, 1st Hons) MIEAust, CPEng, RPEQ, CID))
- Soils and land capability – Geoff Cunningham Natural Resources Consultants Pty Ltd.
 - Mr Geoff Cunningham (BSc Agr (Hons)).
- Traffic and transportation – Traffic Solutions.
 - Mr Chris Hazell (Assoc.Dip.Eng).

2. BACKGROUND TO THE PROJECT

2.1 MINERAL AUTHORITIES

Table 2 presents the mineral authorities held by the Applicant and related companies in relation to the Project. **Figure 1** presents the relevant Exploration Licences.

Table 2
Mineral Authorities

Mineral Authority ¹ (Mining Act)	Holder / Applicant ¹	Application Date	Grant Date	Expiry Date
EL 5748 (1992)	Argent Minerals		28-06-2000	Renewal Pending
EL 5645 (1992)	Argent Minerals		22-11-1999	Renewal Pending
EL 7134 (1992)	Argent Minerals		30-04-2008	Renewal Pending
EL 7785 (1992)	Argent Minerals		16-06-2011	Renewal Pending
PLL 519 (1924)	Argent Minerals		27-02-1940	27-02-2023
PLL 517 (1924)	Argent Minerals		27-02-1940	27-02-2023
PLL 727 (1924)	Argent Minerals		05-03-1946	27-02-2023
PLL 728 (1924)	Argent Minerals		05-03-1946	27-02-2023
ALA 41 (1992)	Argent Kempfield	24-04-2007		
MLA 418 (1992)	Argent Kempfield	24-12-2012		
ELA 4382 (1992)	Argent Kempfield	16-09-2011		
ELA 4529 (1992)	Argent Kempfield	18-04-2012		
ELA 4625 (1992)	Argent Kempfield	26-07-2012		
Note 1: Argent Kempfield = Argent (Kempfield) Pty Ltd Argent Minerals = Argent Minerals Limited EL = Exploration Licence PLL = Private Lands Lease ALA = Assessment Lease Application MLA = Mining Lease Application ELA = Exploration Licence Application				
Source: Argent Minerals Limited				



2.2 GEOLOGY, PREVIOUS MINING AND EXPLORATION AND RESERVES

2.2.1 Regional Geology

The Kempfield deposit is located in the eastern province of the Lachlan Fold Belt, which is dominated by mafic to felsic volcanic rocks and thick turbidite successions of Ordovician to Devonian Age (Glen, 1998; Glen *et al.*, 1995; Glen, 2002) (**Figure 3**). During the mid-Silurian to Middle Devonian time, a number of north-trending, back-arc rift basins formed in the eastern Lachlan Fold Belt, as a result of crustal extension (Glen, 2002). Depositional sequences in these back-arc basins are characterised by quartz-rich turbidites, felsic and mafic volcanic rocks, volcanoclastic rocks and black shales.

Within the back-arc basin that hosts the Kempfield deposit, namely the Hill End Trough, a range of volcanic-hosted massive sulphide deposits, including the Kempfield deposit were formed (**Figure 3**).

Undifferentiated sedimentary rocks of the Mid to Upper Silurian Campbells Group dominate the southern section of the Hill End Trough. This group comprises the Kangaloolah Volcanics, which consist of rhyolitic and dacitic volcanic rocks, and feldspathic sandstone and siltstone. The Kangaloolah Volcanics host the barite–base metal mineralisation at Kempfield.

Further south, in the Peelwood area, a number of base metal deposits (John Fardy, Peelwood and Cordillera, Elsinora) occur on the contact between the undifferentiated feldspathic sandstone, siltstone and slate of the Campbells Group, and the felsic volcanoclastic rocks of the Kangaloolah Volcanics.

2.2.2 Local and Project Site Geology

In the vicinity of the Project Site, the oldest rocks are of Ordovician age and belong to the Combing Formation, which comprise tremolite schists, biotite hornfels, a porphyritic andesite and black carbonaceous slate (**Figure 4**). Overlying these rocks are the Kangaloolah Volcanics, a felsic volcanic-derived sequence of sediments and minor volcanics which can be sub-divided into three units, namely:

- a sequence of fine-grained and quartz-phyric tuffaceous rocks, in a faulted contact with;
- volcanoclastic sedimentary rocks, which host silver-barite and lead-zinc mineralisation and grade up into;
- unaltered barren siltstone.

The mineralised volcanoclastic sedimentary unit comprises poorly sorted, graded sandstones and grits with subangular to angular grains, locally with well-rounded pebble conglomerates as well as primary tuffs. The unit is interpreted to be submarine, immature, reworked felsic ash tuffs, probably located proximal to their erosional source. Textures characteristic of submarine debris flows are common.

Mineralisation is hosted in stratabound barite-rich horizons which are interpreted to have been folded, faulted and weakly metamorphosed. Apparent repetitions of geological horizons may be due to deformation and/or the presence of multiple mineralised layers within the original sequence. An array of northwest-trending faults offset the mineralised sequences.

The mineralised barite-rich horizons occur near the upper boundary of the volcanoclastic sedimentary rocks and unaltered siltstone and can be traced over three kilometres of strike length (**Figure 4**).



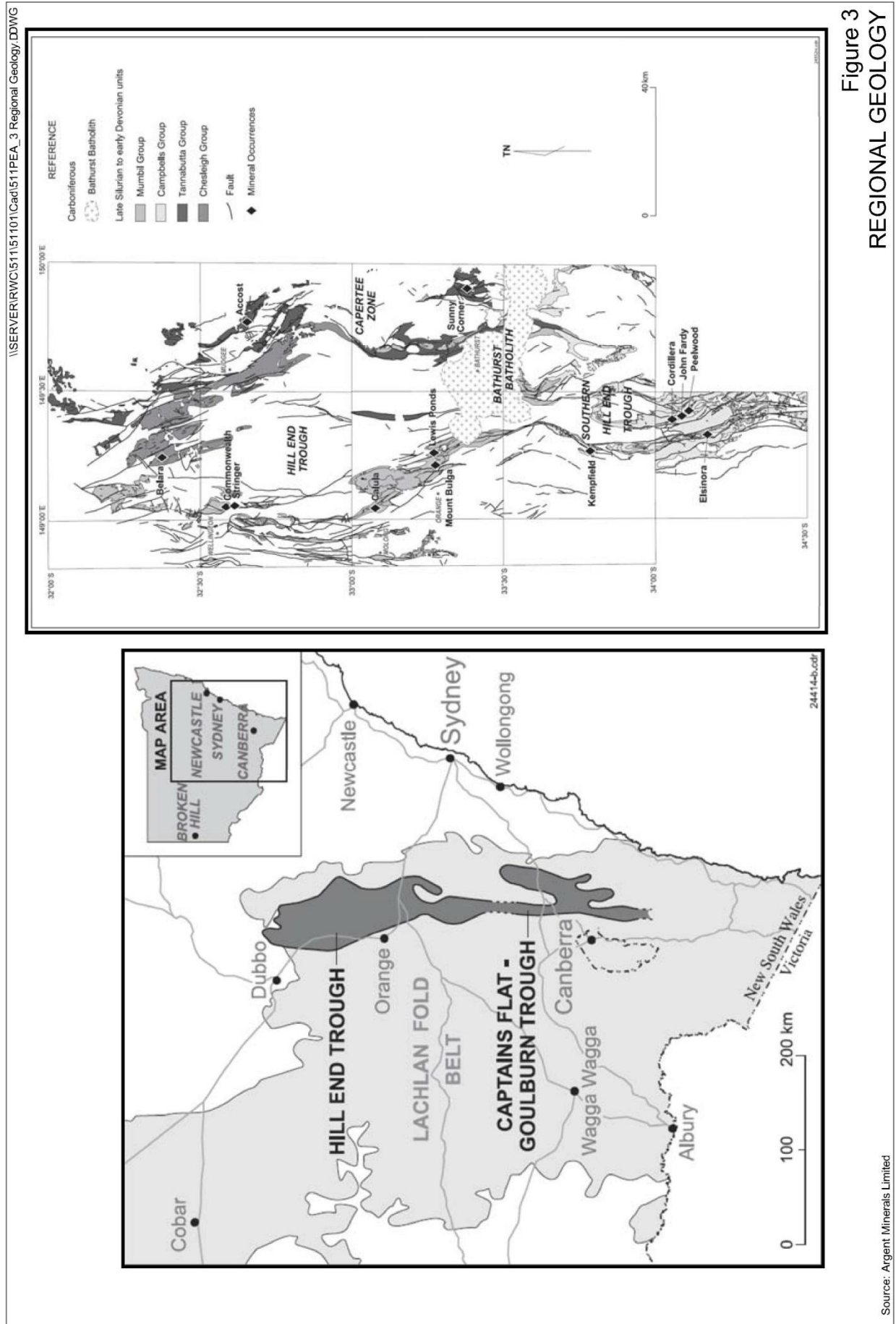
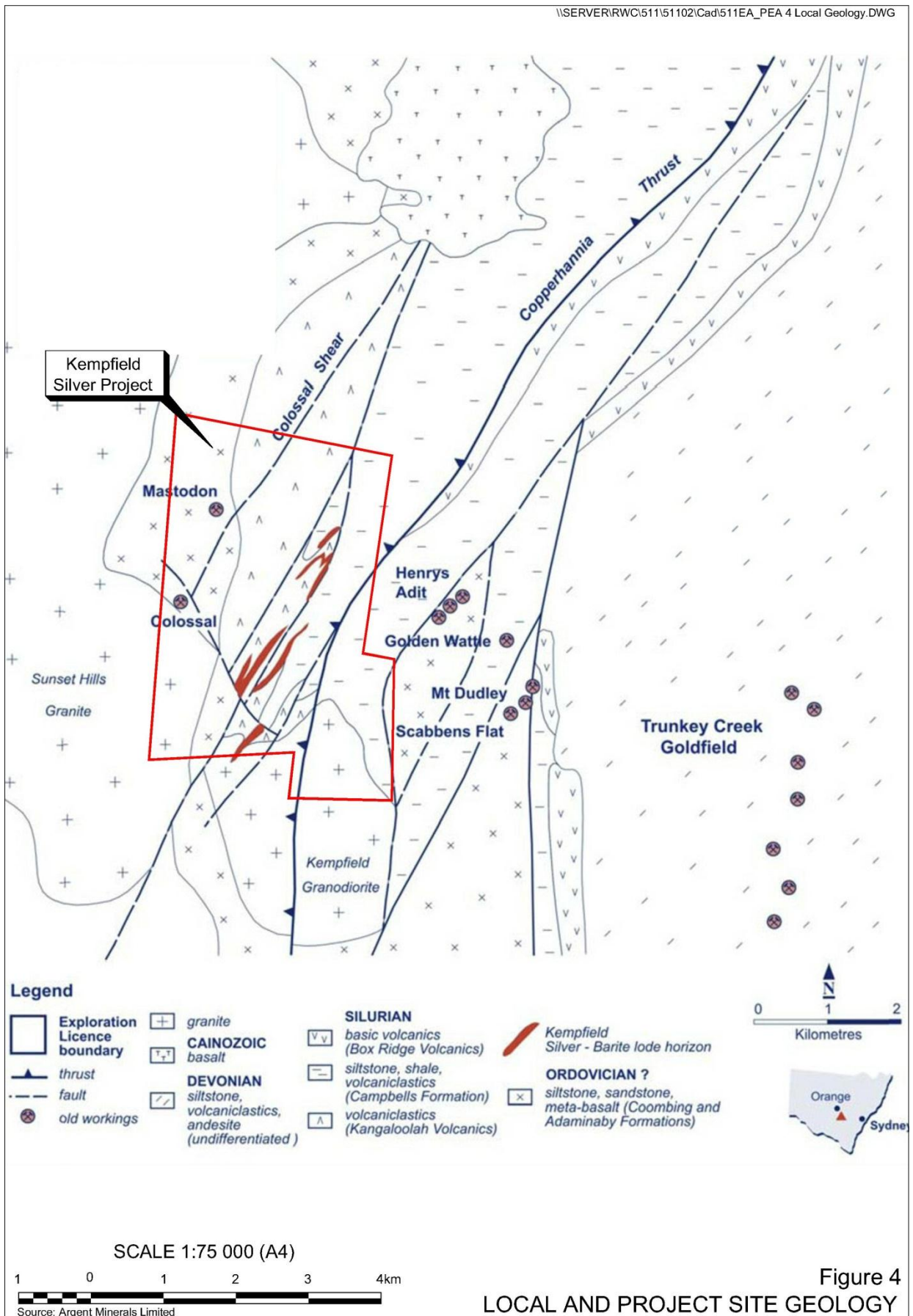


Figure 3
 REGIONAL GEOLOGY





The geology, alteration and mineral assemblage is consistent with the distal portion of a volcanic-associated base metal sulphide deposit (Shell, 1984), with the volcanic-volcanoclastic rock being fragmented and subsequently hydrothermally altered, with replacement by feldspar, mica, quartz, barite, rutile, sphalerite and pyrite (Ashley, 2009). Minor barite also occurs as thin veins, disseminations and more substantial aggregates.

2.2.3 Historic Mining Operations

The Kempfield area was mined at the turn of the century for alluvial gold from terraces overlying and adjacent to the current silver-barite resources. Small-scale barite mining first commenced in 1918 and up to recently, several small open cuts located on the northern boundary of the Project Area, were mined intermittently producing up to 1 500 tonnes per annum.

2.2.4 Previous Exploration Operations

Modern exploration operations commenced in 1971, with the NSW Geological Survey undertaking geological mapping and geochemical studies. A range of companies undertook exploration within and surrounding the Project Site during the 1970s, 1980s and early 1990s identifying the BJ and Quarries deposits.

In 1998, the Applicant's then joint venture partner, Golden Cross Resources, commenced exploration operations within and surrounding the Project Site, identifying the McCarron Zone deposit. Following this, the resources were expanded in other zones through drilling in conjunction with metallurgical test work, regional and detailed geological mapping and geochemical sampling.

Since the Applicant commenced management of the Project, a more comprehensive exploration strategy has been implemented, including a range of geophysical programs and several drilling programs. These programs have resulted in an 80% increase in resources within the Project Site.

2.2.5 Project Site Mineralisation

Mineralisation within the Project Site is located within and in proximity to barite zones striking north-northeast. The barite zones, as well as the associated mineralised zones, dip approximately 70° to the west.

