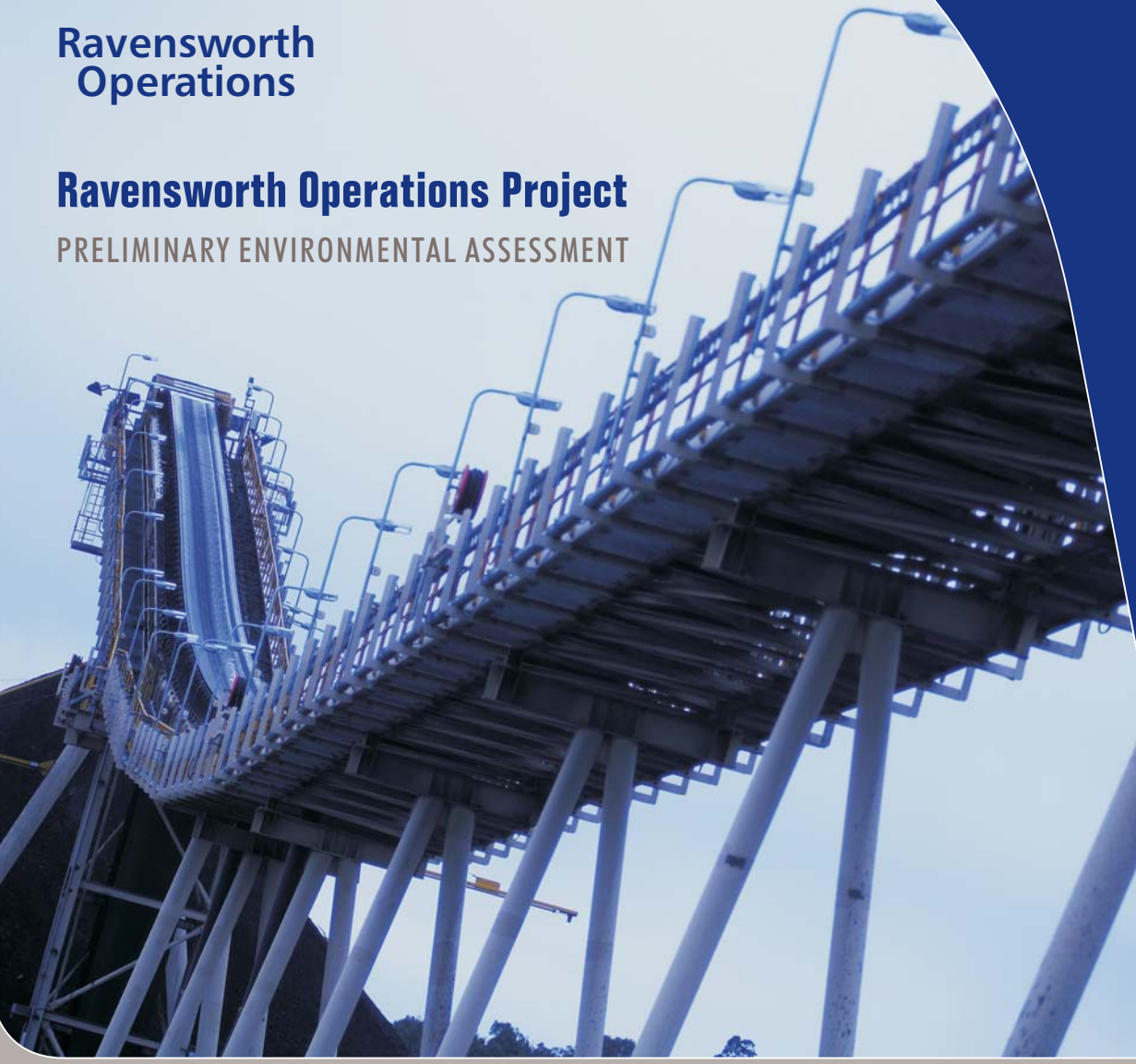
Ravensworth Operations

# Ravensworth Operations Project

## PRELIMINARY ENVIRONMENTAL ASSESSMENT



Managed by

xstrata coal

**JANUARY 2009**

Umwelt
Environmental Consultants

# Preliminary Environmental Assessment
# Ravensworth Operations Project

## Prepared by

## Umwelt (Australia) Pty Limited

## on behalf of

## Ravensworth Operations

| | | | |
|---|---|---|---|
| Project Director: | Barbara Crossley | | |
| Project Manager: | Tim Crosdale | | |
| Report No. | 2383/R05/Final | Date: | January 2009 |


Umwelt
Environmental Consultants

2/20 The Boulevarde
PO Box 838
Toronto NSW 2283

Ph: 02 4950 5322
Fax: 02 4950 5737
Email: mail@umwelt.com.au
Website: www.umwelt.com.au

# TABLE OF CONTENTS

# FIGURES

# PLATES



# APPENDICES

# 1.0 Introduction

Ravensworth Operations Pty Limited (Ravensworth Operations) is comprised of Ravensworth West Mine and Narama Mine and is situated between the townships of Singleton and Muswellbrook, in the Upper Hunter Valley region of New South Wales (NSW) (refer to **Figure 1.1**). Ravensworth Operations is a wholly owned subsidiary of Xstrata Coal (Xstrata).

There has been an extended history of mining operations in this area, with open cut mines associated with the former Ravensworth South and Ravensworth No. 2 mines operating from the early 1970s. The currently approved and operating mining operations, including Narama Mine and Ravensworth West Mine have been operating since the early 1990s. Both of the existing mining operations are approaching their operational extent with the planned cessation of mining in approximately 2011.

In addition to Ravensworth Operations, Xstrata subsidiaries have a number of mining operations within the greater Ravensworth area including Cumnock No. 1 Colliery, Ravensworth Underground Mine (formerly Newpac No. 1 Colliery), Mt Owen Complex, which includes Mt Owen, Ravensworth East and Glendell mines and Liddell Colliery (refer to **Figure 1.2**). The proximity of these operations provides Xstrata with significant opportunities for increased integration to maximise synergies between mining operations within the area.

Ravensworth Operations has undertaken an extensive exploration program within its mining leases, which has identified a significant coal resource within the Ravensworth area. The extent of the identified coal resource indicates sufficient reserves to enable the continuation of open cut mining operations for a further 20 to 30 years.

Due to projected demand for export quality coal, Xstrata is investigating the feasibility of extending the currently approved open cut mining operations. Further project planning is being undertaken in conjunction with environmental studies to ensure that impacts are minimised and up to date management measures are implemented.

The Ravensworth Operations Project (the Project), will involve continued open cut mining within the existing mining leases, including accessing additional mining areas and integration with surrounding Xstrata operations, particularly in relation to coal handling infrastructure, water and environmental management systems.

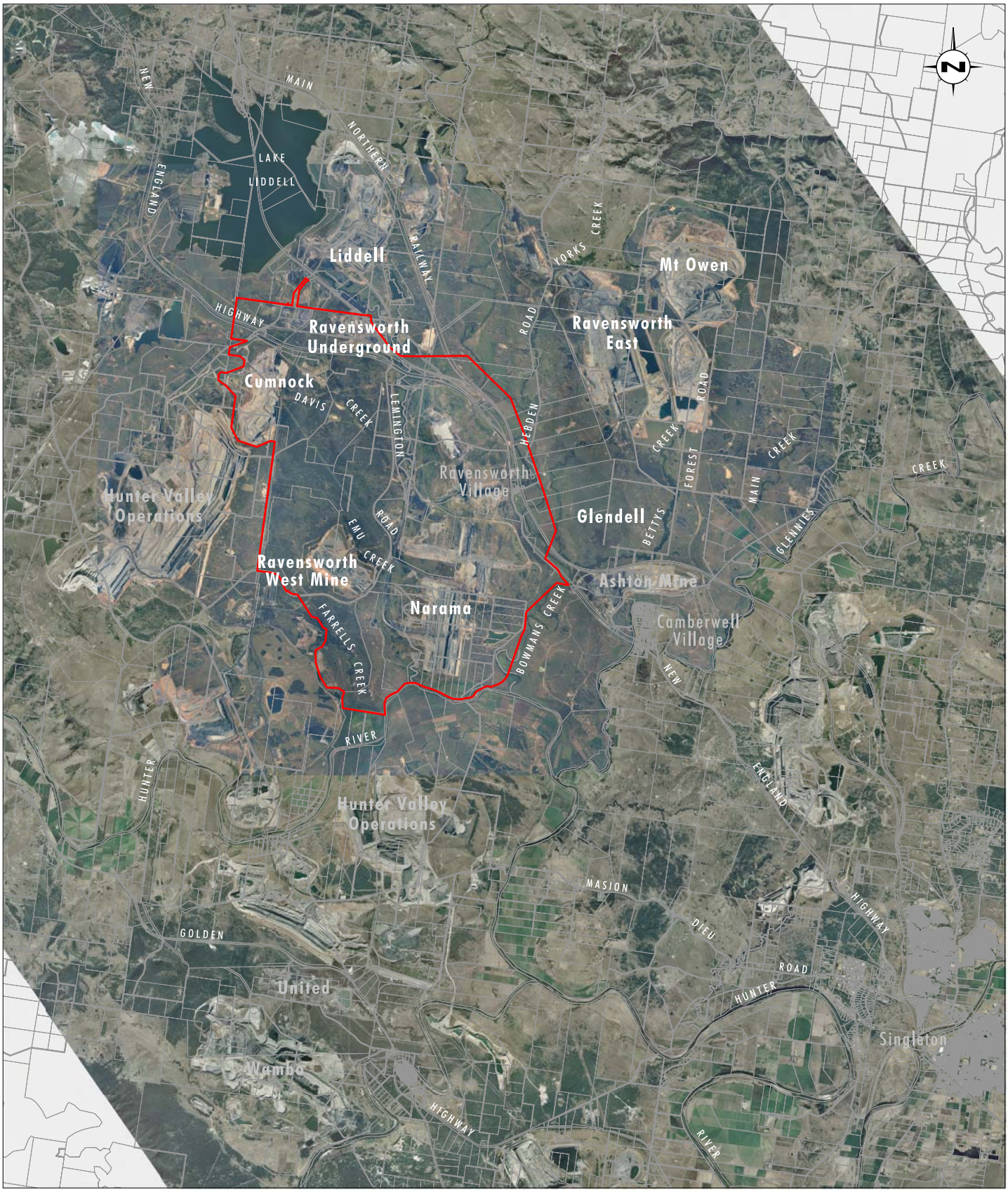
The Project is identified as a Part 3A Project as defined by the State Environmental Planning Policy (SEPP) Major Projects 2005, and requires the approval of the NSW Minister for Planning. An Environmental Assessment report is planned to be lodged with the Department of Planning (DoP) in mid 2009.

## 1.1 Project Overview

The key features of the Project are outlined in **Table 1.1** and depicted on **Figure 1.3**. Further details of the Project are provided in **Section 2.0**.


FIGURE 1.1

Locality Plan



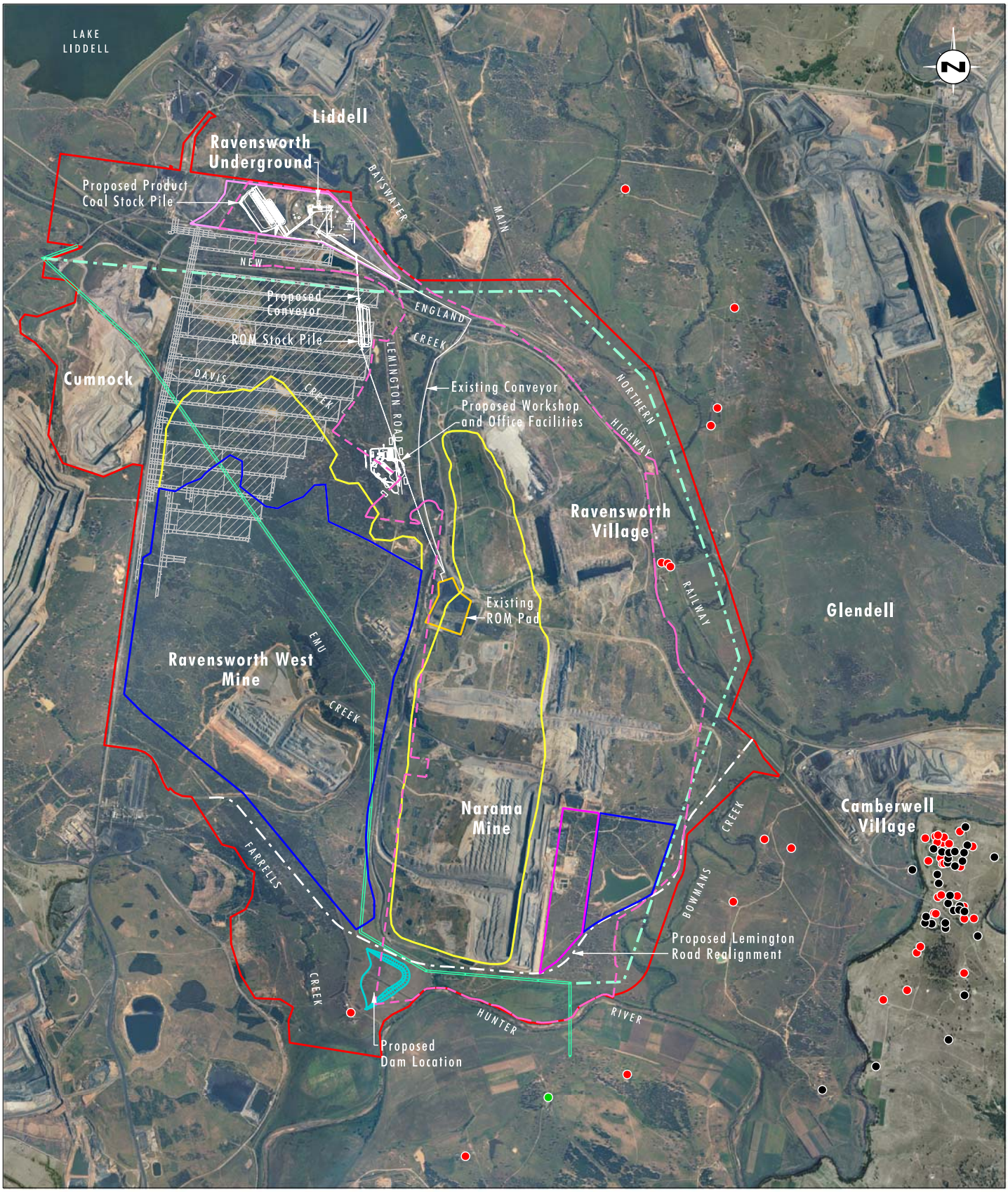

Source: Ravensworth Operations (2007)

0 2.0 4.0 6km
1:130 000

Legend
Project Area

FIGURE 1.2

Existing Mining Operations
Greater Ravensworth Area




Source: Ravensworth Operations 2007, HLA 2001 and ERM 1998

0 1.0 2.0 3km
1:60 000

## Legend

- Project Area
- Indicative Pit Shell (Ravensworth North and Narama Pits)
- Out of Pit Dump
- Ravensworth Coal Terminal
- Narama Extended
- Ravensworth Underground Mining Operations
- Cumnock Underground Workings
- Existing 330kV Transmission Line
- Proposed 330kV Transmission Line
- Mined Owned Residence
- Private Residence
- Private Residence with Agreement

FIGURE 1.3

Ravensworth Operations Project

File Name (A4): R05_V1/2383_041.dgn

**Table 1.1 – Key Features of Project**

| Major Project Components/Aspects | Proposed Operations |
|---|---|
| **Limits on Extraction** | • Up to 16 million tonnes per annum (Mtpa) run-of-mine (ROM) coal |
| **Mine Life** | • 29 years from granting of mining leases |
| **Operating Hours** | • 24 hrs/day, 7 days/week |
| **Number of Employees** | • Up to approximately 450 Full Time Equivalents |
| **Mining Methods** | • Open cut mining using dragline and truck and shovel |
| **Mining Areas** | • Extension of existing operations and additional open cut mine and out-of-pit dump areas |
| **Infrastructure** | • New surface infrastructure facilities and workshop building north of Davis Creek<br>• New conveyor system and ROM stockpile<br>• Expansion and upgrade of the Ravensworth Coal Terminal (RCT) to process up to 20 Mtpa ROM coal from Ravensworth Operations and Ravensworth Underground<br>• Re-alignment of an existing 330 kV transmission line<br>• Upgrade/expansion of Ravensworth Underground Mine surface infrastructure |
| **Tailings Strategy** | • Tailings emplacement in former Cumnock open cut, Ravensworth South and Narama voids |
| **External Coal Transport** | • Use of RCT and transport of product coal via the Main Northern Railway line<br>• Use of existing conveyor system for transport of coal to domestic power generators |
| **Road Diversions** | • Diversion of Lemington Road<br>• Current re-alignment requires the construction of a new intersection with the New England Highway approximately 6 kilometres south-east of the current Lemington Road intersection |

## 1.2 Purpose of the Document

This Preliminary Environmental Assessment has been prepared by Umwelt (Australia) Pty Limited (Umwelt) on behalf of Ravensworth Operations in order to brief relevant government agencies about the Project, introduce the environmental studies conducted to date and identify key issues to be addressed in the Environmental Assessment (EA) for the Project. This document will be provided to each of the relevant agencies prior to the Planning Focus Meeting to be held in early 2009. The Director-General's Requirements (DGRs) for the Project will be sought following the Planning Focus Meeting.

Project planning and environmental impact assessment are in progress. All information presented in this document is therefore in preliminary form and may be subject to change in the future.

References in this document to the 'Project area' relate to the proposed open cut mining area and land required for surface facilities associated with the Project (including existing facilities) and their immediate surrounds, as shown on **Figure 1.3**.

# 2.0 Description of the Project

## 2.1 Approved and Existing Operations

As outlined in **Section 1.0**, the area surrounding the Project area is dominated by existing and decommissioned mining operations. The proposed open cut mining areas associated with the Project are located in an area which includes part of the approved Cumnock No.1 Colliery area in the north-west, encompasses the Ravensworth West Mine in the south, and Narama Mine to the east. Surface facilities will be integrated with surface facilities of the Ravensworth Underground Mine, located in the northern portion of the Project area. The voids remaining from the previous Ravensworth No.2 and Ravensworth South mining operations will also be integrated with continued operations, for use for overburden and tailings placement, optimising the final landform of this area.

A number of existing development consents for current operations overlap with the Project area. The relevant development consent boundaries are shown in **Figure 2.1** and a summary of the existing development consents is provided in **Section 2.1.1**.

### 2.1.1 Existing Development Consents

#### 2.1.1.1 Cumnock No. 1 Colliery

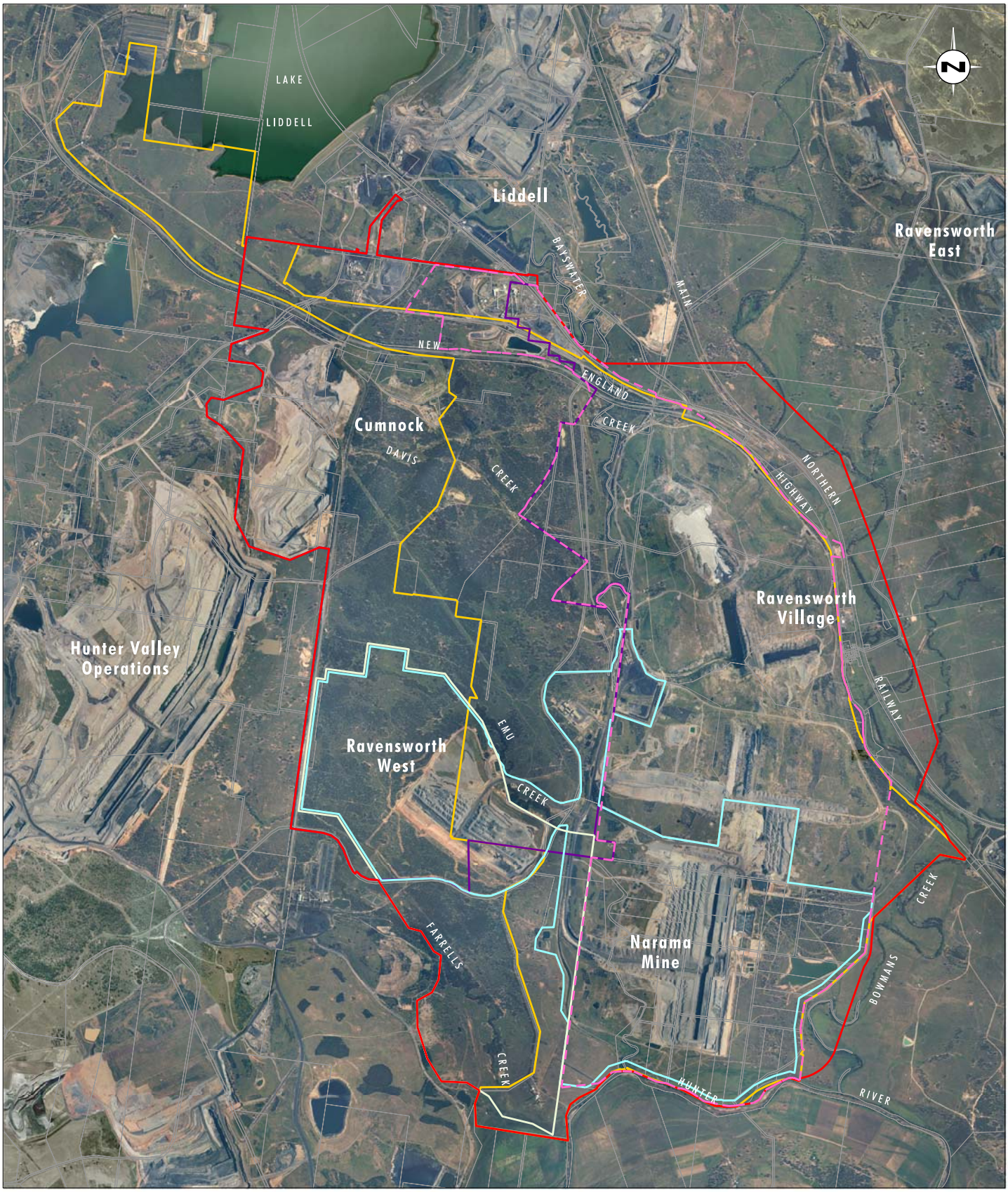
Cumnock is a wholly owned subsidiary of Cumnock Coal Limited, 84 per cent of which is owned by Xstrata. Cumnock is a long established mine, operating since the early 1950s, and operations have included both underground and open cut activities.