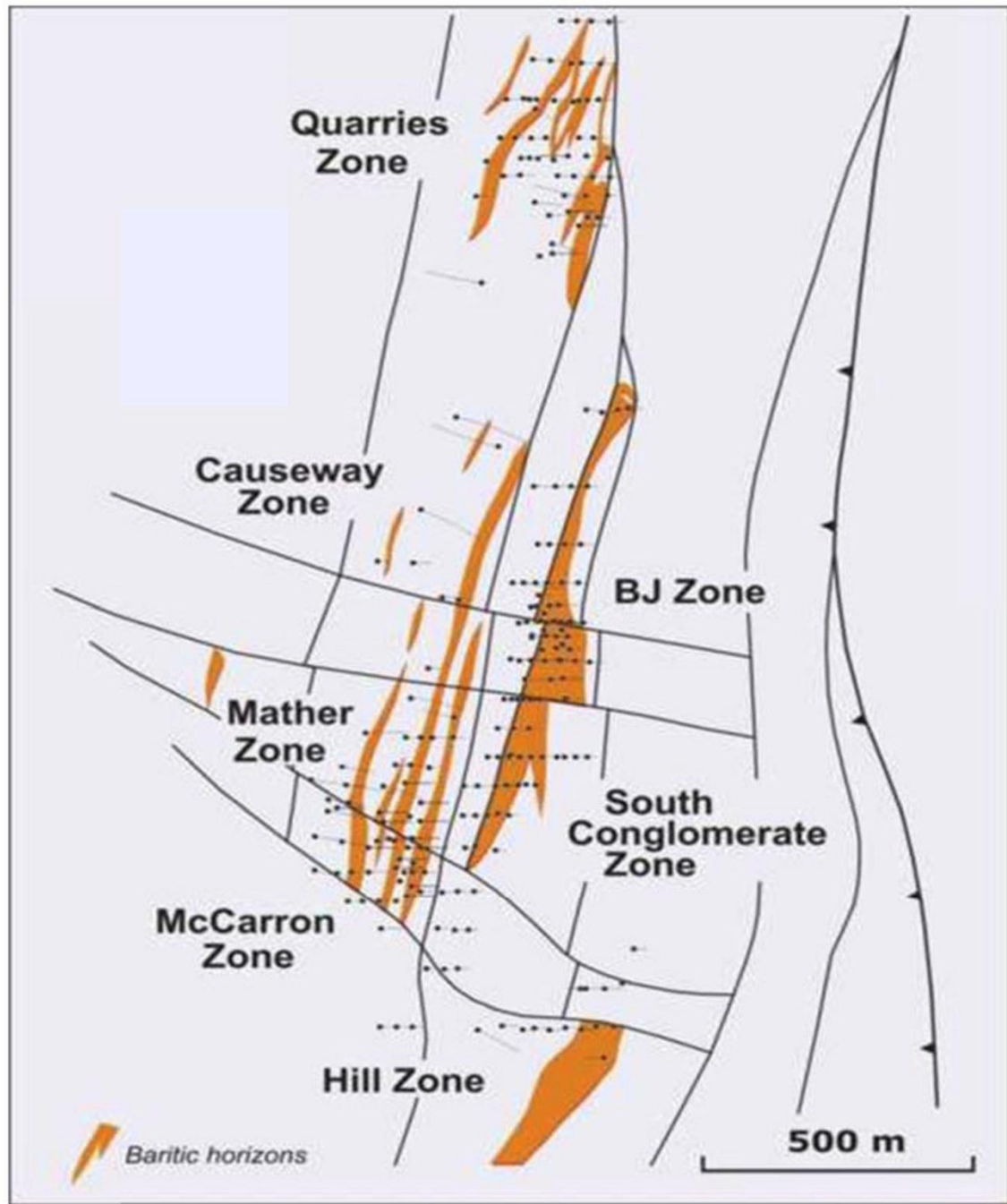
A range of mineralised zones have been identified within and surrounding the Project Site (**Figure 5**). However, four zones are of particular significance, namely the BJ, McCarron, South Conglomerate and Quarries zones. The Quarries zone is the most northerly of the three, and has a strike length of approximately 500m. BJ is the largest zone with a strike length of approximately 400m, with a smaller mineralised zone, BJ South, extending approximately 250m southwest of the BJ zone. The McCarron zone has a strike length of approximately 600m and overlaps the BJ South mineralisation to the west.

In general, the upper sections of the mineralised zones have reduced concentrations of lead and zinc, principally occurring as galena and sphalerite, with these lead and zinc concentrations increasing with depth. Silver occurs as native silver, argentite, chlorargyrite, silver sulphides and as a minor component of galena.

Higher grades of silver are generally encountered at or near the base of oxidation, but potentially economic silver grades occur throughout most of the ore zones.



\\SERVER\RWC\511\51101\Cad\511PEA_5 Mineralisation.DWG



SCALE 1:12 500



Source: Argent Minerals Limited

Figure 5
PROJECT SITE MINERALISATION



2.2.6 Resources

Resource estimates for the BJ and McCarron and Quarries deposits have been prepared by Hellman & Schofield with input from the Applicant's consulting geologists in accordance with the requirements of the Joint Ore Reserve Committee. **Table 3** presents the results of the latest of those estimates.

Table 3
Resource Estimate¹

	Tonnes (million)	Grade (g/t)		Grade (%)	
		Silver	Gold	Lead	Zinc
Oxide and Mixed					
Measured	2.7	68	0.11	-	-
Indicated	2.7	47	0.11	-	-
Inferred	0.6	39	0.08	-	-
Primary					
Measured	4.1	57	0.12	0.66	1.2
Indicated	8.4	41	0.13	0.58	1.2
Inferred	3.2	35	0.13	0.66	1.4
Note 1: 50 g/t Silver Equivalent Cutoff Grade.					
This Resource is only reported in Resource tonnes and contained metal (ounces of silver and gold, and tonnes for lead and zinc). A silver equivalent was not employed for the oxide/transitional material estimation and was based on a 25 g/t silver only cutoff grade. The Resource estimate for the Primary material was based on a silver equivalent cutoff grade of 50g/t and was based on the following assumptions made by Argent:					
Based on metallurgical testing to date, Argent is of the opinion that silver and gold recoveries will be 80%, and recoverable and payable lead and zinc at 55% of the head grade. Argent is also of the opinion that this is consistent with current industry practice. These metallurgical recoveries were included in the calculation of silver equivalent cutoff grades used for reporting of mineral resources.					
Source: Argent Minerals Limited					

3. APPROVALS REQUIRED

The Applicant anticipates that the following approvals will be required for the Kempfield Silver Project.

- Development consent – Minister for Planning and Infrastructure (or their delegate).

Development consent will be required from the Minister for Planning and Infrastructure for the Project under Division 4.1 Part 4 of the *Environmental Planning and Assessment Act 1979*.

- Environment Protection Licence - Environment Protection Authority.

An Environment Protection Licence for open cut mining operations, crushing and agglomerator operations and use of the heap leach pad will be required. It is anticipated that the Licence will also identify licensed discharge points, limits and concentrations.



- Mining Lease – Division of Resources and Energy (DRE) - Department of Trade and Investment and Regional Infrastructure and Services.

The Applicant has lodged a Mining Lease Application with DRE. As indicated in Section 2.2, the Applicant holds, or is in the process of acquiring, exploration licences over the entire Project Site.

- Water Access Licences – NSW Office of Water - Department of Primary Industries.

A Water Access Licence will be required under either the *Water Act 1912* or the *Water Management Act 2000* to permit dewatering of the proposed open cut mining operations. Additional Water Access Licence(s) may be required if extraction of water is more than the Harvestable Rights applicable for the area or to account for lost surface water flows as a result of drawdown of groundwater in the vicinity of Rocky Bridge Creek.

- A Section 138 Permit – Bathurst Regional Council.

A permit or deed under Section 138 of the *Roads Act 1993* may be required for the upgrade of any access road and intersection with local roads.

- Dam Safety Approval – NSW Dam Safety Committee

An approval from the NSW Dams Safety Committee would be required for the design and construction of the tailings storage facility.

- Explosives Storage and Use Licence – WorkCover Authority NSW

A Licence issued by the WorkCover Authority NSW for the storage and use of explosives will be granted only when Department of Trade and Investment, Regional Infrastructure and Services (DTIRIS) approves a Security Plan for the storage and handling of explosives (including explosive precursors).

In addition, if Development Consent is granted, subsequent approvals would be required in accordance with the *Mining Operations Plan* requirements of the *Mining Act 1992* and mining lease conditions.

4. PLANNING ISSUES

4.1 PERMISSIBILITY OF THE PROJECT

The Project Site occurs within the Bathurst Regional Local Government Area and permissibility of development is governed by the *Bathurst Regional (Interim) Local Environmental Plan 2005* (“Bathurst LEP”).

Under the Bathurst LEP, the Project Site is zoned Zone No 1(e) Outer Rural Zone. Clause 6 of the Bathurst LEP identifies that the objectives of Zone No 1(e) as follows:

- “To support and maintain the continued viability of agricultural development in rural lands located in the outer rural areas of the local government area of Bathurst Regional;*
- To enable the carrying out of development that is appropriate for broad acre productive land used for grazing and cropping;*



- c) *To protect and conserve the scenic environment by controlling the location of buildings and materials used, particularly in respect of development adjacent to a major road or located within a scenic protection area or within an identified remnant bushland area; and*
- d) *To protect and conserve valuable deposits of minerals, coal, petroleum and extractive materials by controlling the location of development to enable the efficient extraction of those deposits.”*

In addition, Clause 22 of the Bathurst LEP identifies that development within any land identified as being bushfire prone land can only be carried out with consent. The Project Site is identified as Category 2 (medium risk) and Category 1 (low risk) on the Bushfire Prone Map (**Figure 2**). The Applicant notes that the Project would be constructed in accordance with the document *Planning for Bush Fire Protection* published by the NSW Rural Fire Service in 2006.

In light of the above, mining is permissible with consent under the Bathurst LEP.

4.2 CONSIDERATIONS OF STATE PLANNING INSTRUMENTS

4.2.1 State Environmental Planning Policy (State and Regional Development) 2011.

As indicated in Section 5.13, the anticipated capital cost for the Project is approximately A\$ 60 million. As a result the Applicant anticipates that the Project will be declared to be a “State Significant Development” under Clause 9 of Schedule 1 of the by *State Environmental Planning Policy (State and Regional Development) 2011*.

4.2.2 State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

The *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (Mining SEPP) was gazetted on 17 February 2007 and specifies matters requiring consideration in the assessment of any mining-related development. These matters include the following:

- the compatibility of the proposed mine with surrounding land uses;
- the compatibility of the proposed development with other mining, petroleum production or extractive industry;
- potential impacts on issues associated with natural resource management and environmental management;
- the efficiency of resource recovery and minimisation of the creation of waste;
- consideration of alternative means of product transportation other than by road and that a code of conduct for the transport of materials on public roads is prepared; and
- consideration of rehabilitation of the land affected by the development.

An assessment of how each of these considerations is addressed will be provided within the *Environmental Impact Statement*.



4.2.3 State Environmental Planning Policy (Infrastructure) 2007

The *State Environmental Planning Policy (Infrastructure) 2007* (Infrastructure SEPP) identifies, amongst other things, the matters to be considered in the assessment of development adjacent to particular types of infrastructure.

Clause 45 of the Infrastructure SEPP identifies that where development would be carried out within or immediately adjacent to an easement for electricity purposes, the determining authority must give written notice to the electricity supply, inviting comments about potential safety risks and take into consideration any response received. The Applicant notes that the Project may require the connection of an electricity transmission line. In addition, an upgrade of Colo Road would occur in close proximity to an existing electricity supply easement. As a result, the determining authority would be required to consult with Essential Energy in relation to the Project.

4.2.4 State Environmental Planning Policy No. 33 – Hazardous and Offensive Development

Hazardous and offensive industries, and potentially hazardous and offensive industries, relate to industries that, without the implementation of appropriate impact minimisation measures, would, or potentially would, pose a significant risk in relation to the locality, to human health, life or property, or to the biophysical environment. A risk screening of the project will be presented in the *Environmental Impact Statement* in accordance with the document entitled *Applying SEPP 33 2nd edition*, (DUAP, 1997).

4.2.5 State Environmental Planning Policy No. 44 – Koala Habitat Protection

The Bathurst Regional Local Government Area is identified in Schedule 1 of *State Environmental Planning Policy No 44 – Koala Habitat Protection* as an area that could provide habitat for Koalas. As required by that SEPP, an investigation to determine if the Project Site represents core or potential Koala habitat will be presented in the *Environmental Impact Statement*.

5. PROJECT DESCRIPTION

5.1 INTRODUCTION

This sub-section provides an introduction to the proposed activities associated with the Project. The information provided in this sub-section is preliminary and is provided to a level of detail that reflects the current understanding by the Applicant of the Project. It is acknowledged that details in relation to some aspects of the Project have yet to be determined and that, as additional studies are completed, including the environmental studies already commenced, certain aspects of the Project may be amended. As a result, the following description of the Project as it currently stands is provided to give the relevant government agencies and interested members of the community in the vicinity of the Project Site an understanding of the likely scope and impacts of the proposed activities. This information may, however, vary in some limited respects from the final Project description provided in the *Environmental Impact Statement*.



5.2 OBJECTIVES

The objectives of the Applicant in the construction and operation of the Kempfield Silver Project include:

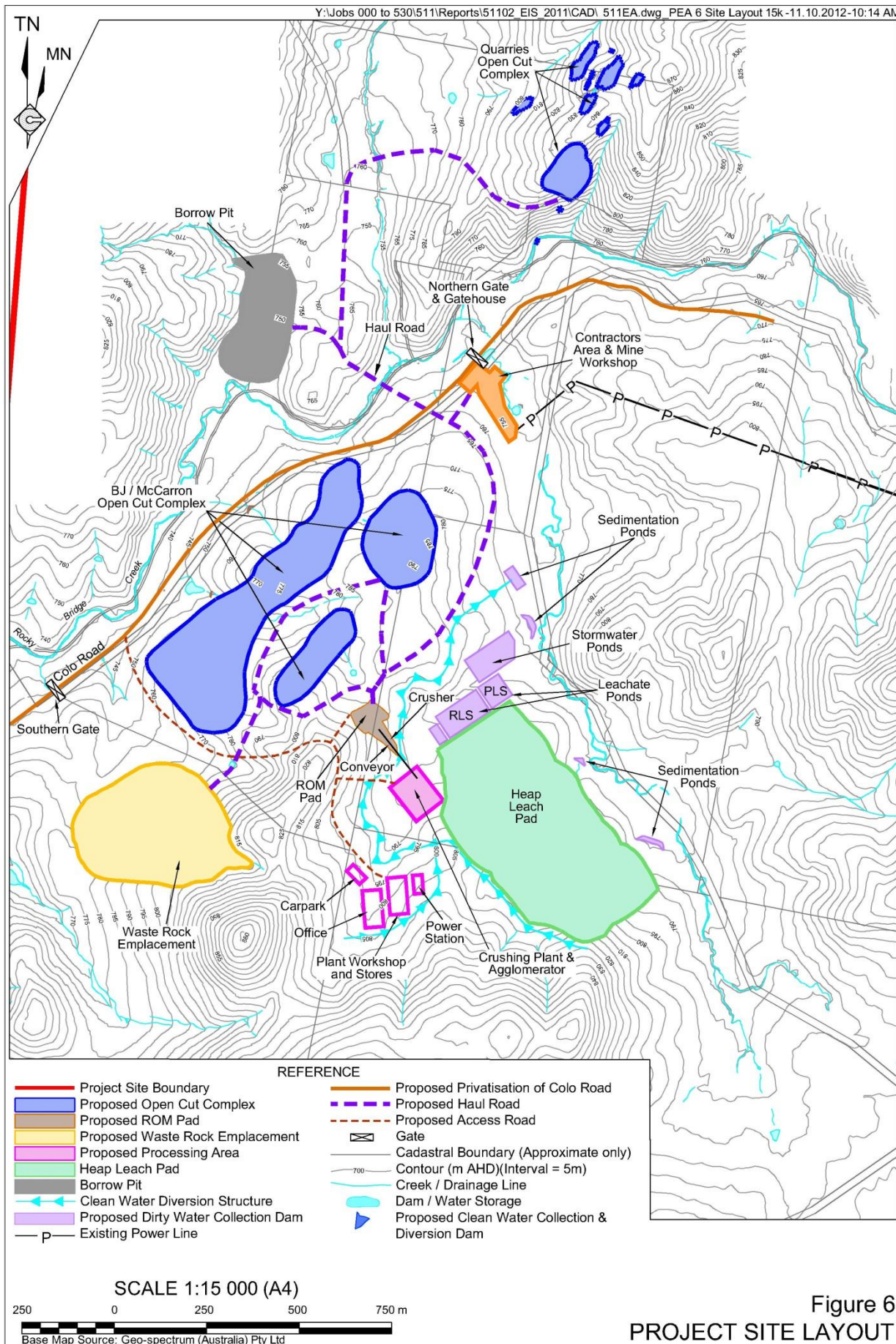
- to safely mine the economically extractable resources;
- to minimise surface disturbance and impacts on surrounding residents and the local environment during construction and operations;
- to continue to communicate and maintain transparent relationships with the relevant agencies and the community;
- to implement a level of management control and mitigation measures that ensures compliance with relevant statutory requirements and reasonable community expectations;
- to establish a facility that can process any additional economic mineral resources that may be identified within or in the vicinity of the Project Site;
- to create a final landform for a post-mining land use that would be determined in consultation with the relevant agencies and the local community and that could include a mixture of nature conservation and agriculture; and
- to achieve the above objectives in a cost-effective manner to ensure security of employment and the continued economic viability of the Applicant.

5.3 PROJECT OVERVIEW AND PROPOSED SITE LAYOUT

The Project would include the following components (**Figure 6**).

- Extraction of ore and waste rock from the Quarries and BJ / McCarron Open Cut Complexes using open cut mining methods.
- Construction and use of a processing plant and office area including a run-of-mine (ROM) pad, crushing plant and agglomerator, heap leach pad and associated precious metals recovery infrastructure, bullion room, site offices, workshops, power plant, laydown areas, ablution facilities, stores, car parking and associated infrastructure.
- Construction and use of a haul road system between the open cuts, the ROM Pad and the waste disposal areas.
- Construction of a waste rock emplacement.
- Construction and use of a water management system to ensure safe and effective control of water flows within the Project Site, and to provide sufficient water for production-related purposes.
- Construction and use of ancillary infrastructure required for production including internal roads, magazines, a communication tower and weather station, fuel store and refuelling facility, soil stockpiles, sediment and erosion control structures and water supply facilities.





- Construction and/or upgrading and use of a site access road and associated intersections to allow safe and convenient access.
- Construction and rehabilitation of a final landform that would be geotechnically stable and would provide a suitable final land use for nature conservation and agriculture.

5.4 INFRASTRUCTURE ESTABLISHMENT

5.4.1 Introduction

This sub-section provides an overview of the infrastructure that would be constructed or upgraded during the initial stages of the Project life, including:

- an access road and intersection (Section 5.4.2);
- Colo Road upgrade (Section 5.5.3)
- a power supply from the Essential Energy power grid north of Neville to the mine site or an alternative diesel powered electricity plant (Section 5.4.4); and
- operational water management structures (Section 5.4.5).

Construction of other infrastructure that would be required for the Project is described in subsequent sub-sections (see Sections 5.6 to 5.9).

5.4.2 Access Road and Intersection

The Applicant would construct an access road for light and heavy vehicles to the south of the BJ / McCarron Open Cut Complex and would permit access for non-mining vehicles to the infrastructure area from Colo Road (**Figure 6**).

The intersection of the access road and Colo Road would be constructed to a standard suitable for light and heavy vehicles turning left into and right out of the access road. Further details will be included in the *Environmental Impact Statement*.

5.4.3 Colo Road Upgrade

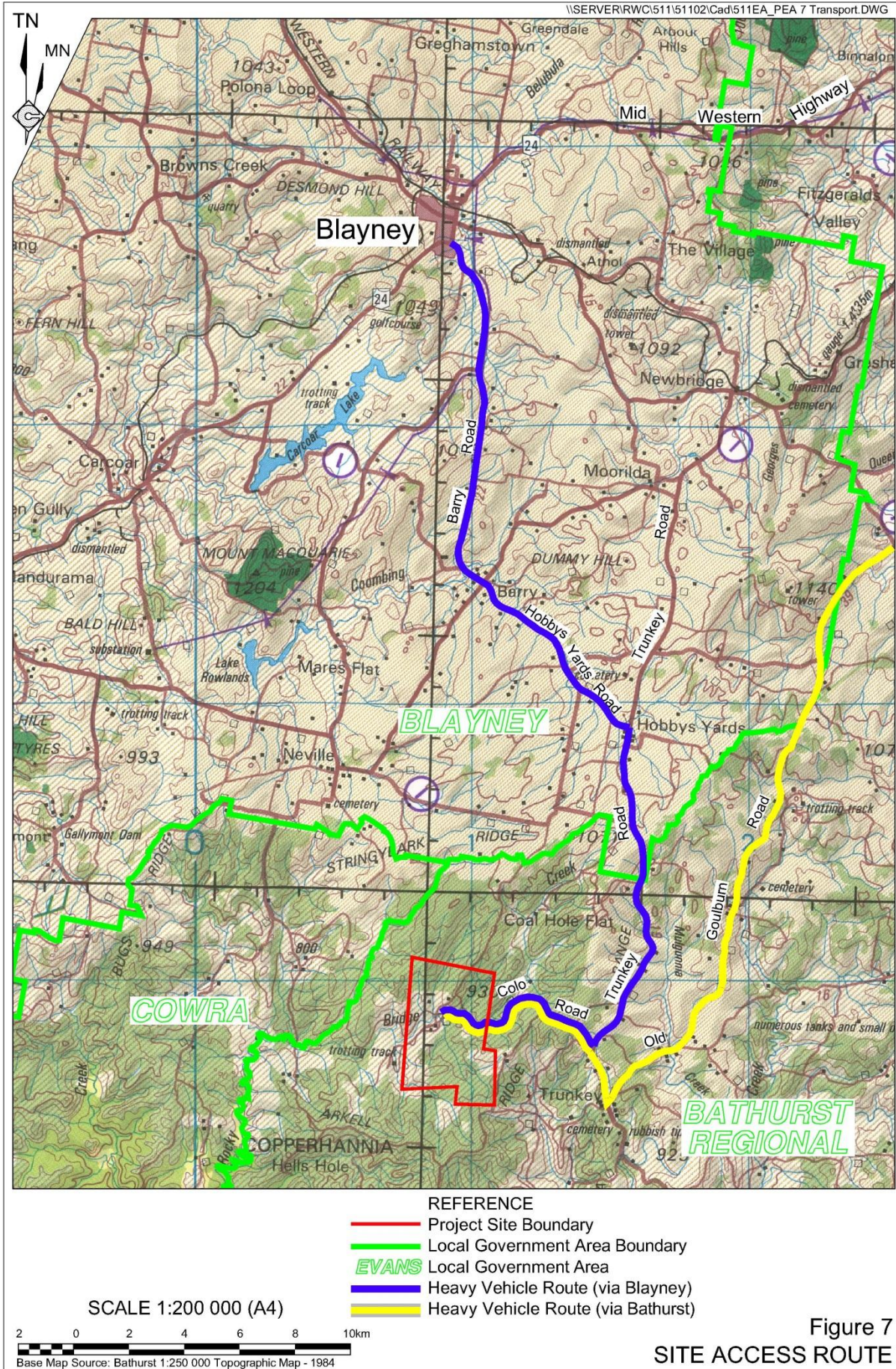
As Colo Road passes through the Project Site in close proximity to the mining-related infrastructure, the Applicant has commenced consultation with relevant landowners and Bathurst City Council to determine the preferred approach to upgrading and privatising a section of Colo Road.

Further details will be provided in the *Environmental Impact Statement*.

Notwithstanding the above, Colo Road will require realignment and upgrading to permit safe access for light and heavy vehicles to and from Trunkey Road (**Figure 7**). Further details in relation to the proposed realignment and upgrading of Colo Road, including the intersection with Trunkey Road, will be provided in the *Environmental Impact Statement*.

Any road-side drainage to be installed would be in accordance with the requirements of *Managing Urban Stormwater – Soils and Construction – Volume 2C Unsealed Roads* published by the Department of Environment and Climate Change in 2008.





Finally, it is noted roads within the vicinity of the Project Area are controlled by Bathurst Regional Council. Some roads that may be associated with heavy vehicle access to Blayney are under the control of Blayney Shire Council. The Applicant notes that works within the road reserves will require approval of and be undertaken in conjunction with the relevant road authority.

5.4.4 Power Supply

The Applicant anticipates that the Project would require up to 1 000MWh per month or around 12GWh per year. This electricity would be provided by a proposed 33kV transmission line from the Essential Energy's power grid north of Neville. That line would be approximately 22km long and the Applicant has commenced negotiations with Essential Energy and relevant landowners in relation to its construction. As this stage, it is anticipated that separate approval for construction and use of that line would be obtained from Essential Energy under Part 5 of the EP&A Act and therefore the proposed transmission line does not form a component of this application.

The proposed transmission line would terminate at a substation and transformer located adjacent to the processing plant. That transformer would reduce the voltage from 33kV to 415V for use within the Project Site. The substation and transformer would comply with Australian Standard AS2067 - *Switch Gear Assemblies and Ancillary Equipment for Alternating Voltages above 1kV*, and would be enclosed within a 2.5m high security fence with appropriate signage.

Alternatively, during the initial stages of the Project, diesel generated power would be used. The *Environmental Impact Statement* will provide a description of both options and further details in relation to the long-term power supply for the Project.

5.4.5 Water Management Structures

A number of water management options are currently being reviewed to ensure the establishment and maintenance of a secure water resource for the Project. The following water supply options are being considered.

- Construction of four dams under the Applicants' harvestable right.
- Supply from groundwater that seeps into the proposed open cuts.
- Supply from one or more bores within the Project Site.

Further details in relation to these structures will be provided in the *Environmental Impact Statement*.

5.5 SITE PREPARATION

5.5.1 Introduction

This sub-section describes the activities that would be undertaken in preparation for mining operations. These activities include the removal of vegetation, soil stripping and stockpiling of soils, and would be carried out with due consideration of the bushfire management strategy for the Project Site.



5.5.2 Vegetation Clearing

Clearing of larger vegetation would predominantly be required for the construction of the Heap Leach Pad and surface facilities and part BJ/McCarron Open Cut Complex. The remaining sections of the Project Site have been previously disturbed and are largely devoid of native trees and shrubs. A section of the Waste Rock Emplacement would disturb an existing pine plantation. Considerable emphasis has been placed on designing the Project in a manner that limits, to the greatest extent practicable, the amount of native trees and shrubs to be disturbed.

Prior to the commencement of vegetation clearing operations, the Applicant would ensure that any commercially viable timber within the areas of proposed disturbance is harvested. Following that program, larger vegetation would be removed using a bulldozer with the blade positioned just above the surface. Ground cover vegetation would be removed with the topsoil to maximise the retention of the seed bank, enhance microbiological activity and minimise soil compaction and soil structure degradation. Available seed would be harvested prior to clearing operations where practicable. Clearance protocols for fauna would be undertaken in accordance with the relevant plans to be developed for the Project Site.

5.5.3 Soil Stripping

A soil assessment has substantially been undertaken by Geoff Cunningham, the Principal of Natural Resource Consultants Pty Ltd. That assessment will identify the relevant soil units within the Project Site and make recommendations in relation to stripping, stockpiling and reuse of soil materials. However, indicatively, the following procedures would be implemented during soil stripping and stockpiling operations.

- Strip soils to the depths identified in the *Environmental Impact Statement* and soils assessment.
- Ensure soils are not stripped when either excessively dry or wet.
- Grade or push soil into windrows using graders or bulldozers for later collection by elevating scrapers or loading into trucks by front-end loaders to minimise compaction of soils.
- Use soils immediately in areas undergoing progressive rehabilitation where practicable. Where this not practicable implement the following procedures:
 - Place soil transported by truck directly into storage.
 - Place soil transported by scrapers in thick “lifts” to minimise compaction.
 - Minimise, as far as practicable, the operation of machinery on soil stockpiles to reduce compaction.
 - Ensure that topsoil and subsoil stockpiles have a maximum height of 2m and 3m respectively.
 - Leave the surface of the stockpiles with slightly roughened surface to assist in erosion control and seed germination.
 - Establish a vegetative or artificial cover on all soil stockpiles retained for more than 3 months.



5.6 MINING OPERATIONS

5.6.1 Introduction

Development consent is sought for the extraction of ore and waste rock from two proposed open cut complexes. This sub-section provides an overview of the layout of each of the open cut complexes, a description of the proposed mining methods, mining rate and sequence and the equipment that would be used during mining operations.

It is noted that three classes of ore material exist within the Project Site, namely:

- oxide ore;
- transitional ore (or material that is transitional between oxide and sulphide ore);
and
- sulphide ore.

During the reassessment of the Project since October 2011, the Applicant concluded that the sulphide ore may not be economically recovered at the current silver price. However, oxide and transitional material may be economically recovered. As a result, the following description of the Project takes into account the reduced disturbance required to extract and process only the oxide and transitional material and the fact that sulphide ore material would remain in the walls and floor of the proposed open cuts and would be available for a subsequent application to extract that material.

5.6.2 Layout of the Proposed Open Cut Complexes

Figure 6 presents an overview of the layout of each of the proposed open cut complexes and the following describes each in turn. It is noted that the further mine design is being undertaken and that detailed optimisation and open cut design will be finalised during preparation of the *Environmental Impact Statement*. As a result, that document will provide further detail in relation to the open cut layouts.

5.6.3 Open Cut Mining Methods

5.6.3.1 Introduction

This sub-section provides an overview of the open cut mining methods that would be employed throughout the life of the Project. These methods would be broadly similar in each of the proposed open cuts and are shown schematically in **Figure 8**.

5.6.3.2 Grade Control Drilling

Grade control drilling would be undertaken in all areas of the open cuts where ore material or low grade (marginal ore) material is expected to occur. This drilling would be undertaken well ahead of planned mining to precisely define the boundary between ore, low grade ore and waste rock material. Grade control is anticipated to be undertaken using blasthole drill rigs with appropriate sampling attachments.

All grade control samples would be transported to an off-site laboratory for analysis.



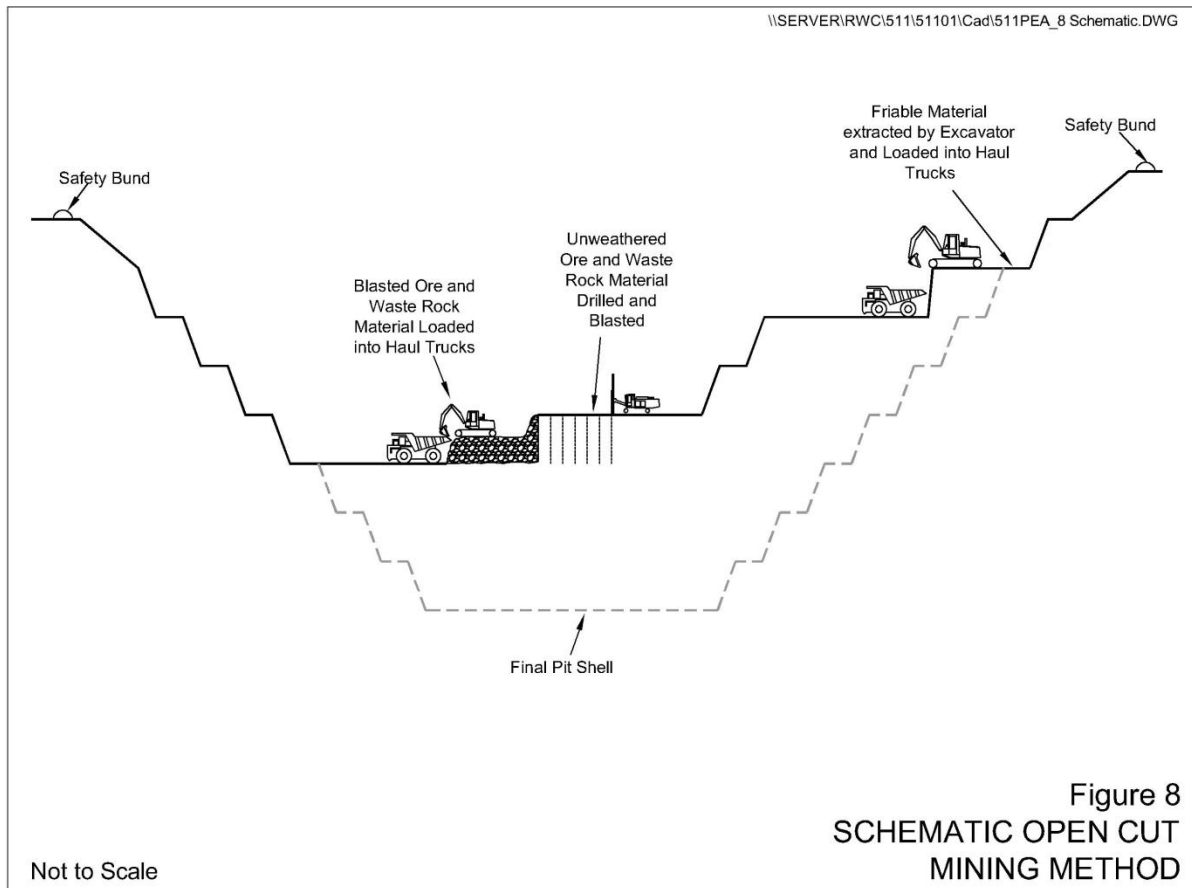


Figure 8
SCHEMATIC OPEN CUT
MINING METHOD

5.6.3.3 Extraction of Friable Material

Following removal of vegetation and soil material as described in Sections 5.5.2 and 5.5.3, mining would commence with the removal of friable material. This material would be directly extracted using an excavator or ripped and pushed up using a bulldozer and loaded using an excavator or front-end loader. Extracted material would be loaded into haul trucks for transportation to the ROM pad, the low grade stockpile, waste rock emplacement or other location within the Project Site where waste rock material is being used for construction of infrastructure. The Applicant anticipates that friable material will occur from the base of the subsoil to a depth of up to 10m below the surface.