A large portion of the Project area is covered by existing Cumnock development consents (refer to **Figure 2.1** and **Table 2.1**). Previous underground operations at Cumnock consisted of three separate seams of the Vane Subgroup of the Wittingham Coal Measure including the Lower Pikes Gully Seam, the Liddell Seam and the Barrett Seam. The most recent workings were located in the Lower Pikes Gully Seam, which involved longwall operations extending south of the New England Highway. In September 2003, underground mining was discontinued due to deteriorating geological conditions and as a result, the mine entries were sealed in 2004.

The Cumnock open cut operations remain active and utilise various infrastructure associated with the surface facilities of the former underground operations. The open cut operations comprise the No. 1 Open Cut, the South Open Cut Stages 1 and 2 and the South Open Cut Stage 3. No. 1 Open Cut was situated to the north of the New England Highway and was operated from March 1992 to July 1994. Cumnock has used this void as a tailings and overburden emplacement area. This area is currently being filled with coarse reject, reshaped and capped to final landform. The South Open Cut Stages 1 and 2, situated in the north-east of the current operations, was operated from January 1994 to January 1999 within five seams. Currently, two cells of the Stage 2 mining area are being used for the emplacement of tailings. The South Open Cut Stage 3 recommenced operations in 2003 and is located in the north-eastern extent. Mining in the South Open Cut Stage 3 was completed in late 2008, and development consent lapses in 2022.

#### 2.1.1.2 Ravensworth West

In 1998, Ravensworth West was granted development consent (DA 165/97) for the construction and operation of the open cut coal mine extension. Ravensworth West was developed as an extension of the Ravensworth South and Narama mining operations. All coal from the Ravensworth West operations is used by Macquarie Generation at its nearby




Source: Ravensworth Operations (2007)

0 1.0 2.0 3km
1:60 000

## Legend

- Project Area
- Ravensworth Operations Complex
- Cumnock Continued Operations Development Consent Boundary
- Ravensworth West Development Consent Boundary
- Narama Development Consent Boundary
- Ravensworth Underground Mining Operations

FIGURE 2.1

Development Consent Boundaries

Liddell and Bayswater power stations. The coal resources being targeted include the Vaux, Broonie and Bayswater Seams of the Jerrys Plains Sub-Group which lie above and are separated from the Vane Subgroup (being targeted by the Project) by the Archerfield Sandstone.

The existing approved development consent boundary for Ravensworth West extends into the proposed mining area for the Project. The consent includes two distinct open cut pits, producing up to 3.9 Mtpa of product coal. Ravensworth West operations currently produce up to 1.1 Mtpa and utilise the existing Ravensworth South/Narama facilities. The current mining operations commenced in 2006 and are planned to cease in 2011. The development consent for Ravensworth West lapses in 2019.

#### 2.1.1.3 Narama

Narama Open Cut Mine, located in the south-east extent of the Project area, was granted development consent (DA 135/90) in 1991 for the production of 2.2 Mtpa of product coal. A recent modification of the Narama development consent (DA 135/90) enabled an increased production rate to up to 3.5 Mtpa. In the Narama Pit, coal is extracted from six seams: the Vaux, Vx, Vo and V1/2, Ravensworth R1 and R2 and Bayswater Seams of the Jerrys Plain Sub Group of the Wittingham Coal Measures. All coal from the Narama operations is used by Macquarie Generation at its nearby Liddell and Bayswater power stations. Current approved mining operations are expected to cease in approximately 2011, and the development consent lapses in 2012.

#### 2.1.1.4 Ravensworth Underground Mine

Ravensworth Underground Mine (RUM) is located to the north and east of the proposed mining area. The lease area underlies the existing Narama and decommissioned Ravensworth South and Ravensworth No.2 Open Cut Mines. It is estimated that the mine has approximately a 35 year resource with a production capacity of 5 Mtpa ROM high quality steaming and semi-soft coking coal. The RUM mine plan is based on extracting reserves from the Lemington, Pikes Gully, Upper and Middle Liddell Seams and the Barrett Seam of the Vane Subgroup of the Wittingham Coal Measures. Longwall extraction depth will vary from a minimum of approximately 180 metres in the Pikes Gully Seam to a maximum of 350 metres in the Barrett Seam (Hawley *et al* 1995). Coal produced by RUM is processed on site through the Ravensworth Coal Terminal (RCT), including the use of the associated rail load out facilities. Coal from RUM is both transported to the Port of Newcastle for exporting and used by Macquarie Generation for use at its nearby Liddell and Bayswater power stations.

### 2.1.2 Future Planning Approval

As noted in previous sections, there are a number of existing development consents for the current mining operations located within the Project area. It is proposed that Project Approval pursuant to Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) will provide for a single consent that covers all of the existing consents for open cut mining and surface facilities within the Project area. The single Project Approval will enable the integration of environmental management across Ravensworth Operations to meet current regulatory and community expectations.

Central to the management of the Project will be the development of comprehensive management systems and procedures consistent with Xstrata's Sustainable Development (SD) Framework. The SD Framework is aligned to, and applies the principles of, ISO14001 (the international Standard for EMS), is designed to achieve Xstrata's 17 Business Principles and SD Policy, and incorporates the NSW Minerals Council's Enduring Value sustainability framework and principles.

A summary of the existing development consents for current operations that will be consolidated into a single Project approval for the Project is outlined in **Table 2.1**.

**Table 2.1 - Current Development Consents within the Project Area**

| Operation | Development consent |
|---|---|
| Narama Mine | DA135/90 |
| Ravensworth West Mine | DA165/97 |
| Cumnock | DA123-05-01 |
| | DA178/99 |
| | DA169/96 |
| | DA90/96 |
| | DA75/94 |
| | DA46/93 |
| | DA40/92 |
| | DA105/92 |
| Ravensworth Underground (RUM)* | DA104/96 |
| | DA161-7-2005 |

* This Project only relates to surface infrastructure of RUM – this approval is not seeking to cover continued RUM underground mining.

### 2.1.3 Mining Leases

There are a number of mining authorities that currently exist within the Project area (refer to **Table 2.2**). Ravensworth Operations proposes to rationalise the existing mining authorities within the Project area as part of this Project.

**Table 2.2 – Ravensworth Operations Mining Leases**

| Instrument | Expiry |
|---|---|
| CL380 | 23/09/2012 |
| CL580 | 31/12/2023 |
| CCL723 | 31/01/2024 |
| ML1357 | 17/08/2015 |
| CCL739 | 10/03/2029 |
| EL5297 | 07/05/2009 |
| ML1576 | 24/02/2027 |
| CL378 | 10/03/2027 |
| CL392 | 24/03/2013 |
| ML1526 | 02/12/2023 |
| MPL311 | 13/05/2014 |
| ML1325 | 09/09/2014 |
| ML1327 | 03/06/2013 |
| ML1300 | 29/09/2013 |
| ML1373 | 09/09/2014 |
| ML1393 | 10/02/2027 |
| ML1421 | 12/10/2018 |

**Table 2.2 – Ravensworth Operations Mining Leases (cont)**

| Instrument | Expiry |
|---|---|
| ML1502 | 02/01/2023 |
| A385 | 02/06/2011 |
| Northern Area EL | Application by Ravensworth Operations Pty Ltd pending |
| Southern Area EL | Application by Ravensworth Operations Pty Ltd pending |

## 2.2 Proposed Mining Operations

### 2.2.1 Geology and Resource Description

The coal resources within the Project area include seams of the Foybrook and Burnamwood Formations, which form part of the Wittingham Coal Measures. These seams include most of the economic seams currently mined at surrounding operations within the Ravensworth area. The coal seams extend from the shallow Broonie Seams, through the Bayswater, Lemington, Pikes Gully, Arties, Liddell and Barrett Seams, to the Hebden Seam (refer to **Figure 2.2**).

The maximum depth from surface to the Hebden Seam within the Project area is approximately 300 metres. The Barrett Seam is the deepest seam proposed to be targeted as part of the Project. The Barrett Seam lies at depths between approximately 160 metres in the north-west and approximately 260 metres in the south-east of the Project area. Due to the known characteristics of the Hebden Seam, it is currently not economically viable to target this seam as part of the Project. Where additional circumstances become apparent, the Hebden Seam may be targeted through the finalisation of the Project design.

There are some 40 separately named coal plies within the target coal seams. Generally the coal plies vary in average thickness between 0.3 metre and 3.35 metres. The related interburden thickness varies between 0.25 metre and 25 metres on average. The interburden and overburden generally consist of sandstones and siltstones with the presence of some Palaeolithic channels. The average ROM coal stripping ratio across the Project area is approximately 4.9:1.

Regionally, the strata dips gently (<5 degrees) to the south-east within the Project area towards the Bayswater Syncline and flattens to the south-west around the Ravensworth North monocline. Structurally, the stratum within the Project area is relatively simplistic.

There are a number of significant geological structures within the Project area (refer to **Figure 2.3**) that have the potential to influence mine plan design. These include:

- **Davis Creek Fault** – the Davis Creek Fault represents the eastern extent of all previous underground mining associated with the approved Cumnock Underground. It is the major fault in the area, trending north-east and located west of the Hunter Valley dyke. It affects all of the target coal seams within the Project area. A series of smaller normal faults are also associated with this feature. Relevant stability studies and careful mine planning will be undertaken to alleviate the impact of this feature on open-cut mining.

- **Hunter Valley Dyke** - the Hunter Valley Dyke is a regional feature which extends across the Project area on a north-west to south-east axis (refer to **Figure 2.3**). Exploration surveys have characterised the dyke as an igneous feature approximately 30 metres wide, and it is inferred that the dyke will cinder and heat affect coal for up to 40 metres

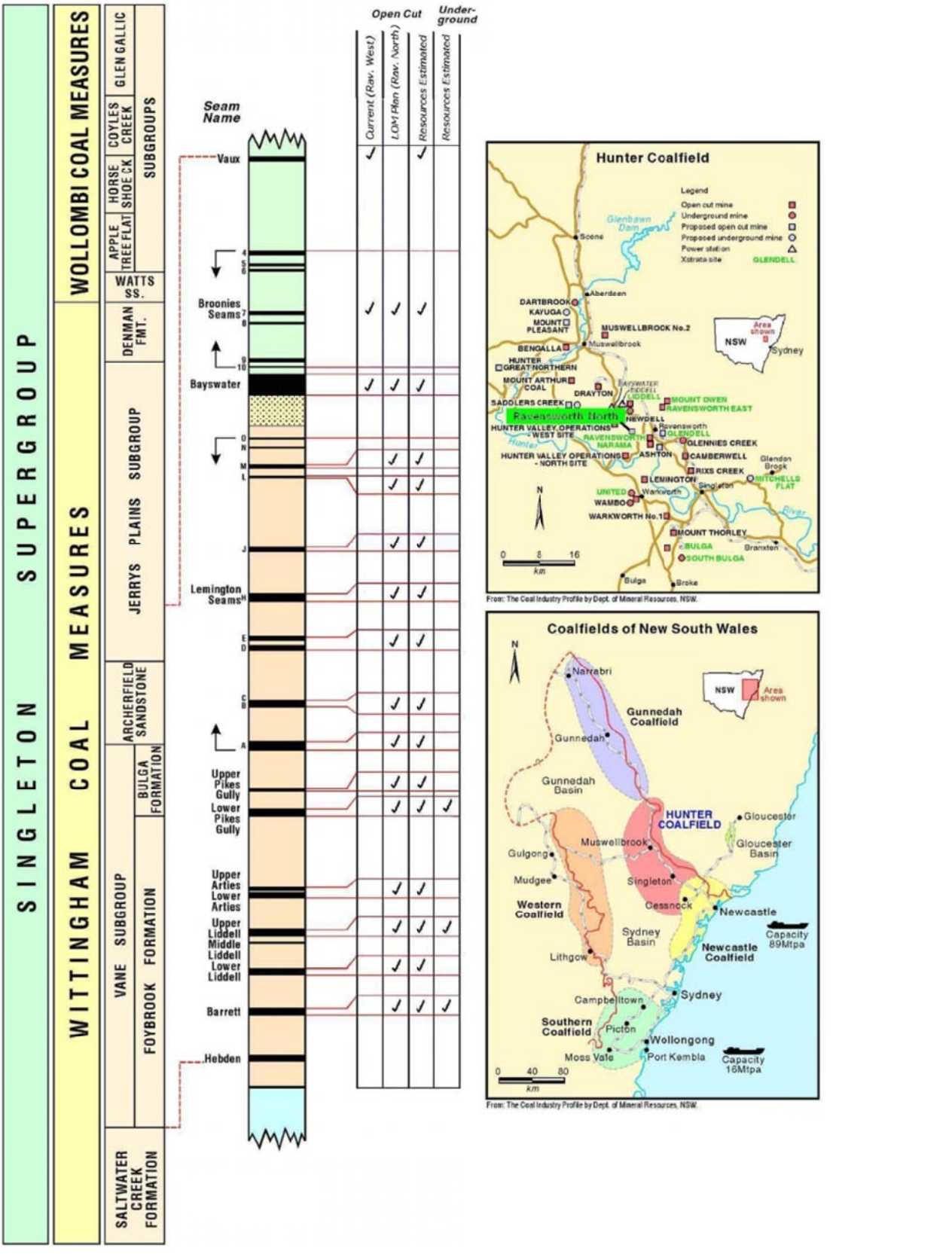
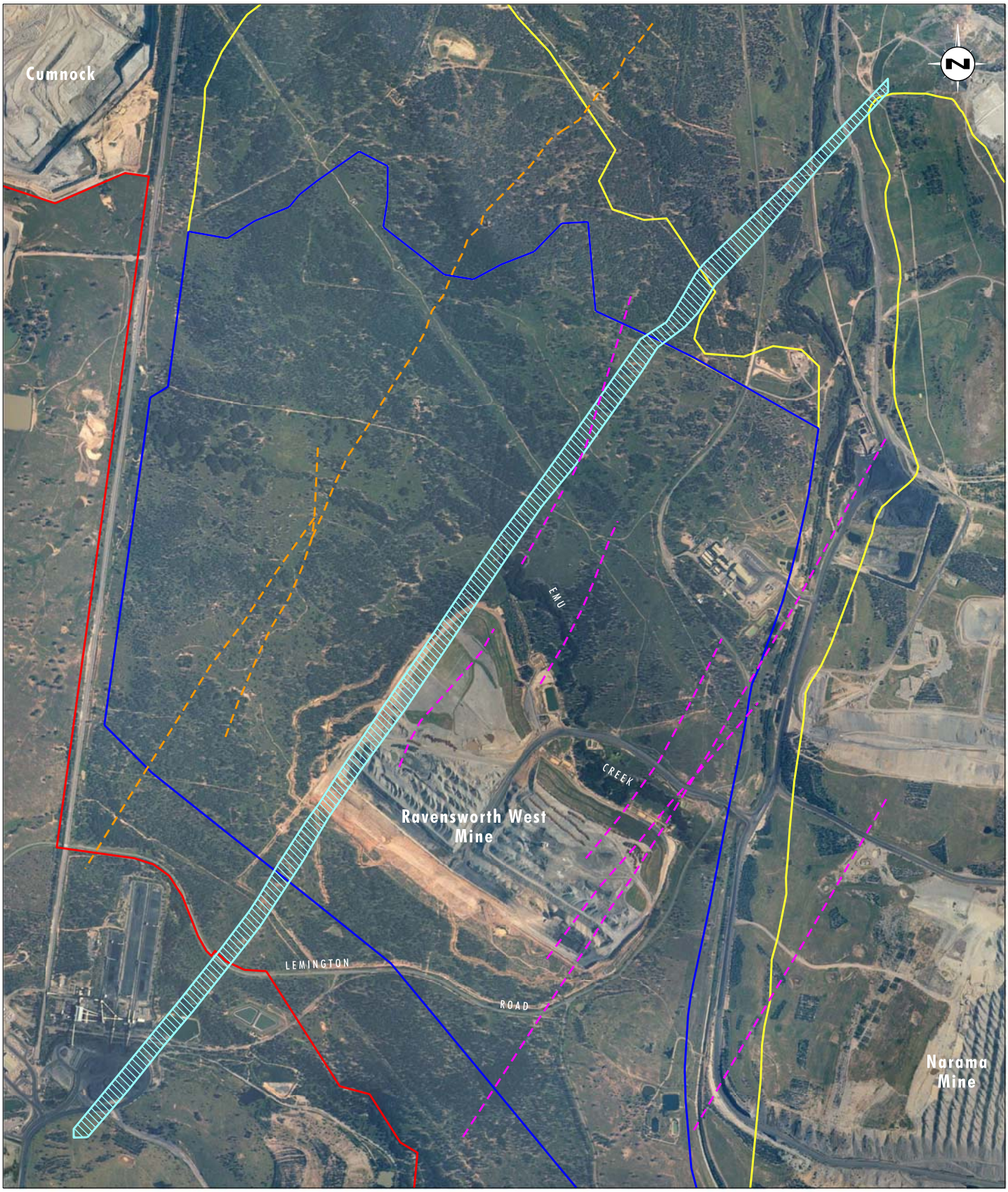



FIGURE 2.2

Typical Stratigraphic Section

Source: McElroy Bryan Geological Services, January 2008

File Name (A4): R05_V1/2383_042.dgn




Source: Ravensworth Operations 2007, Xstrata Coal

0 0.25 0.5 1km
1:25 000

Legend
- Project Area
- Indicative Pit Shell
- Out of Pit Dump
- Hunter Valley Dyke
- Davis Creek Fault
- Block Fault Zone

FIGURE 2.3

Geological Features

from its margins. Surrounding mining operations intersect the dyke and demonstrate that economical and efficient mining operations can be undertaken within the zone associated with this feature.

- **Block Fault Zone** - the Block Fault Zone is a zone of increased frequency of smaller scale faults as intercepted by a number of operations in the central Hunter Valley (Cumnock, Ravensworth West, Liddell, Wambo, Coal and Allied's Hunter Valley Operations). This zone is located about 500 metres to 1 kilometre east of the Hunter Valley Dyke and is trending north-easterly across the Project area.

- **Localised sandstone channels** - affect some target seams within the Project area and predominantly exist in the form of increased mid-burdens between coal seams, but can also occur in the form of localised washouts of portions of the coal seam thickness.

Based on known characteristics of the target coal seams within and surrounding the Project area, it is considered that there is a low propensity for spontaneous combustion. Project design is based on maximising resource recovery through the mining process, with minimal coal wasted to spoil and the holing into old underground workings is not planned.

A number of exploration programs have been conducted in and around the Ravensworth area since the 1960s. The main seams of interest have been the thicker seams in the lower mid sequence (Lower Pikes Gully and Liddell Seams) for underground mining and most exploration focussed on these seams.

Further exploration activity during 2007 sought to gain additional coal quality information on the target seams within the Project area. This recent information enabled Ravensworth Operations to proceed with feasibility studies and provides a basis for ongoing exploration work leading to pit development and production.

Deposit geometry and structure of the area is reasonably well understood due to coverage of holes intersecting all seams to the Barrett seam at a grid spacing of 500 metres. The exploration program undertaken to date has characterised a coal resource of approximately 300 Mt within the target coal seams. Based on current conceptual mine planning, this resource would enable open cut mining operations to occur for a period of up to 29 years.

The target seams located outside of the proposed mining area occur at increasing depth and have been partially mined by underground methods. The proposed mining area is relatively unconstrained by physical and environmental factors affecting mine design. As such, the proposed mine life of 29 years defines the economically and environmentally feasible open cut mining areas within the Project area.

The characteristics of the target coal seams within the Project area demonstrate qualities to produce high quality thermal and semi soft coking coal for the export market.

### 2.2.2 Conceptual Mine Plan

The conceptual mine plan for open cut mining operations associated with the Project is shown on **Figure 1.3**. Ravensworth Operations proposes to develop a multi seam open cut mining operation within an area west of Bayswater Creek, known as the Ravensworth North Pit. This open cut mining area will encompass some of the existing Ravensworth West open cut. Mining is scheduled to commence soon after approval is granted, for a period of approximately 29 years.

Mining is proposed to commence in the northern extent of the Project area and progress to the south over the life of the mine. The initial mining sequence will focus on the establishment of a box cut, targeting the shallow target coal seams within this area, including

the seams overlying the former Cumnock Underground workings. The objective of the initial mining operation is to uncover the lower strata of the target coal seams as early as practicable in the mining process in order to maximise opportunities for overburden emplacement in pit during operations.