5.6.3.4 Drill and Blast Operations

Drill and blast methods would be used to fragment material that cannot be excavated using a bulldozer or excavator alone. All drill and blast operations would be supervised by a suitably qualified and experienced blasting engineer or shot firer. Blast holes would be drilled using one or more hydraulic drill rigs equipped with dust and noise suppression equipment. **Table 4** provides for the indicative blast design parameters to be applied within the Project Site.

Table 4
Indicative Blast Design Parameters

Blasthole Diameter	110mm
Blasthole Depth	5.5 to 11.0m
Blasthole Spacing	3.0m x 3.8m
Depth of Stemming	2.2m
Area of Blast	2 885m ²
Size of Blast	up to 15 000m ³
Bulk Explosive Type	ANFO
Powder Factor	0.60kg/bcm
Maximum Instantaneous Charge (MIC)	225kg
Initiation System	Nonel
Note: bcm = bank cubic metre	
Source: Argent Minerals Limited	

The Applicant would ensure that all relevant blasting criteria are achieved at surrounding non Project-related residences and other sensitive receivers. Blasting would typically be undertaken between the hours of 9:00am to 5:00pm, Monday to Saturday. No blasting operations would be undertaken on Sundays or Public Holidays. Blasting may be undertaken outside of these hours to alleviate a safety hazard such as those caused by misfire.

Detonators and boosters would be stored within magazines within a designated magazine area. This area would be constructed in accordance with Australian Standard AS2187 – *Explosives Storage, Transport and Use*. The magazine area would be secured by a 1.8m high security fence topped with barbed wire and a lockable gate. In addition, the magazine area would be the subject of regular inspection by security personnel. The magazines would be transportable structures which would be constructed, secured, maintained and permitted in accordance with the relevant guidelines.

Signs advising employees, contractors and visitors to the Project Site of the date and time of the next blast would be positioned at the entrances to the Project Site and at other appropriate locations within and surrounding the Project Site. In addition, the Applicant would consult with surrounding residents to determine the most appropriate method to notify them of blast times and would implement the agreed notification methods.

5.6.3.5 Load and Haul Operations

Following completion of each blast, boundaries between ore, low grade and waste rock material would, if required, be identified and marked on the ground using paint, tape or similar materials. Fragmented material would then be loaded into haul trucks using a hydraulic excavator and transported to the waste rock emplacement, or the ROM pad.

5.6.3.6 Mining Rate and Sequence

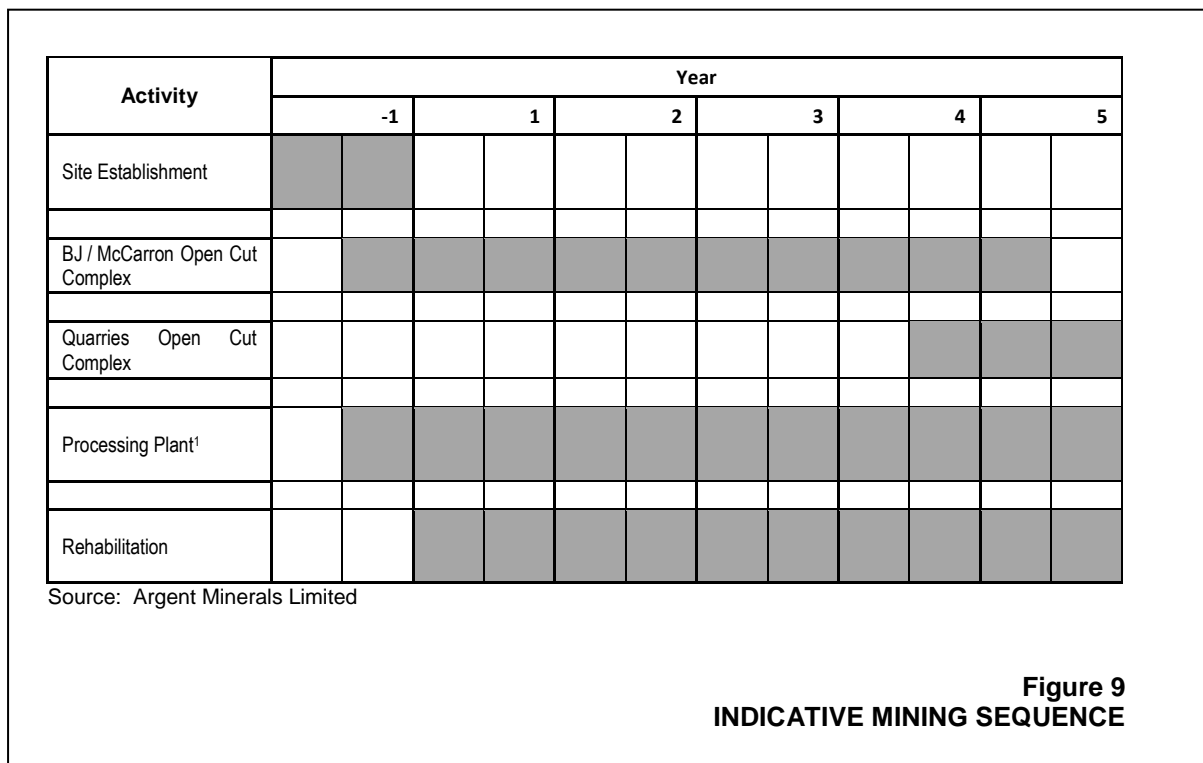
Table 5 presents the anticipated mining rate for the life of the Project. In addition, **Figure 9** presents an indicative outline of the mining sequence.



Table 5
Indicative Mining Rate

Year	Ore ('000t)	Waste Rock ('000t)	Total ('000t)
1	1.5	1.00	2.5
2	1.5	1.00	3.0
3	1.5	0.60	2.1
4	1.5	0.30	1.8
5	0.6	0.10	0.7
Total	6.6	4.50	10.1

Source: Argent Minerals Limited



5.6.3.7 Mining Equipment

Table 6 presents an overview of the indicative mining fleet that would be used during mining operations. In addition to the equipment identified in **Table 6**, a number of light and other vehicles would be used during mining operations.

5.7 PROCESSING OPERATIONS

5.7.1 Introduction

The proposed processing operations comprise the following.

- ROM stockpiling and crushing operations.
- Agglomeration operations where crushed ore material is combined into clusters for placing onto the Heap Leach Pad.



**Table 6
Indicative Mining Fleet**

Equipment	Indicative Number	Use	Proposed Hours of Operation
Major Equipment			
Excavator (CAT365C, 20 tonnes)	2	Extraction of ore material and waste rock	24 hours a day, 6 days per week
Haul Truck (CAT773F, 55 tonne payload)	5	Transportation of ore material and waste rock	
Support Equipment			
Blast Hole Drill Rig (Atlas copco ROC F9 CR, 110mm)	2	Drilling blast holes	24 hours a day, 6/7 days per week
Bulldozer (CATD8T, 38 tonnes)	1	Stripping soil, shaping of waste rock emplacements, clearing of benches, general site maintenance	
Grader (CAT140M, 3.7m blade)	1		
Front-end loader (CAT988H, 50 tonnes)	2	Management of ROM material, loading of haul trucks	
Service Truck	1	Equipment servicing and refuelling	
Watercart (CAT773)	2	Dust suppression	
Tip Truck	1	General Soil & Rock Movement	24 hours a day, 6/7 days per week
Explosives Delivery Vehicle	1	Explosives delivery	Daylight hours only
Maintenance Truck	1	Equipment Maintenance	24 hours a day, 6/7 days per week
Crane (Franna 15T)	1	Materials Movement	24 hours a day, 6/7 days per week
Tool Carrier (CAT IT38H)	1		24 hours a day, 6/7 days per week
Backhoe (CAT 44E)	1	General Excavation	24 hours a day, 6/7 days per week
Light Vehicles (Nissan Navarra)	6	People Movement	24 hours a day, 6/7 days per week
Diesel Generators & Lighting Plants	variable	Pump sump, mobile lighting towers, other power supply as required	Variable
Source: Argent Minerals Limited			

- Construction of a Heap Leach Pad in a series of cells.
- Irrigation of each of the cells with a solution containing sodium cyanide to leach the silver from the ore material.
- Collection of the silver-bearing solution and treatment to recover the contained silver.



This sub-section provides a brief description of the proposed silver leaching and recovery operations and chemical and reagent management procedures that would be implemented.

5.7.2 Processing Plant Area Layout

As the processing plant area is currently in the design stage and a final footprint has yet to be determined, a detailed layout of the plant will be presented in the *Environmental Impact Statement* for the Project. It is noted, however, that the processing plant would comprise the following components (see **Figure 6**).

- Run-of-Mine (ROM) pad.
- ROM ore feed bin.
- Primary and secondary crushers.
- Heap Leach Pad.
- Pregnant Liquor Pond (PLS).
- Silver Recovery circuit.

The processing operations would be designed for an annual throughput of 1.5 million tonnes of ore.

5.7.3 Silver Leaching Operations

5.7.3.1 ROM Stockpiling and Crushing Operations

Ore material would be transported from the various open cuts to the ROM pad by haul truck. This material would be stockpiled within the ROM pad according to ore characteristics. A front-end loader would then be used to blend the material and deliver it to the ROM ore feed bin above the primary crusher.

This material would be crushed using primary and secondary crushes and associated screens to produce a product with a nominal size of 6mm or less. Crushed product would be transferred to a surge bin prior to being passed to the agglomerator.

Dust suppression would be implemented using fine misting sprays and a dust collection system.

5.7.3.2 Agglomeration Operations

Agglomeration, or the process of combining materials with a range of sizes into clusters with a more uniform size, is essential for ensuring adequate leaching of the ore material.

The crushed material would be mixed with cement and barren leaching solution (see Section 5.7.2.5) within a banded, rotating agglomeration drum. The agglomeration drum would be approximately 10m long and 2.5m in diameter. As the drum rotates, the crushed ore material would be cemented together to form agglomerates or clusters between [0.5mm and 20mm] in size.

Agglomerates exiting the drum would feed an overland conveyor system for stacking on the heap leach pad.

The agglomerating drum and related equipment would be located in a concrete banded area to contain any liquids. A sump pump would direct any such material to the heap leach pad.

5.7.3.3 Heap Leach Pad Design and Construction

The Heap Leach Pad has been designed to accommodate approximately 6.6Mt of ore resources in approximately 35 cells over 4 x 8m lifts. The total area of the heap leach pad would be 350m wide by 700m in length. In addition, a range of leachate and water management ponds and



structures would be constructed (**Figure 6**). The Heap Leach Pad and all associated infrastructure would be designed and constructed in a manner that would ensure that cyanide-bearing solutions cannot enter natural drainage, groundwater or undisturbed sections of the Project Site. In summary this would be achieved through:

- installation of suitable liners with a nominal permeability of 1×10^{-9} m/s over 900mm or better and leakage detection and collection systems;
- construction of leachate collection structures capable of managing all runoff associated with normal operations of the Heap Leach Pad together with incident rainfall associated with a 1 in 100 year 24-hour, 72-hour or 5 day rainfall event; and
- construction of clean water diversions capable of diverting water from undisturbed sections of the Project Site to a similar 1 in 100 year rainfall event.

The Heap Leach Pad would be constructed using agglomerated ore material which would be stacked in cells of approximately 185 000t each using mobile conveyors and stackers. Following completion of the construction of each cell, irrigation with the leach solution would commence.

5.7.3.4 Leaching Operations

Following completion of construction of each cell, irrigation with the cyanide-bearing leach solution would commence with sprinklers or wobblers. These would be designed and located to ensure even wetting of the cell and agglomerated ore while minimising overspray, wind drift and evaporative losses. Following an initial wetting and leaching period, the sprinklers or wobblers would be replaced with drippers. For each cell, the initial wetting and leaching period would be expected to be approximately 50 days, with the secondary leaching period using drippers expected to be a further approximately 150 days.

The leach solution would be permitted to filter through the agglomerated ore. As it did so, silver within the ore would be leached into solution. The silver-bearing solution would then reach the base of the cell and would flow through the drainage medium placed above the liner to collector drains and pipes.

The Applicant anticipates that the concentration of silver in the solution collected from the base of the Heap Leach Pad will vary depending on the age of the cell and rate of application. To that end, solution with higher silver concentration or pregnant liquor solution, would be directed to the Pregnant Liquor Solution pond (PLS pond) for recover of silver (see Section 5.7.3), while solution with lower silver concentrations, or recycle liquor solution, would be directed to the Recycle Liquor Solution pond for recirculation to the Heap Leach Pad.

The Heap Leach Pad and irrigation system would be constructed to ensure no ponding of solution occurs on surface. All processing ponds would be fenced and covered with bird netting to prevent any fauna from accessing the area. The external drainage system for the heap leach pad would be encased by piping to also prevent fauna exposure to the solution.

Additionally, regular inspections would be made of the heap leach facilities to determine fauna movements and use of the area. If required, additional management strategies would be implemented.



5.7.4 Silver Recovery

5.7.4.1 Introduction

The following sub-sections provide a description of the preparation of solution and the silver recovery process.

5.7.4.2 Silver Precipitation

The pregnant liquor solution would be pumped from the pregnant liquor solution pond and treated prior to precipitation of the silver. Initially, the solution would be filtered to recover any solids. This would be followed by vacuum de-aeration to remove dissolved oxygen.

Following completion of solution preparation, the pregnant solution would be passed to a Merrill-Crowe plant where it would be mixed with zinc powder, causing the silver, any gold and some base metals to precipitate out of solution for collection using a filter press. The resulting barren solution would be recycled in the leaching process while filtrate would be treated to recover the silver.

5.7.4.3 Silver Recovery

The zinc-silver filtrate would be passed to a tank containing sulphuric acid which would dissolve the zinc, leaving a silver-rich solid component. This material would be filtered and calcined or oxidised at 800°C before being mixed with fluxes and placed into a small furnace to produce molten silver / gold and slag. The silver / gold would be poured into moulds to produce doré (unrefined silver bars) and the slag recycles through the leaching process.

The furnaces within the silver recovery circuit would be fitted with scrubbers to ensure that any emissions comply with the requirements of the Protection of the Environment Operations (Clean Air) Regulation 2010.