The initial mining sequence will require the development of out of pit overburden emplacement areas adjacent to the proposed mining area to the north and east (refer to **Figure 1.3**). The limit of the northern out of pit overburden dump is Davis Creek, which will be maintained through the development of the Project. As outlined above, the conceptual mine plan has been developed to maximise opportunities for in pit overburden emplacement which will also have the effect of minimising the out of pit overburden emplacement areas, where practicable. Based on the current mine plan the northern out of pit overburden emplacement area will be developed during the initial stages of mining and for a period up to seven years. Following this time, overburden will be emplaced in pit as the development of the mine progresses.

The eastern out of pit overburden emplacement areas will be on the rehabilitated voids associated with the former Ravensworth No. 2 and Ravensworth South sites (refer to **Figure 1.3**). In the eastern overburden emplacement area, overburden will be preferentially dumped into the voids associated with the former Ravensworth No. 2, Ravensworth South and the Narama mine operations.

Currently it is expected that mining will occur up to approximately 260 metres below the surface within the Project area, with mining of seams down to the Barrett Seam. The current proposed mining footprint, including proposed mining areas and overburden emplacement areas, is approximately 1800 hectares. All proposed mining areas will be progressively rehabilitated throughout the life of the mine to achieve a suitable final landform.

Ravensworth Operations is also investigating the eastwards extension of mining operations at Narama to enable the continuation of the currently approved operations (refer to **Figure 1.3**). At this stage, the eastern extension of mining will focus on accessing additional coal resources within the Narama mine lease and will enable a further two to three years of production. The limit of the eastward extension of the Narama Mine is currently being reviewed in detail and will be determined by the extent of economic coal reserves and the consideration of relevant environmental constraints and water management system requirements.

Ravensworth Operations proposes to mine up to approximately 16 Mtpa ROM coal over a period of up to 29 years. The proposed 29 year mine life will enable Ravensworth Operations to access all of the identified coal reserves economically viable for open cut mining within the Project area. This will also enable Ravensworth Operations to operate under a single Project approval over the total life of the Project.

Based on current mine scheduling, the proposed rate of ROM coal production is expected to gradually increase over the initial mine plan stages before peaking at approximately 16 Mtpa in approximately Year 7 of the proposed operation. The production rate will be sustained at approximately 11.5 Mtpa to approximately Year 23 of operations, when it is expected to decrease to approximately 8 Mtpa prior to mine closure.

Ravensworth Operations is currently undertaking the detailed design of the proposed open cut mining operations which will consider the findings of the baseline environmental studies and assessment as part of the EA process.

### 2.2.3 Mining Method

Ravensworth Operations utilises a dragline and truck and shovel operation in its two mines to remove overburden and transport raw coal to the mine's crushing plant. A similar method will be used for open cut mining as part of the Project.

The initial mining sequence will be undertaken through an excavator and truck mining fleet, including a number of electric rope shovels. This initial mining method will be maintained for the development of the initial box cut to the uncovering of the lower strata of the target coal seams within the Project area. From this stage of the conceptual mining sequence, the existing dragline at Narama will be moved into the Ravensworth North Pit and will be the primary overburden stripping machine for the remainder of the mine life.

A pre strip fleet is also proposed to be utilised over the life of the Project. The pre strip fleet will advance in front of the mining operation to uncover the upper most target coal seams. A fleet of mine trucks will also be utilised in order to haul overburden to out of pit and in-pit overburden emplacement areas, and extracted coal to coal processing infrastructure (refer to **Section 2.3**).

As part of detailed Project design, Ravensworth Operations will review mining method and fleet specifications in response to potential environmental constraints. This will include, but will not be limited to, review of overburden emplacement sequencing and the potential use of noise attenuation on mining equipment, where required. These controls, where required, will be incorporated into the mine plan for the Project.

Where thickness is sufficient, both overburden and coal will be blasted as part of the proposed mining operations. The Project area is located in proximity to a range of infrastructure including coal handling, water management (dams) and electrical transmission lines. The potential impacts of the proposed mining operations on this infrastructure will be considered as part of detailed Project design.

### 2.2.4 Workforce and Hours of Operation

Once at full operation, it is proposed that approximately 450 people will be employed by the Project. Mining operations are planned to continue to be undertaken 24 hours per day, seven days per week.

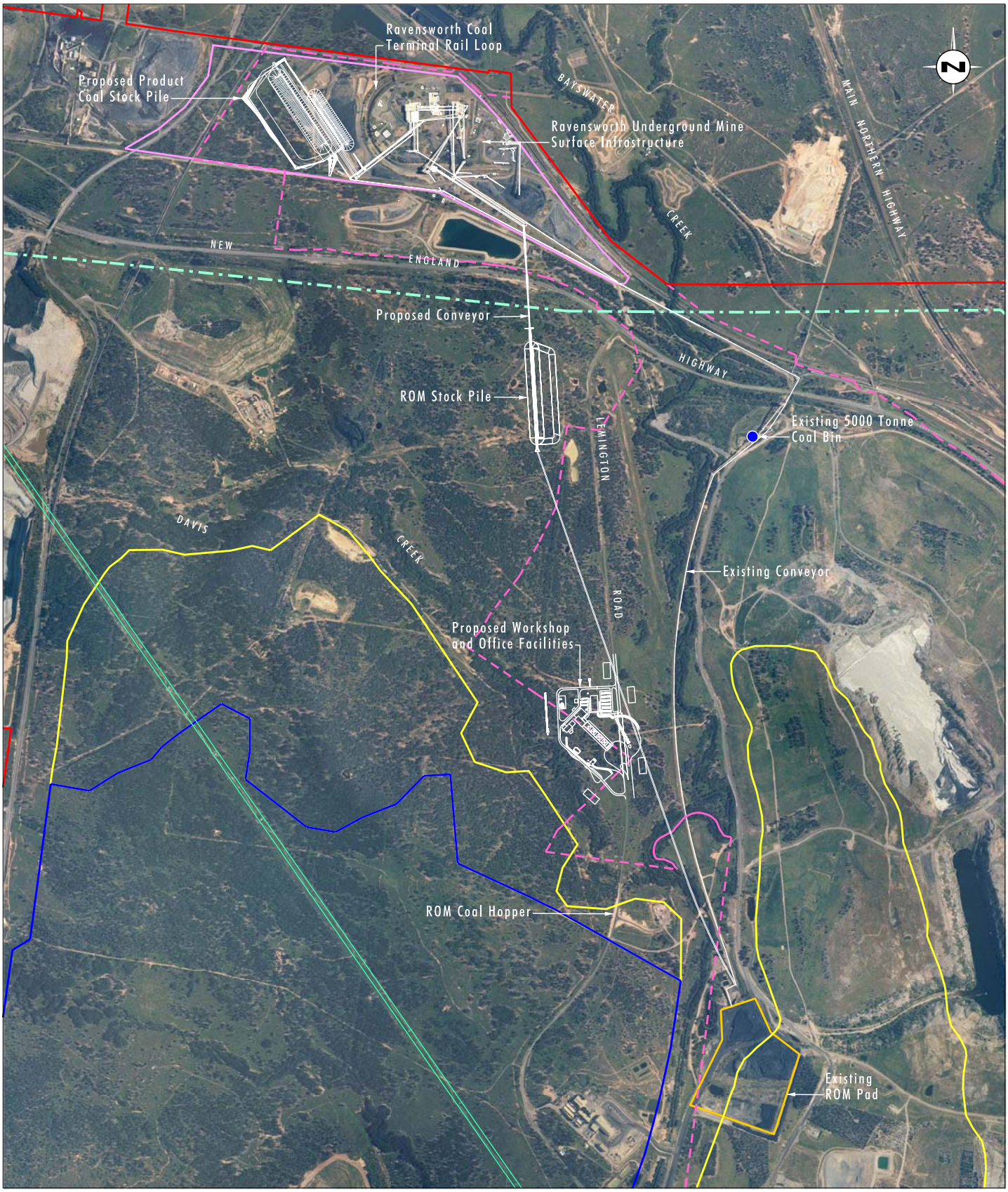
## 2.3 Coal Processing and Transportation

### 2.3.1 ROM Coal Handling

The proposed ROM coal handling system, including proposed conveyor alignments and stockpile areas, are shown on **Figure 2.4**. Coal produced from the Ravensworth North open cut pit will be hauled by truck to a proposed ROM hopper located immediately to the north-east of the proposed mining area, where it will be transferred via conveyor to a proposed ROM stockpile located to the west of the current Lemington Road (refer to **Figure 2.4**).

ROM coal will be reclaimed from the proposed ROM stockpile and conveyed to the RCT for processing (refer to **Section 2.3.2**). From the proposed coal stockpile the conveyor alignment extends to the north where it is proposed to cross the New England Highway via an overhead conveyor bridge.

The proposed conveyor alignment has been developed to enable the establishment of the proposed ROM coal hopper in close proximity to the proposed mining area. In addition, the




Source: Ravensworth Operations 2007, HLA 2001 and ERM 1998

0 0.25 0.5 1km
1:25 000

## Legend

- Project Area
- Indicative Pit Shell
- Out of Pit Dump
- Ravensworth Coal Terminal
- Ravensworth Underground Mining Operations
- Existing 330kV Transmission Line
- Proposed 330kV Transmission Line

File Name (A4): R05_V1/2383_043.dgn

FIGURE 2.4

**Project Infrastructure Layout**

existing ROM coal stockpile and conveyor system will be maintained to provide additional ROM handling and transportation capacity (refer to **Figure 2.4**).

The existing conveyor system transports coal produced from the existing Narama and Ravensworth West mines to a 5000 tonne coal bin adjacent to the New England Highway, and onto the 'M' series conveyor to Macquarie Generation. The existing conveyor system is proposed to be augmented to enable transport of ROM coal to RCT either via the proposed ROM coal stockpile or directly to the RCT.

## 2.3.2 Coal Handling and Processing

As outlined in **Section 2.3.1**, coal produced from the Project is proposed to be processed at the RCT facility located in the northern extent of the Project area. The RCT facility was originally approved in 1982 and is currently utilised for the processing and loading of coal produced by RUM, Cumnock No. 1 Colliery and Muswellbrook Coal. The RCT facility provides an opportunity for Ravensworth Operations to maximise the use of existing coal handling infrastructure within the Ravensworth area.

Ravensworth Operations proposes to upgrade the RCT to increase its capacity to up to 20 Mtpa to enable the processing of coal from the Project, as well as to continue to process coal from existing users of the facility. The objective of the proposed upgrade to the RCT facility is to achieve the latent capacity of this established coal handling infrastructure. The conceptual design for the upgrade of the RCT facility includes the following key features:

- expansion of existing ROM coal stockpiles at RCT to receive coal from the overland conveyor system;
- construction of additional product coal stockpiles at the existing RCT facility and augmentation of existing stacking systems;
- upgrades to coal handling modules to increase the rate of ROM coal feed into RCT and increase product coal handling and train load out facilities; and
- install additional coal processing module at the RCT.