5.7.5 Chemical and Reagent Management

The *Environmental Impact Statement* will present a detailed list of chemicals and reagents that would be stored and used within the Project Site together with the measuring that will be implemented to ensure appropriated management of those materials. The following provides a brief overview of the principal chemicals and reagents and relevant management measures that would be implemented during the life of the Project.

- Sodium Cyanide

Sodium cyanide would be delivered in solid form in 22t capacity isotainers, sealed tanks designed for the transport and management of potentially harmful substances. Water would be circulated through the isotainer to dissolve the sodium cyanide which would then be transferred to one or more liquid storage tank(s) with an indicative capacity of 5 000L. The isotainer would remain in place until all the solid sodium cyanide is consumed, after which it would be replaced with a new isotainer. The liquid storage tank and isotainer would be contained within concrete bunds with a capacity of 110% of the volume of the liquid storage tank.



- Caustic Soda

Caustic soda would be delivered to the Project Site by road in liquid form in 1m³ bulker bins held inside shuttle bins and stored in a bunded, undercover area until required. Care would be taken to ensure that the liquid is stored appropriately with other compatible chemicals.

- Hydrochloric and Sulphuric Acid

Concentrated hydrochloric and sulphuric acid would be delivered to the Project Site in liquid form in 1 000L sealed containers held inside shuttle bins. The containers would be unloaded into an undercover, acid resistant, concrete containment bund adjacent. Care would be taken to ensure that the liquid is not stored inappropriately with other chemicals.

- Cement

Cement would be delivered in bulk and pneumatically discharged to a silo, which would be vented to atmosphere via a bag house dust collector. The cement powder would be discharged directly onto the agglomerator feed conveyor which would be covered to prevent cement dust emissions.

- Fluxes

A variety of materials such as borax, fluorspar and silica would be required for the final stage of silver recover to form a slag that would extract impurities that may be co-precipitated with the gold and silver. Fluxes are typically supplied in 25kg paper bags, which will be stored undercover near the smelting facility.

In summary, systems would be implemented to ensure that environmental and occupational health and safety risks associated with transportation, handling, storage and use of all chemicals and reagents are minimised to the greatest extent possible. These procedures would be embodied in a *Hazardous Materials Management Plan* prepared in consultation with the relevant government agencies that would be prepared prior to commencement of processing operations and in accordance with Development Consent conditions

5.8 WASTE ROCK MANAGEMENT

5.8.1 Introduction

During mining operations, material that does not contain sufficient silver or other metals to justify immediate processing or stockpiling for later processing would be placed within the Waste Rock Emplacement or used to construct site infrastructure (**Figure 6**). In-pit placement of waste rock has been considered but is not feasible because sulphide ore will remain in all open cuts at the end of the Project and in-pit placement of waste rock may sterilise that material.

5.8.2 Characteristics of the Waste Rock

Testing of the waste rock material is ongoing and the results of that testing will be provided in the *Environmental Impact Statement*. Preliminary results, however, indicate that some waste rock material may be acid forming.



The Applicant will provide further details in relation to management of acid forming material in the *Environmental Impact Statement* once the anticipated volume of such material has been determined. In summary, however, those measures would include the following.

- Construction of an appropriate encapsulation area within the Waste Rock Emplacement.
- Construction of appropriate seepage and leachate collection structures to prevent discharge to natural drainage or aquifers.

5.8.3 Design and Construction of the Waste Rock Emplacements

The design and construction of the waste rock emplacement is currently being finalised and detailed information will be presented in the *Environmental Impact Statement*.

5.8.4 Waste Rock Emplacement Procedures

The following provides an indicative description of the anticipated emplacement procedures.

In general, waste rock material removed from the open cuts may be divided into three categories, namely:

- friable or weathered material;
- non-acid generating unweathered material; and
- potentially acid generation unweathered material.

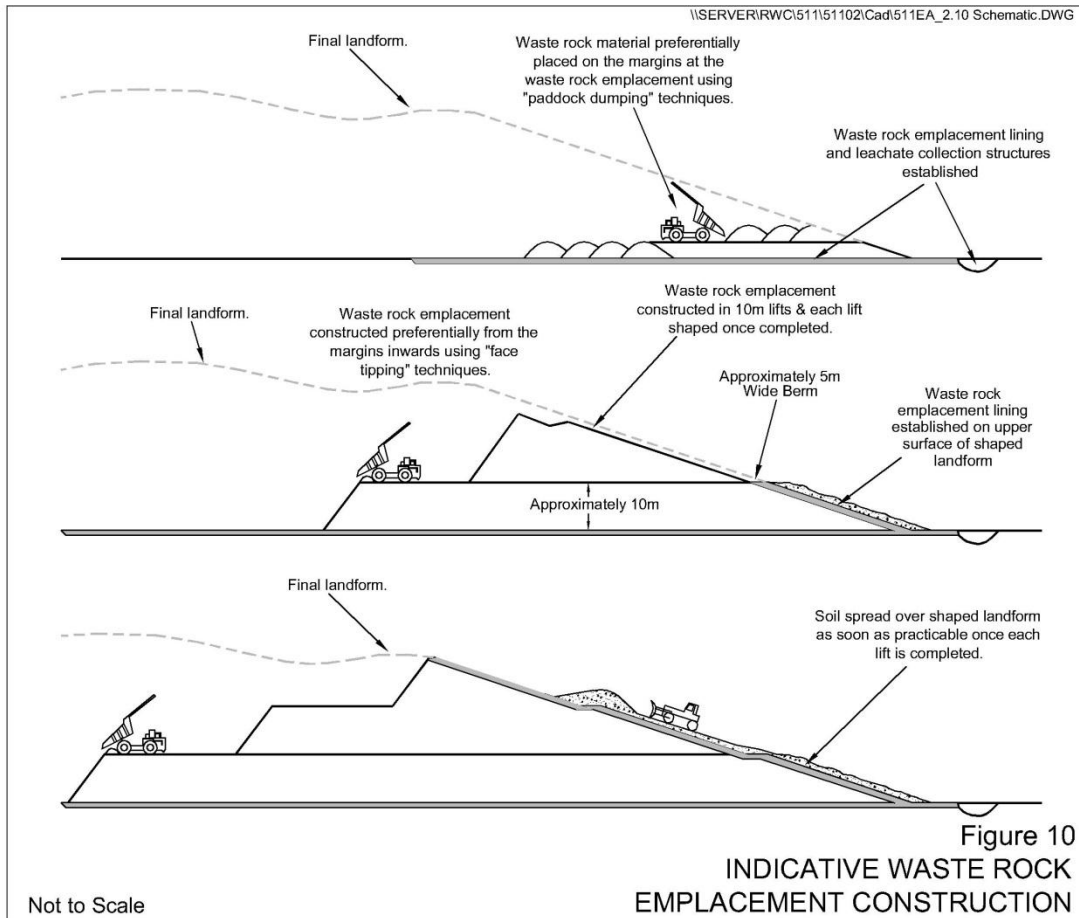
Waste rock material would be transported to the Waste Rock Emplacement using off-road haul trucks. In addition, weathered material may also be used to construct other infrastructure within the Project Site including ROM pad, surface water diversion structures, hardstands, haul roads, and car parks.

Figure 10 presents an overview of the indicative methods that would be employed during construction of the waste rock emplacement. In summary, waste rock material would initially be ‘paddock dumped,’ within the proposed footprint of the waste rock emplacement. The piles of waste rock material would be pushed flat using a bulldozer prior to construction of the next layer. Subsequent layers would be built by establishing a tip head on the active emplacement face. The emplacements would be constructed in 10m lifts, typically from the outer margins of the emplacement towards the centre, allowing for the final face angle for each lift of 1:3 (V:H). Between each lift, a 5m wide berm with a 1:20 (V:H) or 5% backslope and a 1:200 (V:H) or 0.5% longitudinal grade would be constructed. The waste rock emplacement would be compacted during construction by heavy vehicles travelling across the surface of the emplacement.

Following completion of construction of the outer section of each lift, the outer face of the emplacement would be progressively shaped and, where practicable, covered with friable waste rock material. Subsoil and topsoil would then be spread over the emplacement and the emplacement progressively revegetated.

Further details in relation to the proposed emplacement operations will be provided in the *Environmental Impact Statement*.





5.9 NON-PRODUCTION WASTE MANAGEMENT

Table 7 presents a description of the non-production wastes that would be generated during the life of the Project and briefly describes how they would be stored and subsequently removed from the Project Site.

Table 7
Non-Production Waste Management

Page 1 of 2

Waste Type	Storage	Removal
General waste (including food scraps)	Covered bins located within meal rooms, offices and elsewhere as required. Where these bins would be located in open areas, they would be fitted with animal-proof lids.	Collected on a regular basis by licensed waste contractor and transported to a licensed waste disposal facility.
Waste oils and greases	Placed within bunded tank(s) within the workshop area.	Collected on a regular basis by a licensed waste contractor and transported to an appropriately licensed facility.

Table 7 (Cont'd)
Non-Production Waste Management

Page 2 of 2

Waste Type	Storage	Removal
Batteries and tyres	Batteries would be placed within a covered and marked used battery storage area until removed from site. Tyres would be placed within a marked used tyre storage area until removed from site or used for another purpose.	Batteries would be collected on a regular basis by a licensed disposal contractor and recycled. Tyres would be reused on site for construction of retaining walls, erosion protection, traffic control or would be removed from site for reuse elsewhere or recycling.
Scrap Steel/Metal	Stored in a specified areas within the workshop area or elsewhere as required.	Collected on a regular basis by a scrap metal recycler.
General Recyclables	Covered bins located within meal rooms, offices and elsewhere as required. Where these bins are located outside a closed building they would be fitted with animal-proof lids.	Collected on a regular basis by a licensed recycling contractor and transported to an appropriate recycling facility.
Waste water	Waste water from ablutions facilities would be treated within one or more 'biocycle' or aerated treatment facilities and the treated water used for irrigation of garden areas or areas undergoing rehabilitation within the Project Site.	

5.10 TRANSPORTATION

5.10.1 Introduction

This sub-section describes the Project-related transportation activities within and surrounding the Project Site.

5.10.2 Internal Road Network

A range of internal haul roads and other roads would be constructed during and following site establishment. These would include the following (**Figures 6 and 7**):

- a site access road;
- a range of internal haul roads from each of the open cuts to the ROM pad and waste rock emplacement; and
- ancillary unsealed tracks for site management and monitoring requirements.

The internal haul roads would be designed, constructed and/or maintained in accordance with the document *Managing Urban Storm Water – Volume 2C – Unsealed Roads* published by the Department of Environment and Climate Change in 2008 (DECC, 2008a). In summary, the haul roads would be constructed to the following parameters.

- The width of the haul roads would be a minimum of 2.5 to 3 times the width of the largest haul truck. Typically, total haul road width would be approximately 20m wide, for dual access roads.



- A safety bund, a minimum of the wheel height of the largest vehicle likely to travel the road, would be positioned on the downslope side of all haul roads where they are located adjacent to or traverse steep slopes.
- Haul roads would typically be constructed with a gradient of no more than 1:7 (V:H).
- In order to maintain all weather access, the surfaces would be sheeted with suitable waste rock materials recovered during the mining activities.
- The roads would be routinely maintained and watered to suppress the generation of dust.
- All haul roads would be constructed in a manner that would avoid excessive erosion during rain events. Surface runoff from these haul roads would be contained as part of the overall dirty water management system.

Where haul roads or other internal roads are required to cross water courses the crossings would be constructed in accordance with the requirements of the document *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* published by NSW Fisheries in 2003.

Further details in relation to the internal road network will be provided in the *Environmental Impact Statement*.

5.10.3 Colo Road

As indicated in Section 5.4.3 the Applicant is currently negotiated with Bathurst Regional Council to close a section of Colo Road. In addition, realignment and upgrading of the Colo Road will be required to permit safe and convenient access to the Project Site for heavy and light vehicles.

Further details in relation to the proposed road closure and realignment and upgrade will be provided in the *Environmental Impact Statement*.

5.10.4 External Transportation

5.10.4.1 External Road Network and Transportation Routes

Project-related heavy vehicle traffic would travel between the Project Site and Mid-Western Highway via Bathurst or Blayney (**Figure 7**).

Further details in relation transportation routes, destinations and proportion of vehicles using each route will be provided in the *Environmental Impact Statement*.

5.10.4.2 Traffic Types and Levels

Traffic types associated with the Project would include the following.

- Light vehicles – including passenger vehicles, light trucks and buses.
- Light Trucks – including delivery vehicles and secure trucks moving silver doré.



- Heavy vehicles – including rigid trucks and semi-trailers delivering consumables and supplies to the Project Site and transporting concentrate products from the site
- Oversize and overweight vehicles – delivering components of the processing plant and mobile fleet. The Applicant would ensure all oversize and overweight vehicles would have the necessary permits and approvals where required.

Table 8 presents the anticipated Project-related traffic levels for the Project.

Table 8
Anticipated 85th Percentile Daily Traffic Movements¹

	85 th Percentile Daily Movements ¹
Project Construction	
Light vehicles	40
Heavy vehicles	12
Oversize and Over-weight Vehicles	2
Project Operation	
Light Vehicles (including shuttle buses from Blayney)	40
Heavy vehicles	10
Note 1: 2 movements = 1 return journey	
Source: Argent (Kempfield) Pty Ltd	

5.11 FACILITIES AND SERVICES

5.11.1 Facilities

5.11.1.1 Introduction

The Applicant would establish a range of facilities within the Project Site to support the proposed mining and processing operations. Further details in relation to those facilities will be provided in the *Environmental Impact Statement*.

5.11.2 Services

5.11.2.1 Site Electricity Supply and Distribution

As indicated in Section 5.4.4, the Applicant is currently assessing a range of electricity options for the Project. Further details in relation to those options will be provided in the *Environmental Impact Statement*.

5.11.2.2 Communications

The Project Site would be connected by private microwave link to a commercial communication network. This would provide voice and data communication within building and fixed infrastructure. Communication within the remainder of the Project Site would be via two-way radio and/or mobile phone.

5.11.2.3 Hydrocarbons

Diesel fuel usage is currently being reviewed and the design perimeters for storage will be included in the *Environmental Impact Statement*. In summary, however, hydrocarbon storage tanks would be either self-bunded or located within one or more bunded fuel bays. Bunding, if required, would be sized to meet the EPA containment requirements of 110% of the largest container and *AS 1940:2004 - Safe storage & handling of flammable & combustible liquids*.

A sealed refuelling area would be located adjacent to the fuel bay with all drainage from both areas directed to an oil/water separator. All haul trucks and graders and some light vehicles would utilise the refuelling area while less mobile equipment such as excavators, bulldozers and generators would be refuelled at their work site using a mobile fuel tanker.

Any bulk oils, greases and waste oils would also be stored within this bunded fuel bay or alternative appropriately bunded areas.

In addition, LPG would be used within the processing plant for heating reagents during processing operations. The LPG would be stored in tanks within the processing plant.

5.11.2.4 Potable Water

Potable water would be transported to site as required in bulk or in 20L containers. Water for ablutions purposes would be sourced from water resources located on the Project Site.

5.11.2.5 Operational Water

The Project would require a maximum of approximately 300ML of make-up water per year for processing operations

At this stage, the Applicant has identified a range of sources for the required operational water. These may include the following.

- Surface water collected under the Applicant's harvestable rights.
- Groundwater that would be removed from the proposed open cuts or dewatering bores.
- Groundwater sourced from bores in other areas of the Project Site.
- Other surrounding surface water sources.

Further details in relation to the requirements and source(s) of operational water, including a water balance and assessment of impacts of the proposed extraction, will be provided in the *Environmental Impact Statement*. The Applicant acknowledges that one or more water licences would be required for extraction of this water.

5.12 PROJECT LIFE AND HOURS OF OPERATION

5.12.1 Project Life

At the planned mining rate of 1.5Mt per year, the Applicant anticipates that mining operations would, following an initial one year construction period, require approximately five years to complete. However, in the event that the proposed rate of mining is lower than anticipated or more ore material is identified, additional time may be required. In addition, following completion of mining operations, site decommissioning and rehabilitation operations may take up to two years. As a result, the proposed Project life would be up to ten years from the commencement of construction activity.



The Applicant, however, notes that throughout the life of the mine, the Applicant plans to explore for possible extensions to the known mineralisation and for new areas of mineralisation within its mining tenements. Further ore reserves indicated by this program may extend the Project life. Separate applications for approval to extract that material would be made at that time.

5.12.2 Hours of Operation

Table 9 presents the proposed hours of operation for each of the relevant components of the Project.

**Table 9
Proposed Hours of Operation**

Activity	Proposed Days of Operation	Proposed Hours of Operation
Vegetation clearing and topsoil stripping	7 days a week, during each campaign	7:00am to 6:00pm
Construction operations	7 days a week	24 hours per day
Open Cut mining operations	7 days a week	24 hours per day
Maintenance operations	6 days a week	24 hours per day
Processing operations	5 days a week	24 hours per day
Transportation operations	6 days a week	7:00am to 6:00pm
Rehabilitation operations	6 days a week	7:00am to 6:00pm

Source: Argent Minerals Limited

5.13 EMPLOYMENT, CAPITAL COST AND ECONOMIC CONTRIBUTIONS

Additional information in relation to the employment, capital cost and economic contributions of the Project would be provided in the *Environmental Impact Statement*. However, in summary it is anticipated that the Project would contribute the following.

- Approximately 150 full-time equivalent positions during the construction phase and approximately 90 full-time equivalent positions during the operational phases of the Project.
- The initial capital cost of the Project is anticipated to be approximately A\$60 million.
- The Project would contribute between approximately \$25 million to \$34 million per year to the local, regional and national economies through wages, purchases of goods and services, taxes and royalties.

5.14 SITE REHABILITATION AND DECOMMISSIONING

5.14.1 Introduction

The following sub-sections describe the Applicant's rehabilitation objectives and the proposed final landform on completion of all proposed mining and associated disturbance. A summary of procedures to be applied to each component of the mine, the water management structures and other areas of disturbance associated with the mining activities are also outlined. Further details will be provided in the *Environmental Impact Statement*. In addition, refinements to these procedures, if required, would be undertaken on the basis of operational experience



gained by the Applicant, or by others at similar operations. These refinements would be reported in the relevant Annual Environmental Management Report (AEMR) and/or any amended Mining Operations Plans (MOPs) produced by the Applicant throughout the life of the mine.

5.14.2 Rehabilitation Objectives

The Applicant's rehabilitation objectives are divided into three specific categories, namely:

- landform establishment;
- growth media development; and
- ecosystem development and final land use.

The specific objectives associated with each category are as follows.

Landform Establishment

- To stabilise all disturbed areas and minimise erosion and dust generation.
- To blend the created landforms with the surrounding topography.
- To provide a low maintenance, geotechnically stable and safe, non-polluting landform which blends with surrounding landforms and provides land suitable for the final land use of nature conservation, agriculture, tourism or light industry.

Growth Media Development

- To achieve a soil profile capable of sustaining the specified final land use.
- To establish native vegetation with the species diversity commensurate to each relevant ecological community.

Ecosystem Development and Final Land Use

- To re-instate ecosystems consistent with the proposed final land use of nature conservation and agriculture.
- To protect and enhance those sections of the Project Site with remaining vegetation, focusing particularly on that vegetation that may be classified as endangered ecological communities under State or Commonwealth legislation.

5.14.3 Strategic Rehabilitation Management

5.14.3.1 Rehabilitation Domains

Rehabilitation domains refer to areas of related disturbance based on processes and use prior to rehabilitation and for which decommissioning and rehabilitation activities would be similar. A description of each domain is given below. Further details in relation to each domain, including plans showing the distribution of each, will be included in the *Environmental Impact Statement*.

- Domain 1 – Infrastructure Areas.

This domain would include the Processing Plant, ROM pad, office and workshop areas, explosives magazine, the site access, haul and other internal roads.



- Domain 2 –Surface Water Management Structures.
This domain would include all clean and dirty water dams, diversion drains, amenity bunds and associated infrastructure.
- Domain 3 – Waste Rock Emplacement Area.
This domain would include the Southern Rock Emplacements and soil stockpile locations.
- Domain 4 – Heap Leach Facility.
This domain would include the Heap Leach Pad and associated infrastructure.
- Domain 5 – Final Void Areas
- This domain would include the post-mining voids and any associated access roads.

5.14.3.2 Rehabilitation Hierarchy

The rehabilitation hierarchy for the Project follows a modified rehabilitation hierarchy based on the Division of Resources and Energy guidelines aligned to the rehabilitation objectives in Section 5.14.2. A summary of each phase of the rehabilitation hierarchy based is as follows. Further details will be provided in the *Environmental Impact Statement*.

Decommissioning

Specific details of decommissioning completion criteria would be covered in a *Mine Closure Plan* to be prepared closer to completion of mining activities. In general, however, the decommissioning phase of the rehabilitation hierarchy involves the cessation of usage of infrastructure, as well as its demolition, removal and any remediation of the land that may be required.

Landform Establishment

The landform establishment phase involves the earthworks required to cover and/or profile all or part of each domain to create a landform suitable for the proposed final land use and which blends with the adjacent topography. This stage would also include the construction of any drainage structures needed for the area.

Growth Media Development

The growth media development phase of the rehabilitation hierarchy involves the replacement of soil over disturbed areas and preparation of the soil for revegetation including fertiliser or ameliorant application and ripping or scarifying the soil. It also covers the revegetation of the rehabilitated landform and biodiversity areas with native species commensurate with the targeted final land use.

Ecosystem Development and Final Land Use

The ecosystem development and final land use phase of the rehabilitation hierarchy occurs once monitoring shows that there is adequate vegetation over the area. An area may be in this stage for a long period of time, depending on what the final land use outcome is. During this stage, the area would continue to be monitored and would not reach its nominated sustainable end land use until monitoring determines that any completion criteria have been met.



5.14.3.3 Completion Criteria, Associated Performance Indicators and Monitoring Strategy

The strategic rehabilitation completion criteria, associated performance indicators and monitoring strategy for the Project will be provided in the *Environmental Impact Statement*. These criteria will aim to achieve the following.

- The ongoing refinement of completion criteria and monitoring programs that would facilitate lease relinquishment following mine closure.
- Alignment with rehabilitation and biodiversity offset area objectives.
- The facilitation of continuous improvement in restoration management practices of the rehabilitation and biodiversity management areas.

5.14.4 Final Landform

A final landform has yet to be determined. Further details in relation to the proposed final landform, including a detailed plan, will be presented in the *Environmental Impact Statement*. In summary, however, the final landform would include the following.

- A shaped and covered waste rock emplacement with undulating upper surfaces, outer faces with maximum slopes of approximately 18° (1:3 (V:H)) and appropriately located and designed surface water control structures to minimise the risk of erosion and sedimentation.
- The potentially acid-forming rock encapsulation areas would be incorporated in the final landform in a manner that would ensure the long encapsulation of such material in order to ensure no potentially acidic leachate would be released to natural drainage.
- A shaped, covered and free draining Heap Leach Pad.
- Four appropriately bunded, fenced and signed open cuts.
- A shaped and covered ROM pad and processing plant area.
- All other disturbed sections of the Project Site would be shaped and covered, with the exception of those areas required for the final landuse, including some access tracks and possibly the electricity transmission line and substation.

5.14.5 Final Land Use

The final land use would be mixture of nature conservation and agriculture. These final land uses mimic the existing land uses. Further details, including a plan showing the respective areas of each land use will be presented in the *Environmental Impact Statement*.

5.14.6 Rehabilitation Methods and Procedures

5.14.6.1 Introduction

Following receipt of project approval, and as a component of a Mining Operations Plan for the Mine Site, the Applicant would prepare a detailed rehabilitation plan for the Project. This would provide the agreed final landform and land uses, detailed progressive rehabilitation



schedule and specific revegetation species mix to be used as part of direct seeding and ameliorative planting over the Project Site. The following sub-sections provide a summary of the methods that the Applicant would adopt for each of the identified rehabilitation domains to meet the objectives described in Section 5.14.2, and achieve the conceptual final landform described in Section 5.14.4 and the principal land uses described in Section 5.14.5.

5.14.6.2 Decommissioning Activities

Following completion of mining-related operations, and assuming that no further mining operations are proposed, the Applicant would remove infrastructure and services specifically established to service the mining operation that would no longer be required. This would include the processing plant and associated infrastructure. Other items of infrastructure would remain provided that a subsequent use can be identified. Indicatively, this would include the following.

- Water reticulation system.
- Electricity transmission line, substation and transformer.
- Site buildings, including the office and workshops.
- Site access road.

All concrete footings and foundations of buildings or structures to be dismantled or demolished, if any, would be broken up and removed and all areas to be rehabilitated would be re-profiled to near pre-mining levels. Previously stockpiled soil material would be re-spread over all areas to be rehabilitated and the areas would be revegetated.

5.14.6.3 Infrastructure Areas

Once infrastructure decommissioning has been completed, the remaining infrastructure would be rehabilitated as follows.

- Any internal haul roads and other access tracks, with the exception of those to be retained, would be ripped, covered with previously stockpiled topsoil and seeded with locally occurring tree, shrub or grass species (dependent on the intended final land use). Section 5.14.6.8 provides details as to the indicative revegetation activities to be completed over this and other rehabilitation domains of the Mine Site.
- Remaining hardstand areas would be scraped to remove any material not appropriate for rehabilitation. The areas would be ripped and covered with previously stockpiled soil. Revegetation would be generally undertaken as described in Section 5.14.6.8.
- Appropriate drainage controls would be installed.

5.14.6.4 Surface Water Management Structures

The Applicant would construct a range of surface water management structures during the life of the Project. Where these structures would promote the final land use, they would be retained following completion of the Project. Other structures would be removed and rehabilitated.



5.14.6.5 Waste Rock Emplacement

Completed sections of the waste rock emplacement would be progressively shaped as soon as practicable after it is no longer required for mining-related purposes. Remaining sections of the waste rock emplacement would be shaped following completion of mining operations.

During shaping operations, contour banks would be constructed on the rehabilitated landform. These structures would direct water at non-erosive velocities from the emplacement to the natural landform or to high-slope, drop-down structures such as flumes. These drop-down structures would be constructed on the slopes of the final landform to direct the surface water flows collected by the contour banks initially to the dirty water management system and then, following completion of rehabilitation operations, to natural drainage lines. Detailed plans showing surface water structures would be provided in the *Mining Operations Plan* prepared for the Project.

Soil would be placed on the shaped landform in accordance with the following procedures.

- Where practicable, weathered overburden material would be placed on the surface of the area to be rehabilitated to prevent large rocks from protruding from the final landform and provide a growth medium/water retention material during revegetation.
- Soil material would be placed on the shaped landform. The thickness this material would be determined by the area to be rehabilitated and the volume of soil material available for rehabilitation operations.
- The surface of the shaped landform would be left even but roughened. This would assist in maintaining soil stability, maximising seed retention and germination and minimising erosion.
- If required, artificial covers such as bitumen impregnated straw or mulches would be used to stabilise the soils on the shaped landform.
- The shaped landform would be revegetated with an appropriate species mix to be determined by an appropriately qualified and experienced rehabilitation consultant.

The soil stockpile areas from which the soil would be stored and then sourced for rehabilitation would be ripped, covered with a layer of topsoil and revegetated in accordance with the general strategies described in Section 5.14.6.8.

5.14.6.6 Heap Leach Facility

The Heap Leach Facility would be, following completion of processing-related operations, flushed with water until such time that monitoring indicates that water quality levels are acceptable. If necessary, suitable chemicals would be added to neutralise any remaining weak acid dissociable sodium cyanide. The Facility would then be covered with material suitable for the development of a free draining, store and release landform. This material would then be covered with soil material to act as a growth medium and revegetated.

Appropriate drainage would be installed to direct surface flows to a designated drop-down structure. Clean water diversion structures up slope of the facility would be retained.



5.14.6.7 Open Cut Areas

Prior to the commencement of mining operations within each open cut, a safety bund would be constructed around each open cut area. Following completion of mining operations, the haul ramps would be blocked using large rocks or bunds to prevent vehicular access to the open cuts. No planned revegetation of the open cuts would be undertaken, though it is likely vegetation could re-establish on the benches of the open cuts through natural revegetation.

5.14.6.8 Indicative Project Site Revegetation Strategy

Revegetation of the Project Site would be undertaken as either:

- revegetation of the rehabilitated final landform; or
- ameliorative planting of native species.

The Applicant would undertake a program of collecting seed from native vegetation within and surrounding the Project Site for use during rehabilitation and enhancement operations. In addition, the Applicant would also undertake revegetation trials to determine the most appropriate mechanism and species mix for rehabilitation within the Mine Site. Details of the trials would be included in the AEMR.

Over the major areas of disturbance, i.e. the waste rock emplacement and Heap Leach Facility, a mixture of native and introduced species of grasses and legumes would be used for rapid stabilisation of slopes. Once stabilisation of the final landform is confirmed, these areas would be seeded with a native species mix that would be determined in consultation with qualified specialists and relevant government agencies. The indicative species list would include both tree, shrub and grass species and would be refined with experience and the actual species used would be presented in the AEMRs that would be prepared for the Project.

5.14.7 Rehabilitation Management and Monitoring

The Applicant's commitment to effective rehabilitation would involve an ongoing monitoring and maintenance program following completion of mining-related operations. Areas being progressively rehabilitated would be regularly inspected, including during AEMR meetings. During these inspections the following would be noted.

- Evidence of any erosion or sedimentation from areas with establishing vegetation cover.
- Success of initial cover crop or grass cover establishment.
- Success of tree and shrub plantings.
- Natural regeneration of native species.
- Adequacy of drainage controls.
- General stability of the rehabilitated areas.

Post-mining rehabilitation remediation and enhancement activities would include but not be limited to the following.

- Where rehabilitation success appears limited, maintenance activities would be initiated. These may include re-seeding and where necessary, re-topsoiling and/or the application of specialised treatments.



- If drainage controls are found to be inadequate for their intended purpose, or compromised by wildlife or native vegetation, these would be replaced.
- Temporary fences would be installed to exclude native fauna, if grazing appears to be excessive.
- In the event areas of excessive erosion and sedimentation are identified, remedial works such as importation of additional fill, subsoil or topsoil material, or redesigning of water management structures would be undertaken.
- Appropriate noxious weed control or eradication methods and programs would be undertaken in consultation with Industry & Investment NSW (NSW Agriculture) and / or the local Noxious Weeds Inspector.

No time limit has been placed on post-mining rehabilitation monitoring and maintenance. Rather, maintenance would continue until such time as the objectives outlined in Section 2.14.2 are achieved to the satisfaction of the relevant government agencies.

6. BIODIVERSITY STRATEGY

The Applicant recognises that a Biodiversity Strategy will be required to manage impacts to habitat within the Project Site. The Applicant anticipates that further consultation with the relevant government agencies will be required during preparation of the *Environmental Impact Statement* and that a detailed description of the strategy will be presented in that document.

7. ENVIRONMENTAL SETTING

7.1 INTRODUCTION

The descriptions of the environmental aspects of the Project throughout this section are reliant upon a range of background information common to many of the key environmental issues. In this sub-section, background information is provided on the topography, climate and the land uses surrounding the Project Site. Additional information in relation to land ownership, residences and the community will be provided in the *Environmental Impact Statement*.

7.2 TOPOGRAPHY AND DRAINAGE

The Project is located in an area of undulating hills west of the Great Dividing Range. Regional, local and Project Site topography and drainage are presented on **Figures 11, 12 and 13**.