### 2.3.2.1 Ravensworth Underground Mine Surface Infrastructure

The surface infrastructure associated with RUM is located adjacent to the RCT facility (refer to **Figure 2.4**). As part of the proposed upgrade to RCT, opportunities for the augmentation and upgrade of the surface facilities associated with RUM will be investigated and included as part of the Project. As outlined in **Section 2.1.2**, it is proposed that the Project approval will cover only the relevant surface facilities associated with RUM, with the underground operations to be continued under the existing development consent.

## 2.3.3 Product Coal Transportation

Export coal processed from the Project will be transported via the upgraded RCT facility. As outlined on **Figure 2.4**, the RCT rail loop comes directly off the Main Northern Railway line, which provides direct access to the Port of Newcastle and export markets. There are a number of existing users of the RCT rail load out and rail loop, which will be consulted through the finalisation of Project design.

As outlined in **Section 2.3.1**, it is proposed to maintain the overland coal conveyors associated with existing Ravensworth Operations for the transport of coal produced directly to Macquarie Generation for domestic power generation. It is envisaged that this existing

coal transportation system would be predominantly used by continued Narama Mine operations. It is proposed to maintain this existing infrastructure over the life of the Project to provide the option of servicing any future contracts with domestic power generators with coal produced from the Project.

### 2.3.4 Rejects and Tailings Management Strategy

Within the Project area there are a number of existing reject and tailings emplacement areas currently servicing coal processing facilities associated with Cumnock wash plant and the RCT facility. The existing reject and tailings emplacement areas are primarily void spaces associated with former open cut mining operations in the Ravensworth area (refer to **Figure 2.5**) and include:

- Cumnock Stage 1 and Stage 2 open cut tailings dams;
- RUM 7 South tailings dam – eastern final void associated with former Ravensworth South mining operations; and
- tailings dams associated with RUM surface infrastructure facilities.

The increased coal processing capacity as a result of the proposed RCT upgrade will require the development of additional rejects and tailings management capacity for coal produced from the Project. The conceptual rejects and tailings management strategy for the Project will include the continued use of the existing rejects and tailings emplacement areas and a number of additional locations. There are a number of voids within the Project area that are available for rejects and tailings emplacement and will be targeted for use as part of the Project. The proposed rejects and tailings emplacement areas for the Project are shown on **Figure 2.5** and include:

- Cumnock Stage 3 void;
- Narama southern ramp; and
- Narama final void.

The conceptual tailings management strategy currently provides for use of the rejects and tailings emplacement areas on a staged basis throughout the life of the Project. The specific staging will be determined in relation to operational considerations. Further details of the rejects and tailings management strategy will be developed through the finalisation of the Project design and will be assessed as part of the EA.

## 2.4 Site Infrastructure

The conceptual mine plan for the Ravensworth North pit proposes mining through the existing Ravensworth Operations administration and workshop facilities located off Lemington Road. It is proposed to construct a new mine infrastructure area as part of the Project. In addition, the Project will require the re-alignment of the existing Lemington Road and a 330 kV transmission line that currently crosses the proposed mining area. Further discussion of these infrastructure requirements is provided in following sections.


Source: Ravensworth Operations 2007, HLA 2001 and ERM 1998

0 1.0 2.0 3km
1:50 000

## Legend

- Project Area
- RUM Surface Infrastructure
- Cumnock Stage 1 Tailings Dam
- Cumnock Stage 2 Tailings Dam
- Cumnock Stage 3 Void
- 7 South Tailings Dam
- Narama Final Void
- Narama Southern Ramp

File Name (A4): R05_V1/2383_044.dgn

FIGURE 2.5

**Conceptual Reject and Tailings Emplacement Areas**

### 2.4.1 Mine Infrastructure Area

The conceptual mine plan sequence will enable the continued use of the existing Ravensworth Operations administration and workshop facilities for approximately the first five years of the Project. Ravensworth Operations proposes to construct a new mine infrastructure area to the north of Davis Creek. The existing and proposed mine infrastructure facilities are shown on **Figure 2.4**. The proposed mine infrastructure area has been positioned to enable ready access from the northern portion of the existing Lemington Road. The conceptual design of the mine infrastructure area includes the following facilities:

- office and bathhouse;
- maintenance workshop facilities;
- vehicle wash down areas;
- refuelling facilities; and
- hardstand areas for car parks and vehicle manoeuvring.

The proposed relocation of mine infrastructure facilities will require the augmentation of existing ancillary services, such as power, water supply and telecommunications facilities. Ravensworth Operations will consult with relevant service providers through the detailed design and construction of the proposed infrastructure facilities.

### 2.4.2 Lemington Road Realignment

The current Lemington Road alignment crosses the proposed mining area (refer to **Figure 1.3**). As outlined in **Section 2.4.1**, the northern extent of the current Lemington Road, to the intersection with the New England Highway, will be maintained for access to the mine infrastructure area. It is proposed to realign the southern portion of Lemington Road prior to the commencement of open cut mining.

The proposed realignment of Lemington Road is shown on **Figure 1.3**, and will include the relocation of the road to the southern extent of the Project area. The proposed location is consistent with the original alignment of Lemington Road prior to the commencement of the Narama mine operations. It is a requirement of the Narama development consent (DA 135/90) for Ravensworth Operations to reinstate Lemington Road to its original alignment after completion of mining.

The proposed realignment will include the upgrade of the original intersection of Lemington Road and the New England Highway approximately 6 kilometres to the south of the existing intersection. The proposed intersection is the former original alignment of Lemington Road.

### 2.4.3 330 kV Transmission Line

As shown on **Figure 1.3**, an existing 330 kV transmission line crosses the proposed mining area and will need to be relocated as part of the Project. Ravensworth Operations has investigated a number of options for the relocation of the 330 kV transmission line, including a range of options in proximity to the proposed mining area. Due to the operational constraints associated with the maintenance of the transmission line in proximity to mining areas, it is proposed to relocate the transmission line to outside of all proposed operational areas.

The proposed alignment is shown on **Figure 1.3**, and includes the relocation of the transmission line to the east of its current alignment north of the proposed mining area. The proposed alignment will cross the New England Highway and run adjacent to the Highway towards the south, prior to crossing the Highway to join the current alignment south of the Project area.

### 2.4.4 Water Management System

Xstrata operations in the greater Ravensworth area, including the existing Ravensworth Operations, Mt Owen Complex, Liddell Colliery, Cumnock Colliery and RUM, participate in the Greater Ravensworth Water Sharing System (refer to **Figure 2.6**). The Greater Ravensworth Water Sharing System links the existing water management systems of Xstrata operations in the Ravensworth area to enable the sharing and beneficial re-use of water between operations. The operations are linked through a range of water transfer infrastructure and storages, including surface storages, voids and former underground workings.

The location of the Project provides an opportunity for the integration of the proposed development into the Greater Ravensworth Water Sharing System. Ravensworth Operations has undertaken detailed studies on the Greater Ravensworth Water Sharing System to assess the opportunities for the integration of the Project into this system, including the beneficial re-use of existing mine water sources for uses such as coal processing, dust suppression and vehicle wash down.

As part of this review of water management requirements, Ravensworth Operations has identified the need for additional surface water storage capacity for the Project. It is proposed to maximise the use of the final voids associated with former mining operations within the Project area for water storage and management, where possible. As shown on **Figure 1.3**, it is also proposed to construct a water storage dam within the southern extent of the Project area. The proposed water storage dam will be designed to provide additional water storage for use as part of the Project and will enable participation in the Greater Ravensworth Water Sharing System.

## 2.5 Alternatives and Justification

### 2.5.1 Project Alternatives

Ravensworth Operations has undertaken detailed concept and pre-feasibility studies into the proposed mining operation and as part of this process numerous alternative mine and infrastructure plans were considered. Minimising environmental and community impacts and maximising economic resource recovery have been major considerations in the evaluation of alternative options.

In this context, early conceptual mine plans for the Project included mining and out of pit overburden emplacement areas extending to the northern extent of the Project area, requiring the removal of Davis Creek. In response to the identification of a number of ecological and archaeological constraints, including grinding groove sites, along Davis Creek, a decision was made early in the Project design process to limit mining operations to the south of Davis Creek. **Figure 2.7** depicts the evolution of the conceptual mine design in relation to the identified environmental constraints associated with the removal of Davis Creek.