To the north of the Project Site the topography is dominated by undulating hills with approximate elevations between 800m AHD and 1000m AHD with occasional steep sided hills. The highest point in this area is 1000m AHD approximately 2 kilometres north of the Project Site.

To the south of the Project Site the topography is dominated by undulating hills with approximate elevations between 700m AHD and 900m AHD with occasional steep sided hills.



To the west of the Project Site the topography is dominated by undulating hills with approximate elevations between 700m AHD and 900m AHD, with occasional steep sided hills. The highest point in this area is 922m AHD, located approximately 3km west of the Project Site.

To the east of the Project Site the topography is dominated by undulating hills with approximate elevations between 800m AHD and 900m AHD with occasional steep sided hills. The highest point in this area is 'Arkell' Trig Station at a height of 988m AHD, located approximately 2km east of the Project Site.

Elevations range from 700m AHD to 920m AHD within the Project Site.

Drainage within the region flows towards the southwest where local tributaries discharge into either Rocky Bridge Creek or the Abercrombie River. These watercourses then meet and flow into Lake Wyangala, approximately 25km to the southwest of the Project Site.

Drainage within the locality is dominated by the Arkell Ridge to the east of the Project Site which promotes drainage to the local area towards the southwest. The local tributaries, including Meadow Paddock Creek, flow westerly from Arkell Ridge until combining with Rocky Bridge Creek and then flow in a general southwest direction until combining with the Abercrombie River which flows into Lake Wyangala (**Figure 11**).

7.2.1 Climate

7.2.1.1 Introduction

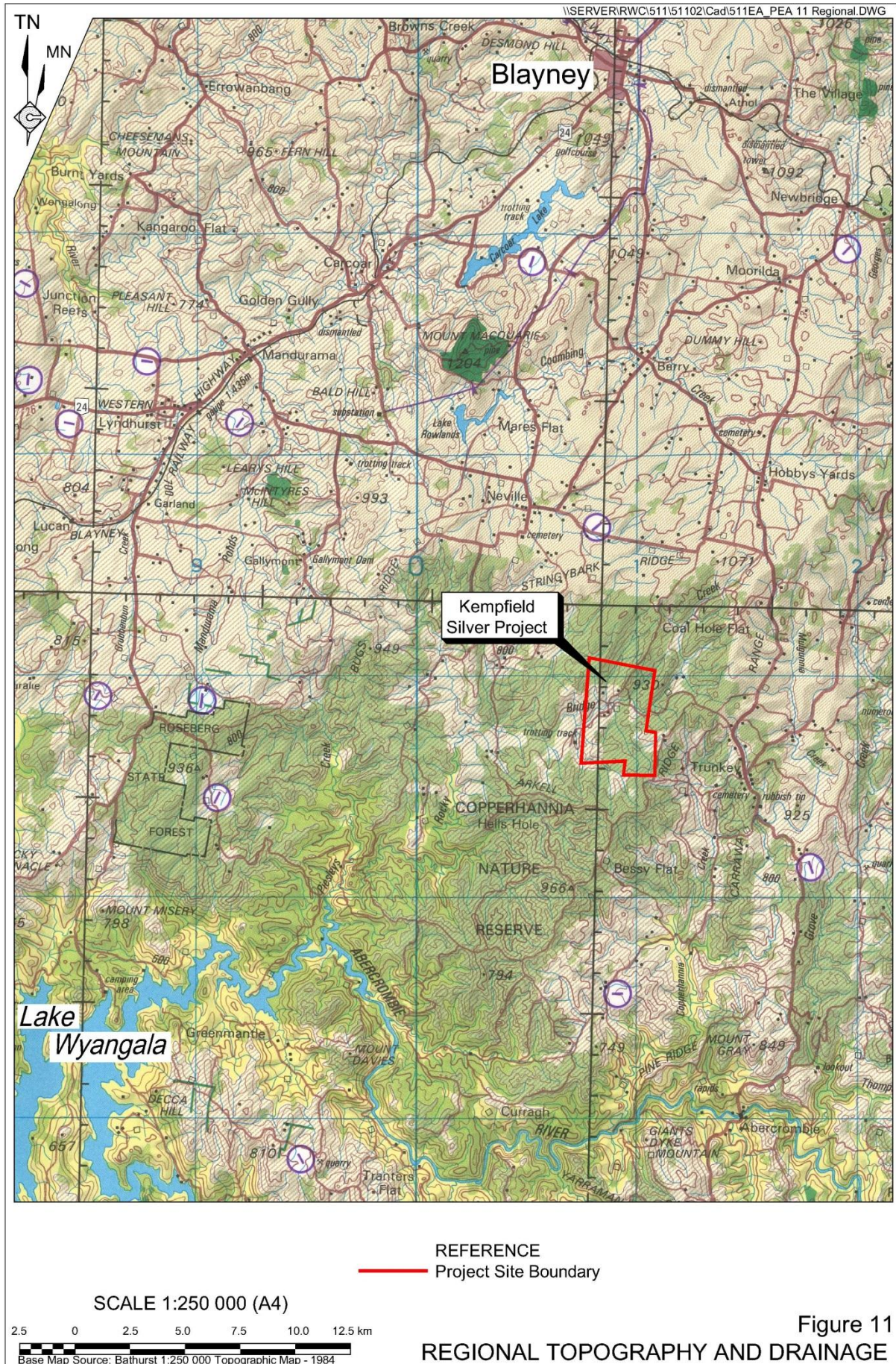
Climatic conditions have the potential to influence a range of potential Project-related impacts on surrounding residents and the environment. This sub-section provides a brief overview of the climatic conditions surrounding the Project Site, focusing particularly on those aspects of the climate that are likely to influence the potential Project-related environmental impacts. Further information will be presented in the *Environmental Impact Statement*.

Table 10 presents meteorological data from the Bathurst Agricultural Station (Station Number: 063005) located approximately 50km to the northeast of the Project Site.

Table 10
Climate Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Temperature (°C)													
Mean Maximum	28	27.2	24.6	20.1	15.7	12.2	11.2	12.9	16.3	19.9	23.3	26.3	19.8
Mean Minimum	13.3	13.3	10.8	6.7	3.4	1.6	0.6	1.3	3.4	6.2	8.9	11.6	6.8
Rainfall (mm)													
Mean rainfall	68.1	58.5	50.4	41.9	41.9	43.4	48.9	49.5	46.6	60.5	61	65.7	636.3
Highest rainfall	224	236	205	166	115	193	155	163	130	216	196	219	1275
Lowest rainfall	1.4	0	0	0.5	1	0.8	3.7	1.4	3.8	2.3	0.8	0	214.2
Highest daily rainfall	91.4	101	78.2	60.4	49.8	82.3	109	93.5	48.2	54.6	66.2	96.5	109
Source: Bureau of Meteorology – Bathurst Agricultural Station (Station Number: 063005)													





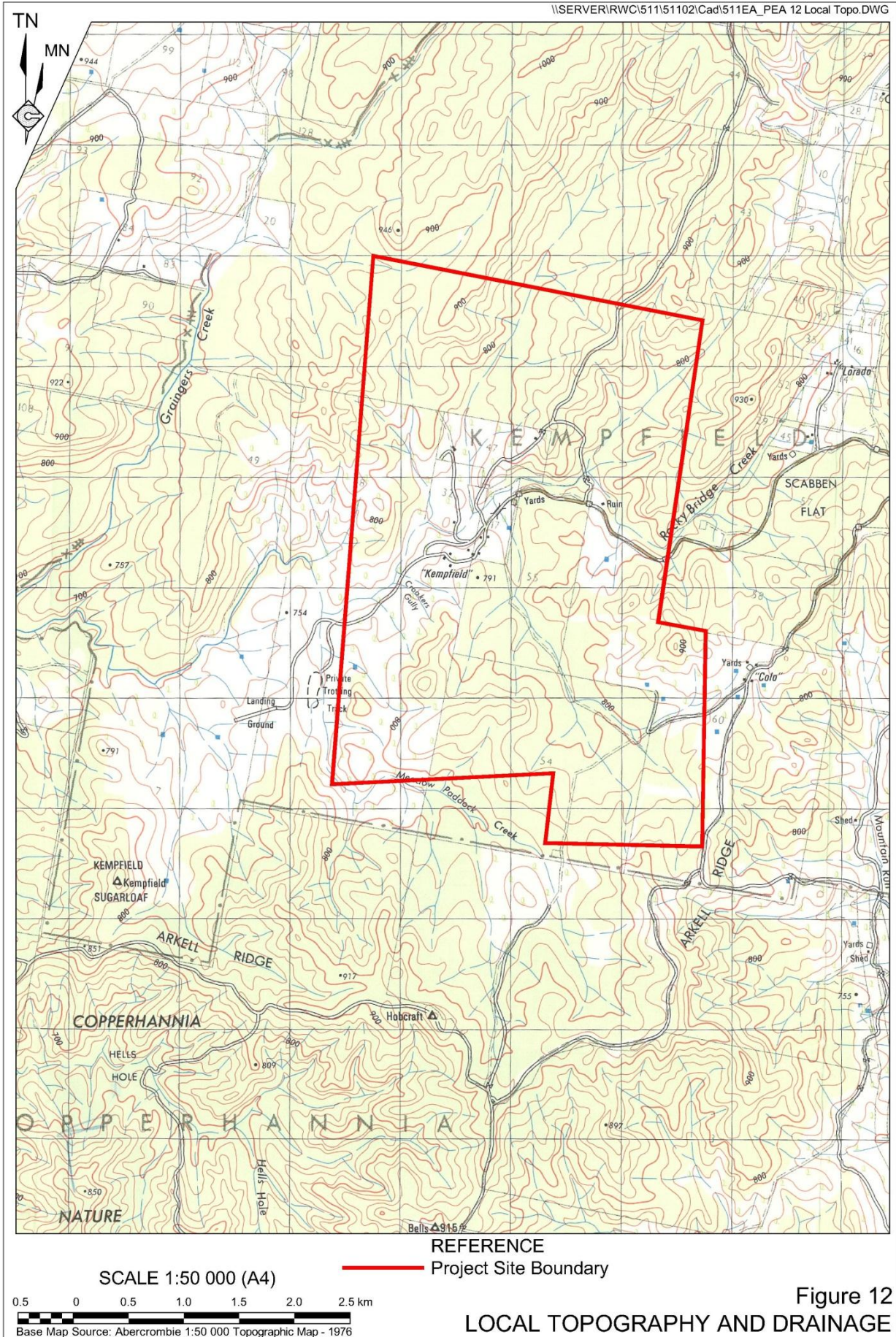
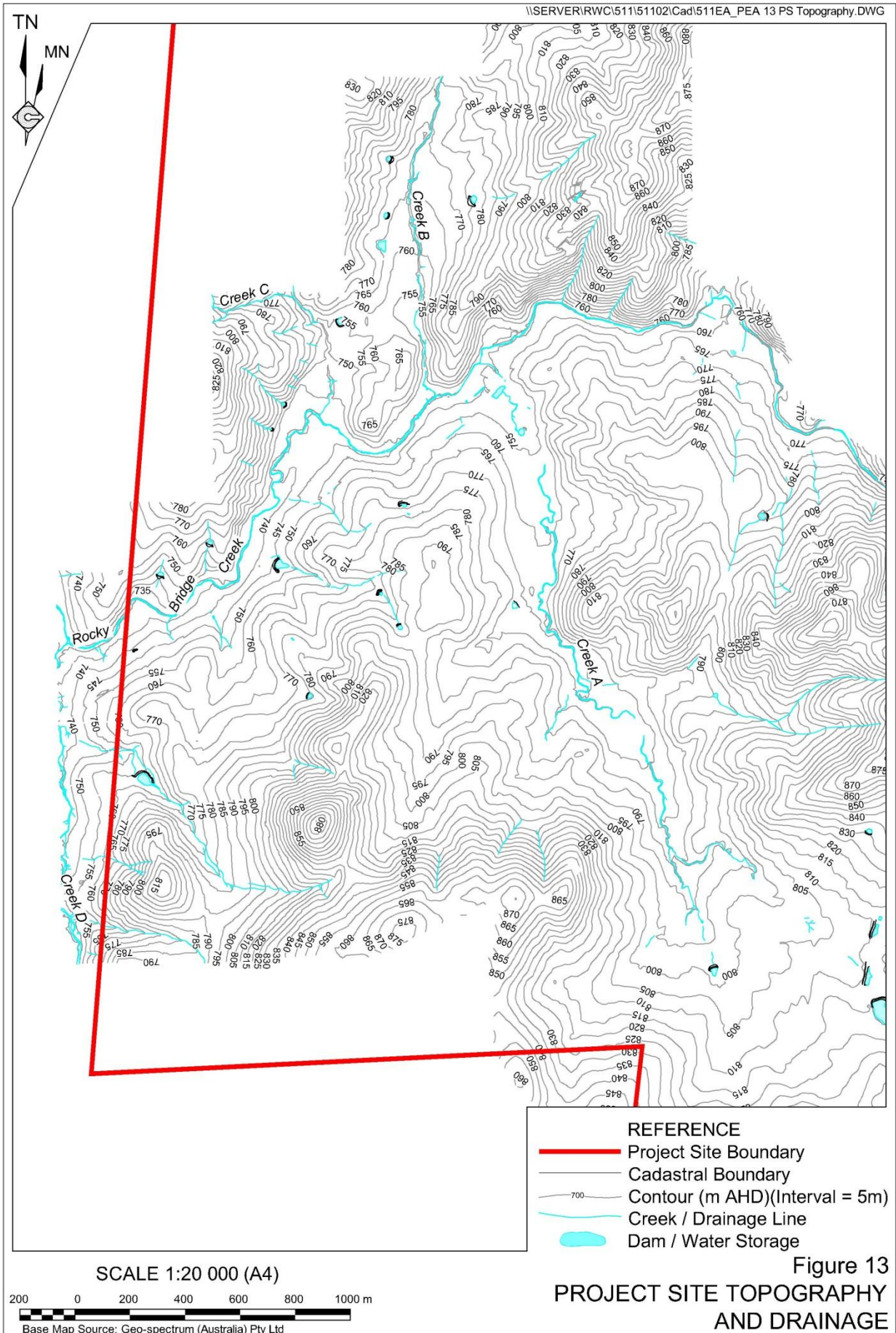


Figure 12
 LOCAL TOPOGRAPHY AND DRAINAGE



7.2.1.2 Temperature and Humidity

January is the hottest month, with a maximum average temperature of 28.0°C. July is the coldest month with an average maximum temperature of 11.2°C and an average minimum temperature of 0.6°C.

7.2.1.3 Rainfall and Evaporation

Annual average rainfall is 636.3mm, with the cooler months (April to September) typically drier than the remainder of the year, with an average monthly rainfall of 45.3mm compared with 60.7mm. The maximum daily rainfall recorded is 109mm which was recorded on 25 July 1922.

8. ENVIRONMENTAL CONSTRAINTS

8.1 INTRODUCTION

A range of specialist environmental studies are ongoing and that each of those studies is in the formative stages of preparation. As a result, this sub-section only provides a brief overview of the existing environment surrounding the Project Site and the resulting potential constraints on the Project. The *Environmental Impact Statement* will include detailed information on each of the aspects identified below, including the existing environment, assessment methodology, proposed management and mitigation measures, residual impact assessment and proposed monitoring regime.

8.2 WATER

8.2.1 Existing Environment

The *Groundwater and Surface Water Assessment* is being undertaken by RPS Aquaterra.

RPS Aquaterra have commenced a program of groundwater testwork comprising a range of monitoring bores and a pumping test. The preliminary results of that test work indicate that groundwater inflows into the Open Cuts may be significant. Further test work and modelling will be undertaken to further quantify the anticipated groundwater inflows and associated impacts to surrounding groundwater users and the environment. That work has been, and will continue to be, undertaken in consultation with the NSW Office of Water.

8.2.2 Key Water Management Issues and Constraints

Key water management issues and constraints associated with the Project include the following potential impacts.

- Dewatering of open cuts causing drawdown of groundwater levels with associated adverse impacts on surrounding groundwater users and reduced discharge to groundwater dependent ecosystems and surface water drainages within and in the vicinity of the Project Site.



- Direct impacts to a tributary of Rocky Bridge Creek through construction of the Heap Leach Facility and Waste Rock Emplacement. Construction of these facilities will require installation of clean water diversion structures around the facilities to minimise the area of catchment removed from natural drainage.
- Indirect impacts to Rocky Bridge Creek through reduced surface water flows associated with a reduced catchment area and increased risk of contamination with chemical- or sediment-laden water.

The Applicant would implement a range of management and mitigation measures to minimise to the greatest extent practicable Project-related impacts to the surrounding water resources. In addition, the Applicant notes that it will be required to obtain a range of licences to permit:

- extraction of groundwater that would otherwise flow into the proposed open cuts; and
- extraction of water from surface water sources, or to account for water lost from those sources as a result of lowered groundwater levels.

These licences are likely to be the subject of embargos on the granting of further allocations. As a result, the Applicant acknowledges that it may be required to purchase allocations from existing licences or seek an exemption from the embargos.

8.3 BIODIVERSITY

8.3.1 Existing Environment

8.3.1.1 Introduction

The *Flora Assessment* is being undertaken by Anne Clements and Associates Pty Limited while the *Fauna Assessment* is being undertaken by Biodiversity Monitoring Services. Both specialists have undertaken the majority of their fieldwork on site, with further fieldwork required to clarify a number of issues.

It is noted that flora and fauna assessments were commenced by the Applicant's predecessor and that these surveys have been undertaken from 1999 to the present. As a result, the Applicant notes that while the length of surveys provide an overview of species present over a long period of time, it is noted that not all data has been collected in a manner that is consistent with the Biobanking methodology. The Applicant acknowledges that it is the preference of Office of Environment and Heritage that all assessment information be presented in a format compatible with that methodology. The Applicant intends to discuss this issue separately with Office of Environment and Heritage during preparation of the *Environmental Impact Statement* to ensure that data presented in that document is appropriate.



8.3.1.2 Existing Environment – Flora Assessment

The preliminary results of the flora assessment are summarised below.

- A total of 234 flora species have been identified within the flora survey area, including:
 - 165 native species,
 - no species listed under the *Threatened Species Conservation Act 1995* (TSC Act); and
 - no species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.
- Five vegetation communities have been identified within the Project Site, including the following. Further details, including a plan showing the distribution of each community, including nomenclature consistent with the TSC Act and EPBC Act will be provided in the *Environmental Impact Statement*.

- Box Gum Community.

This community occurs on more fertile soils within drainage areas covering small segmented sections within the Project Site. The community typically has a canopy height of 10m to 30m and is dominated by *Eucalyptus melliodora*, *E.* and *E. blakelyi / dealbata*.

Native understory species include *Acacia dealbata*, *Cassinia arcuata*, *Echinopogon ovatus*, *Microleana stipoides*, *Schoenus opogon*, *Euchiton involucratus*, *Geranium solanderi*, *Gonocarpus tetragynus*, *Hydrocotyle laxiflora*, *Hypericum gramineum*, *Oxalis exilis*, *Poranthera microphylla*, *Senecio prenanthoides* and *Senecio quadridentatus*.

Anne Clements and Associates classify this community as an Endangered Ecological Community & EPBC Act as follows.

- White Box, Yellow Box, Blakely's Red Gum Grassy Woodland and Derived Native Grassland – EPBC Act.
- White Box, Yellow Box, Blakely's Red Gum Woodland TSC Act.

- Shallow Soil Woodland on Ridges.

This community comprises uncleared areas of ridge-top and upper slopes and support a mixed eucalypt woodland on shallow gravelly soils, with tree canopies mostly around 15m to 20m in height. The dominant tree species are *Eucalyptus gonioclayx* (Bundy), *E. polythemos* (*Red Box*), *E. dealbata* I(Tumbledown Red Gum), *E. macroryncha* (Red Stringybark), *E. melliodora* (Yellow Box), *E mannifera* (Brittle Gum) and *Acacia dealbata*.

The understory contains the exotic *Rubus anglocandicans* (Blackberry). Native shrub species include *Cassinia arcuata* (Sifton Bush), *Daviesia leptophylla* (Slender Bitter-pea), *Dillwynia sericea* (Snowy Parrot-pea) and *Styphelia triflora*.

– Open Forest/Woodland on Lower Slopes of Valleys/Gullies

This community occurs in the southern sections of the Project Site. The community typically has a canopy height between 20m and 25m and is dominated by *Eucalyptus bridgesiana* (Apple Box), *E. macrorhyncha*, *E. mannifera* and *E. melliodora*. Regrowth areas contained large populations of *Acacia dealbata* at 7m to 8m in height.

Native understorey species included *Joycea pallida* (Red-anther Wallaby Grass), *Austrodanthonia racemosa* (Ringed Wallaby Grass), *Daviesia leptophylla*, *Dochondra* sp. A (Kidney Weed), *Galium gaudichaudii* (Rough Bedstraw), *Hibbertia obtusifolia* (Guinea-flower), *Hyupericum gramineum* (Small St John's-wort), *Lmondra filiformis* subsp. *Flavior* (Wattle Mat-rush), *Lomandra multiflora* (Many-flowered Mat-rush), *Luzula meridionalis* (Wood-rush), *Poa sieberiana* (Fine-leaf Tussock Grass), *Poranthera microphylla*, *Veronica claycina* (Hairy Speedwell) and *Wurmbea dioica* (Early Nancy). Exotic weed infestation by *Rubus anglocandicans* was noted on the valley slopes to the north-east of the Project Site.

– Creek Flat Open Forest

This community occurs on deeper more fertile soils on the creek flats. The canopy is dominated by *Eucalyptus viminalis* (Ribbon Gum) and *E. melliodora* and *E. bridgesiana* at heights of approximately 27m. *Acacia dealbata* occurs frequently in the mid-storey to a height of 8m.

A high frequency of exotic species included *Nasseall trichotoma* (Serrated Tussock), *Rosa rubiginosa* (Briar Rose) and *Rubus anglocandicans*. Also frequent were *Acetosella vulgaris* (Sorrel), *Anagallis arvensis* (Pimpernel), *Briza maxima* (Quaking Grass), *Cirsium vulgare* (Spear Thistle), *Crepis capillaris* (Smooth Hawksbeard), *Hypochaeris radicata* (Cat's-ears), *Trifolium flomeratum* (Clustered Clover), *Vicia sativa* subsp. *Angustifolir* (Narrow-leaved Vetch) and *Vulpia* spp. (Rats-tail Fescue).

Native understorey species include *Dichondra* sp. A, *Glycine clandestine* (Twining Glycine), *Juncus gregiflorus* I (a rush), *Microtis unifolia* I (Onion Orchid) and *Poa labillardierei* (Tussock Grass).

– Cleared Grazing Paddocks

The pasture is mostly composed of exotic grasses *Bromus molliformis* (Silky Brome), *Cynosurus echinatus* (Rough Dogtail Grass), *Dactylis glomerata* (Cocksfoot), *Lolium perenne* (Perennial Ryegrass) and *Phalaris aquatic* (Phalaris), the pasture legume *Trifolium subterraneum*, (Subterranean Clover) and the herbaceous weed species *Carthamus lanatus* (Saffron Thistle) and *Echium plantagineum* (Paterson's Curse).

Some native grasses are also present, the most abundant being *Austrodanthonia racemosa*, *A. setacea*, *Microlaena stipoides* (Meadow Rice-grass), *Panicum effusum* (Hairy Panic) and *Themeda australis* (Kangaroo Grass). The sedge *Carex incomitata* and the rush *Juncus gregiflorus* also occurred in patches.

On a cleared, level summit of the spur in the vicinity of the BJ North Open Cut an anomalous area of extremely stunted native grassland dominated by dwarfed plants of the native grass *Austrodanthonia monticola* was observed. The area, however, included bare or lichen-encrusted soil between the grass tufts. It is possible the stunting, together with exclusion of most exotics, may be related to high metal concentrations in the soil.

The only native shrub recorded in the cleared area was *Cassinia arcuata*.

8.3.1.3 Existing Environment – Fauna Assessment

Biodiversity Monitoring Services note that a search of the Atlas of New South Wales Wildlife administered by the Office of Environment identified 7 mammals, 17 birds, 3 amphibians and 1 invertebrate species listed under the TSC Act within 50km of the Project Site. Biodiversity Monitoring Services has undertaken targeted searches for each of these species and will include an assessment of significance for each in the final *Fauna Assessment*.

Biodiversity Management Services have undertaken three surveys within the Project Site, namely in July 1999, November 1999 and February 2010. Those surveys identified a total of 112 fauna species comprising

- 77 birds;
- 19 native and 7 introduced mammals;
- 11 reptiles; and
- 5 amphibians.

Of the identified species, the following are listed under the TSC Act.

- Eastern False Pipistrelle.
- Eastern Bent-wing Bat.
- Large-footed Myotis.
- Greater Broad-nosed Bat.
- Gang-gang Cockatoo.
- Brown Treecreeper.
- Scarlet Robin.
- Varied Sittella.

The four threatened bird species are woodland-dependant and are associated with remnant patches of woodland. Two of the four bat species (Eastern Bent-wing Bat and Large-footed Myotis) utilize caves or mines for roosting whilst the Greater Broad-nosed Bat utilizes tree hollows. The Eastern False Pipistrelle mainly roost in tree hollows but are known to also use caves.

Fauna species listed under the EPBC Act and possibly could occur within 10km of the Study Area include:

- Regent Honeyeater.
- Swift Parrot.
- Superb Parrot.
- Australian Painted Snipe.
- Fork-tailed Swift.
- White Egret.
- Cattle Egret.
- White-bellied Sea-Eagle.
- White-throated Needletail.
- Rainbow Bee-eater.
- Satin Flycatcher.
- White Egret.
- Latham's Snipe.
- Painted Snipe.
- Murray Cod.
- Macquarie Perch.

An assessment of the significance of potential impacts on all listed species identified within or recorded as likely to occur in the vicinity of the Project Site will be included in the *Environmental Impact Statement*.

8.3.2 Key Biodiversity Issues and Constraints

Key biodiversity-related issues and constraints associated with the Project include the following.

- potential impacts on TSC Act or EPBC Act-listed species, communities or populations; and
- potential loss of biodiversity and habitat caused by vegetation clearing.

The *Flora Assessment* and *Fauna Assessment* will each include a detailed description of the surveys undertaken for the Project, including the survey methodology, recommendations in relation to minimising biodiversity-related impacts and assessments of significance of impacts under both the TSC Act and EPBC Act. In addition, the *Environmental Impact Statement* will include a range of management and mitigation measures as well as a justification of the Project Site layout with a focus on minimising the potential biodiversity-related impacts to the greatest extent practicable.

Finally, the Applicant would, continue to consult with the Office of Environment and Heritage, identify and assess appropriate Biodiversity Management Strategies that will be included in the *Environmental Impact Statement*.

8.4 NOISE AND BLASTING

8.4.1 Existing Environment

The *Noise and Blasting Assessment* is being undertaken by Spectrum Acoustics Pty Ltd.

The Project Site lies within an isolated rural setting encompassed predominantly by native vegetation, pine plantations and light grazing agricultural land. There are no industrial noise sources and the default *Industrial Noise Policy* background noise levels of 30dB(A) have been assumed.



8.4.2 Key Noise and Blasting Issues and Constraints

The key potential noise-related impact associated with the Project is noise levels in excess of the relevant criteria at a single residence located immediately adjacent to the Project Site to the west of the Quarries Open Cut. This residence, referred to hereafter as the Cooper Residence, may also be adversely impacted by noise and blasting emissions and changes to the visual environment within the Project Site. The Applicant has commenced preliminary discussions with the owner of the Property, with a view to further negotiations to purchase part or all of the property. Those negotiations are ongoing and further details will be provided in the *Environmental Impact Statement*.

No other surrounding residences are expected to receive noise levels in excess of the relevant criteria.

8.5 AIR QUALITY

8.5.1 Existing Environment

The *Air Quality and Greenhouse Gas Assessment* is being undertaken by Environ Australia Pty Ltd.

The Project Site lies within an isolated rural setting encompassed predominantly by native vegetation, pine plantations and light grazing agricultural land. As a result, the existing air quality environment is typical of a rural setting, namely, particulate emissions are principally associated with vehicle movement on unsealed roads, agricultural operations, wind erosion of bare areas and, occasionally, bushfires.

Environ Australia will include a detailed description of the existing environment in the *Air Quality and Greenhouse Gas Assessment*,

8.5.2 Key Air Quality Issues and Constraints

The key potential air quality-related impact associated with the Project is suspended and deposited dust concentrations and levels in excess of the relevant criteria at the Cooper Residence. As indicated in Section 8.5.2, the Applicant has commenced preliminary discussions with the owner of the Property, with a view to further negotiations to purchase part or all of the property.. Those negotiations are ongoing and further details will be provided in the *Environmental Impact Statement*.

No other surrounding residences are expected to receive dust concentrations or levels in excess of the relevant criteria.

8.6 HERITAGE

8.6.1 Existing Environment

The *Heritage Assessment* is being undertaken by OzArk Environment and Heritage Management Pty Ltd (OzArk).

A field survey for the assessment was undertaken between 19 and 21 July 2011 and during September and October 2012. Preliminary results from that assessment are as follows.

- A number of open scatters were identified, principally located on flat terraces adjacent to creek lines.



- While the number of trees of an age suitable to possess cultural scars are limited, two scarred trees were identified.
- One culturally significant site was identified, namely a cluster of grass trees.

The Aboriginal community involved with the field survey did not provide an assessment of the significance of the identified sites. However, OzArk anticipate that the community will determine the sites to have a high cultural significance.

No sites of non-Aboriginal heritage significance were identified.

8.6.2 Key Heritage Issues and Constraints

The location of these sites in relation to the proposed site layout had not been confirmed at the time that this document was finalised. However, OzArk indicated that it was likely that a small proportion would be disturbed. The Applicant will, once the locational information has been made available, investigate options to modify the proposed layout to minimise the number of sites that may be impacted.

In addition, the Applicant would develop, in consultation with the Aboriginal community, a range of management and mitigation measures that would be embodied in an *Aboriginal Heritage Management Plan* during preparation of the *Environmental Impact Statement* or immediately following it.

8.7 TRAFFIC AND TRANSPORTATION

8.7.1 Existing Environment

The *Traffic Assessment* is being undertaken by Traffic Solutions. That assessment will include the *Heavy Vehicle Route Assessment* identified in Section 5.4.2.

The Applicant notes the following in relation to the local roads surrounding the Project Site.

- Roads immediately surrounding the Project Site are typical rural local roads with a mix of light and heavy vehicles and generally low traffic levels.
- The proposed transportation route to Blayney would require the use of local road controlled by both Bathurst Regional and Blayney Shire Councils.
- The Mid-Western Highway is a State Road.

8.7.2 Key Traffic Issues and Constraints

The following constraints are likely to apply which ever route is selected.

- Increased traffic levels on local roads resulting in damage to those roads and increased maintenance costs.
- Use of roads and intersections that may require upgrading or additional maintenance for the type and number of vehicles.
- Increased traffic levels resulting in increased journey times for residents.

Each of these issues would be addressed in the *Environmental Impact Statement*.



8.8 BUSHFIRE MANAGEMENT

8.8.1 Key Bushfire Management Issues and Preliminary Assessment

The Project Site is identified under the Bathurst LEP, the Project Area is located within the Category 1 and 2 bushfire risk zone. The Applicant is currently undertaking further assessment and the necessary mitigation measures required. This will be presented in the *Environmental Impact Statement*.