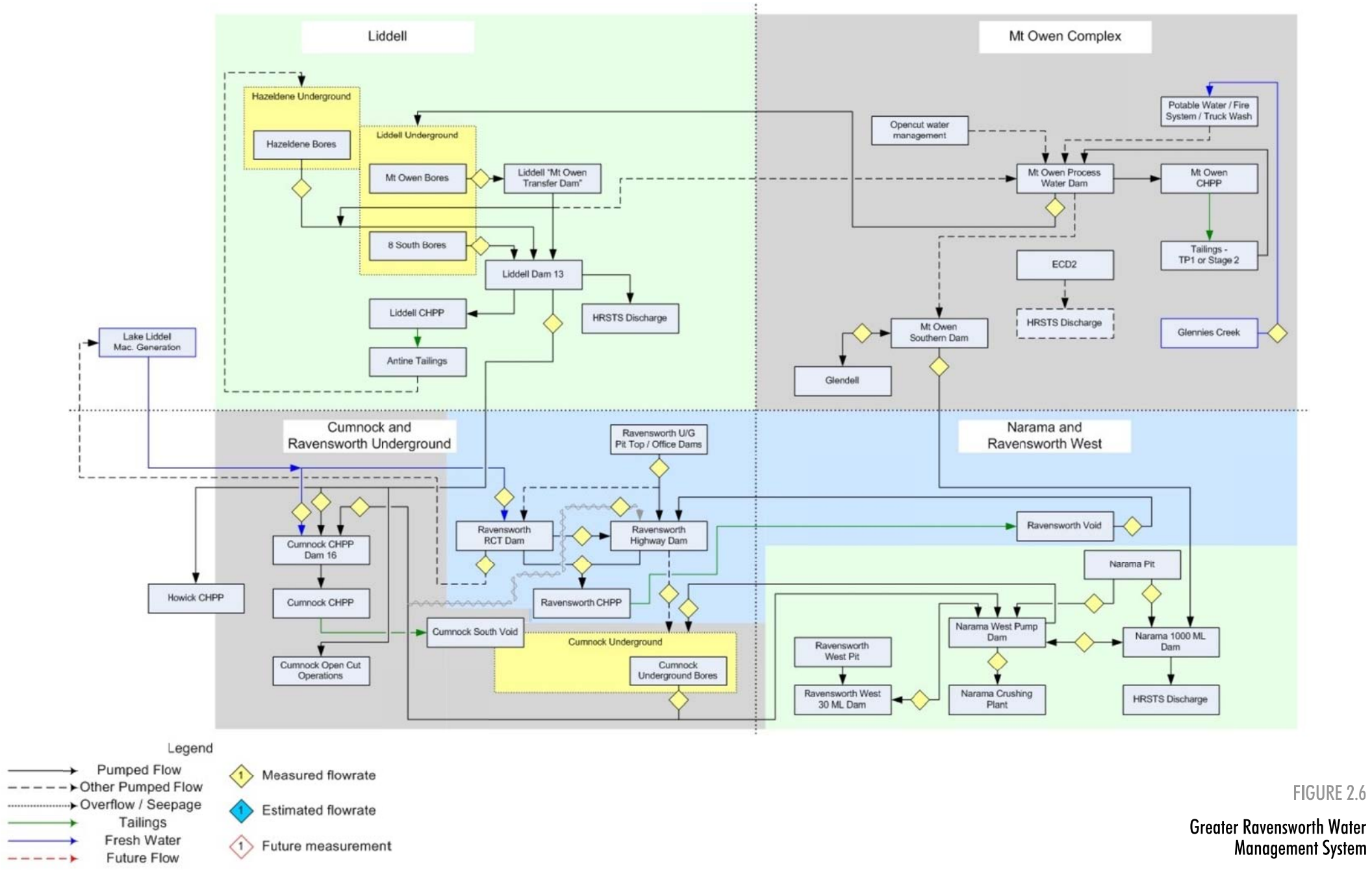
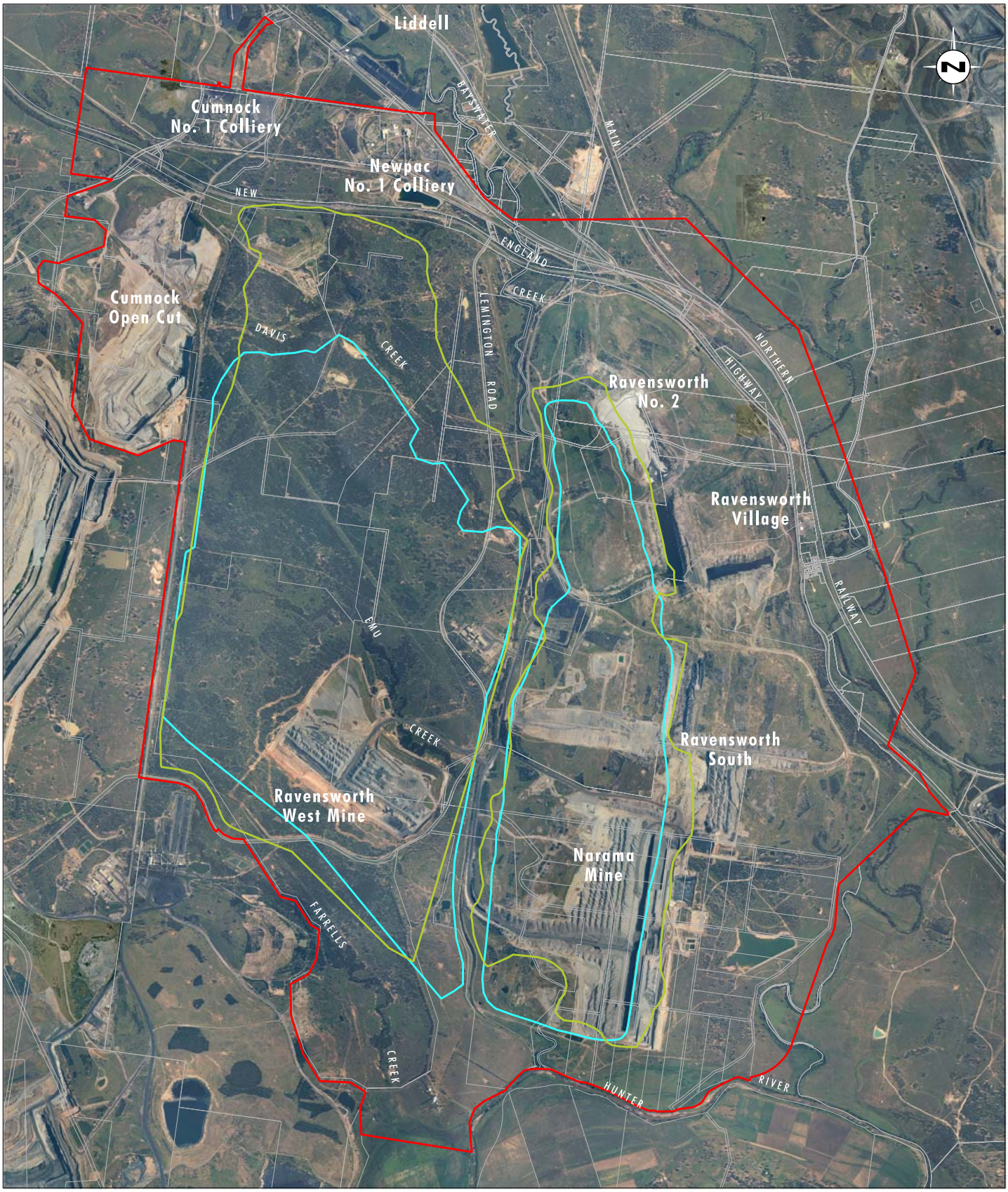



FIGURE 2.6

Greater Ravensworth Water Management System




Source: Ravensworth Operations 2007

0 1.0 2.0 3km
1:50 000

## Legend

- Project Area
- Proposed Mining and Overburden Emplacement Area Option 1 (Preferred)
- Proposed Mining and Overburden Emplacement Area Option 2

FIGURE 2.7

Alternate Mine Plans

Through the development of the concept and pre-feasibility studies, a broad range of alternatives were considered including:

- mining footprint areas;
- mining method (including mining equipment and mine layout);
- options for location of surface facilities, including the proposed mine infrastructure area, Lemington Road realignment and the relocation of the 330 kV transmission line; and
- coal handling and preparation plant (CHPP) options including consideration of a new facility verses upgrading the existing RCT facility.

The key alternatives considered during these studies will be discussed in the EA.

The alternative of not proceeding has also been considered. This option is not considered appropriate as it is expected that the environmental and social impacts of the Project can be effectively managed, and not proceeding would result in the loss of the substantial economic benefits of the Project. Further discussion of this alternative will be included in the EA.

### 2.5.2 Project Justification

Ravensworth Operations provides substantial economic benefits at Federal, State and local levels whilst maintaining a good working relationship with the community and implementing sound environmental management practices. Ravensworth Operations will build on these attributes of the existing operations through the development and operation of the Project. The Project also provides an excellent opportunity for the integration of future open cut mining operations and surface infrastructure within the Ravensworth area, including the realisation of latent capacity in established coal handling infrastructure, optimisation of the final landform associated with mining voids from previous operations, and integrated environmental and water management systems.

The Project will provide the following key benefits:

- employment of approximately 450 people, with many more indirect jobs created through flow-on effects;
- economic recovery of approximately 190 million tonnes (Mt) of product coal;
- payment of significant royalties to the State of NSW;
- significant export earnings for Australia; and
- significant economic benefits to the local community through local employment, purchase of goods and services, and local expenditure both directly and through employee wages.

Ravensworth Operations has demonstrated its commitment to effective environmental management in its existing operations. This management approach will also be implemented during the design, construction and operation of the Project, ensuring that environmental and community impacts will be effectively managed.

Further detailed justification for the Project will be provided in the EA, considering the potential environment and community impacts and benefits.

# 3.0 Planning Considerations and Consultation

## 3.1 Planning Considerations

The Project requires approval under Part 3A of the EP&A Act because it is of a class of development listed in Schedule 1 of SEPP (Major Projects) 2005. The listing in Schedule 1 of the SEPP that applies to this Project is:

> Development for the purpose of mining that is coal or mineral sands mining.

he Minister for Planning is responsible for granting approval for the Project Application pursuant to Part 3A of the EP&A Act.

The land which is the subject of the Project Application is located wholly within Singleton Local Government Area (LGA) zoning Rural 1(a). The objectives of the Rural 1(a) zone, as described in the Singleton Local Environmental Plan (LEP) 1996, are:

(a) to protect and conserve agricultural land and to encourage continuing viable and sustainable agricultural land use;

(b) to promote the protection and preservation of natural ecological systems and processes;

(c) to allow mining where environmental impacts do not exceed acceptable limits and the land is satisfactorily rehabilitated after mining;

(d) to maintain the scenic amenity and landscape quality of the area;

(e) to provide for the proper and co-ordinated use of rivers and water catchment areas; and

(f) to promote provision of roads that are compatible with the nature and intensity of development and the character of the area.

Coal mines and coal works are permitted with Council consent in this zone. As mining is an activity that is permissible in the whole of the Project area, the Minister can approve the Project.

In addition to approval under Part 3A of the EP&A Act, the Project may also require approvals under a number of additional Acts or assessment under State Environmental Planning Policies.

Under s75U of the EP&A Act, if the Project is granted project approval under Part 3A of the EP&A Act, the following approvals, which may otherwise have been relevant, will not be required to carry out the Project.

**Table 3.1 - Approvals Legislation which does not apply**

| Act | Approval |
|---|---|
| *Fisheries Management Act 1994* (FM Act) | Permit for works or structures within a waterway. |
| *Heritage Act 1977* (Heritage Act) | Disturbance to an item listed on State Heritage Register or Interim Heritage Order; Excavation permit |
| *National Parks & Wildlife Act 1974* (NP&W Act) | Preliminary research permit; consent to destroy relics |
| *Water Management Act 2000* (WM Act) | Water use approval, water management work approval or activity approval |

If the Project is granted project approval under Part 3A of the EP&A Act, the following approvals, which will be required for the Project, must not be refused by the relevant approval authority and must be substantially consistent with the terms of the Project approval.

**Table 3.2 - Approvals Legislation to be applied**

| Act | Approval | Authority |
|---|---|---|
| *Mine Subsidence Compensation Act 1961* (MSC Act) | Development within Mine Subsidence District | Mine Subsidence Board (MSB) |
| *Mining Act 1992* (Mining Act) | Mining Lease | Department of Primary Industries (Mineral Resources) (DPI) |
| *Protection of the Environment Operations Act 1999* (PoEO Act) | Environmental Protection Licence | Department of Environment and Climate Change (DECC) |
| *Roads Act 1993* (Roads Act) | Permit to impact on a public road | State roads – NSW Roads and Traffic Authority (RTA)<br>Local roads – Singleton Council |

The Acts and policies relevant to this Project are listed in **Table 3.3** below with an indication of any approvals likely to be required.

**Table 3.3 - Other Potentially Relevant Acts and State Environmental Planning Policies**

| Planning Provision | Comments | Relevant Licences/Approvals/ Assessments |
|---|---|---|
| **Commonwealth Legislation** | | |
| *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) | A number of flora and fauna species and migratory species listed in the EPBC Act have been recorded or potentially occur in the Project area and an assessment of the impact of the Project on these species is required. This assessment will be a component of the ecological assessment undertaken as part of the EA. | An assessment of the impact of the Project on these ecological matters is yet to be completed. Once completed, a decision will be made as to whether a preliminary referral to the Commonwealth Minister for Environment, Heritage and the Arts is required. |
| *Native Title Act 1993* (Native Title Act) | The Native Title Act is administered by the National Native Title Tribunal. The Tribunal is responsible for maintaining a register of native title claimants and bodies to whom native title rights have been granted. These native title holders and claimants must be consulted prior to the granting of a mining lease over land to which the native title claim or right applies. The Act prescribes that native title can be extinguished under certain circumstances, including the granting of freehold land. | The Project is located within existing mining leases at Ravensworth. As part of the proposed consolidation of mining leases within the Project area, Ravensworth Operations will consult with any Native Title holder or claimant, where relevant. In addition, there are a number of areas of Crown land located within the Project area associated with Crown Roads. At present there are no known native title claims within the Project area. |

**Table 3.3 - Other Potentially Relevant Acts and State Environmental Planning Policies (cont)**

| Planning Provision | Comments | Relevant Licences/Approvals/ Assessments |
|---|---|---|
| **NSW Legislation – State Environmental Planning Policies** | | |
| State Environmental Planning Policy 33 – Hazardous and Offensive Development (SEPP No. 33) | SEPP No. 33 requires the consent authority to consider whether an industrial proposal is a potentially hazardous industry or a potentially offensive industry. A hazard assessment is completed for potentially hazardous or potentially offensive development to assist the consent authority to determine acceptability of a Project. | The existing Ravensworth operations are not classed as hazardous or offensive development under SEPP No. 33. An assessment under SEPP No. 33 to determine whether the Project is a potentially hazardous or potentially offensive development will be undertaken to determine whether a hazard assessment needs to be undertaken as part of the EA. |
| State Environmental Planning Policy 44 – Koala Habitat Protection (SEPP No. 44) | SEPP No. 44 restricts a Council from granting development consent for proposals on land identified as core koala habitat without preparation of a plan of management. | A koala habitat assessment will be undertaken as part of the ecological assessment. However, no core koala habitat is expected to occur within the Project area. |
| State Environmental Planning Policy (Major Projects) (SEPP (Major Projects)) | As discussed above, the Project is of a class of development listed in the SEPP. The Project therefore requires approval under Part 3A if the EP&A Act and the Minister for Planning will be the consent authority. | The Project will be assessed under Part 3A of the EP&A Act. |
| State Environmental Planning Policy - (Mining, Petroleum Production and Extractive Industries) 2007 (Minerals SEPP) | The Minerals SEPP repeals SEPP No. 37 - Continued Mines and Extractive Industries and SEPP No. 45 - Permissibility of Mining. The Minerals SEPP also removed mining developments from Schedule 1 of SEPP No. 11- Traffic Generating Development, meaning that SEPP No. 11 no longer applies to mining projects.<br>With regards to mining, the Minerals SEPP outlines where various minerals activities are permissible both with and without development consent. The Minerals SEPP also defines mining developments that are prohibited, exempt or complying developments. | The provisions of the Minerals SEPP do not affect the requirement for approval under Part 3A of the EP&A Act for the Project. |

**Table 3.3 - Other Potentially Relevant Acts and State Environmental Planning Policies (cont)**

| Planning Provision | Comments | Relevant Licences/Approvals/ Assessments |
|---|---|---|
| State Environmental Planning Policy 55 - Remediation of Land (SEPP No. 55) | SEPP No. 55 – Remediation of Land aims to provide a state-wide planning approach to the remediation of contaminated land and to reduce the risk of harm to human health and the environment by consideration of contaminated land as part of the planning process. Under SEPP No. 55, a consent authority must not consent to the carrying out of development on land unless it has considered potential contamination issues. | No potential contamination issues have been identified within the Project area. The Project will be designed to prevent contamination and the storage and handling of chemicals will be undertaken in accordance with Australian Standards and relevant DECC guidelines. A closure and decommissioning strategy, including a contaminated land management strategy, will be developed for the decommissioning and closure of the Project in consultation with DPI. This management strategy will incorporate the investigation and remediation of any contaminated land and will be included in Mining Operations Plans (MOPs) submitted to DPI for approval should this Project be approved. |
| **NSW Legislation – Acts** | | |
| *Coal Mine Health and Safety Act 2002* (CMHS Act) | The principal aim of the CMHS Act is to secure the objectives of the *Occupational Health and Safety Act 2000* in relation to coal operations. It does this by imposing certain specific safety requirements on coal mines. This includes the requirement to comply with minimum barriers for underground mine workings and the requirement to obtain consent from the Minister for Mineral Resources for the establishment of emplacement areas. | The northern extent of the proposed open cut mining will be undertaken within a number of seams above the former Cumnock Underground workings. The relevant requirements for minimum barriers have been considered as part of the conceptual Project design.<br>A Section 100 approval will be required for the proposed tailings emplacement areas. |

**Table 3.3 - Other Potentially Relevant Acts and State Environmental Planning Policies (cont)**

| Planning Provision | Comments | Relevant Licences/Approvals/ Assessments |
|---|---|---|
| *Occupational Health and Safety Act 2000* (OH&S Act) | On 1 September 2005 the *Dangerous Goods Act 1975* was repealed by the *OHS Amendment (Dangerous Goods) Act 2003* and the supporting OHS Amendment (Dangerous Goods) Regulation 2005.<br>The changes mean that dangerous goods are now regulated under the OH&S Act and the Occupational Health and Safety Regulation 2001.<br>There are no specific licensing or approval requirements for the management of dangerous goods under the OH&S Act and any dangerous goods at the facility will be managed within the Occupational Health and Safety management framework established by the OH&S Act. All people with unsupervised access to explosives or concentrated ammonium nitrate must now be licensed. | There is no requirement for licensing of dangerous goods under the OH&S Act. |
| *Crown Lands Act 1989* (Crown Lands Act) | The Crown Lands Act provides for the administration and management of Crown land in the eastern and central divisions of NSW. Crown land may not be occupied, used, sold, leased, dedicated, reserved or otherwise dealt with unless authorised by this Act or the *Crown Land (Continued Tenures) Act 1989*. | There are a number of parcels of Crown land located within the Project area associated with Crown Roads.<br>Ravensworth Operations is currently investigating processes to close Crown Roads within its Mining Lease area. |
| *Water Management Act 2000* (WM Act) | The Project does not involve the extraction of water from the surface water bodies that are currently subject to a Water Sharing Plan. However, the Hunter Unregulated and Alluvial Water Sources Water Sharing Plan is expected to be gazetted in mid 2009.<br>The licensing provisions of the WM Act are therefore not relevant at this stage. | The Project will not require approval under sections 89, 90 or 91 of the WM Act due to the exemptions outlined under section 75U of the EP&A Act, however an approval may be required for aquifer interference once the Hunter Unregulated and Alluvial Water Sources Water Sharing Plan is gazetted. |

**Table 3.3 - Other Potentially Relevant Acts and State Environmental Planning Policies (cont)**

| Planning Provision | Comments | Relevant Licences/Approvals/ Assessments |
|---|---|---|
| *Water Act 1912* (Water Act) | The licensing provisions of the Water Act still apply. The Water Act is administered by the Department of Water and Energy (DWE). Under the Act, a permit and/or licence must be obtained to extract surface water (Part 2 of the Act) or groundwater (Part 5 of the Act). | An approval under Part 5 of the Act will be required for the Project to intercept and extract groundwater from mine workings and for the proposed groundwater monitoring bores.<br>Ravensworth Operations already maintain Water Licences for Industrial purposes. |
| *Threatened Species Conservation Act 1995* (TSC Act) | Under the EP&A Act, impacts on threatened species listed under the TSC Act are required to be assessed. | All threatened species listed in the TSC Act potentially located within the Project area will be assessed in the ecological assessment. |
| *Dams Safety Act 1978* (Dams Safety Act) | This Act requires that the NSW Dams Safety Committee (DSC) periodically review large dams that may constitute a hazard to human life and property. These dams are known as prescribed dams and are listed in Schedule 1 of the Dams Safety Act. Any new prescribed dams are to be designed to the satisfaction of the DSC. | Any dams required to be constructed as part of the Project will be subject to assessment in accordance with the DSC requirements to determine if any of these dams will be prescribed dams.<br>The existing 1000ML dam located in the south-eastern extent of the Project area is a prescribed dam under the Dams Safety Act. The DSC will be consulted as part of the preparation of the EA. |
| *Mine Subsidence Compensation Act 1961* (MSC Act) | The approval of the MSB will be required for the construction of surface infrastructure associated with the Project, except where exemptions apply. | Approval of the MSB will be required for the construction of surface infrastructure. |

## 3.2 Authority Consultation

The authority consultation process for the Project has commenced with initial briefing meetings held with DoP and other relevant government agencies. These meetings introduced the Project, discussed the approvals process and sought feedback on relevant issues to be considered in the EA. The briefing meetings held to date include:

- initial Project briefings and discussions with DoP were undertaken on 2 April 2008, 16 May 2008 and 31 July 2008;
- an introductory presentation regarding the Project was made to DoP on 3 November 2008;
- a Project briefing was provided to DPI Executive on 12 November 2008;

- a Project briefing with Singleton Council Mayor and General Manager was held on 24 November 2008 with the agreement to provide further detailed briefings to Councillors in early 2009; and

- a Conceptual Mine Plan meeting was held with DPI on 16 December 2008 to discuss the Project including initial conceptual mine plans.

The next phase of the consultation process is the lodgement of this Preliminary Environmental Assessment with DoP and the subsequent Planning Focus Meeting to be held with the key agencies. Following this meeting and the lodgement of the Project Application, it is expected that DoP will provide Ravensworth Operations with the DGRs for the Project.

In addition to DoP, the key agencies for this Project will be:

- Singleton Council;

- DPI;

- DECC;

- DWE;

- MSB;

- RTA; and

- Department of Lands.

As outlined in **Table 3.3**, there is potential for a number of threatened species listed under the EPBC Act to occur within the Project area. Once the assessment of impact on these species associated with the Project has been completed, a preliminary referral to the Commonwealth Department of Environment, Water, Heritage and the Arts (DEWHA) is likely to be made. The DEWHA will be consulted throughout the preliminary referral process.

Consultation with each of these key agencies will be undertaken throughout the preparation of the EA and will focus on specific issues associated with the Project.

## 3.3 Community Consultation

Ravensworth Operations has developed a comprehensive stakeholder consultation strategy for the Project. The strategy identifies the stakeholders relevant to the Project, the methods of communication proposed for each stakeholder group, the timing of consultation and the feedback mechanisms required.

In consulting with stakeholders, Ravensworth Operations aims to:

- be proactive in its engagement with the community;

- be the primary source of information to the community;

- be transparent and honest in dealings with the community; and

- utilise a range of consultation methods to ensure all stakeholder interests are considered and addressed in a timely manner.

It is likely that the Project will involve a high degree of interest at the local level and also some interest at the regional and broader level. Stakeholders to be consulted in relation to the Project include:

- Local Landholders – including Camberwell Village residents and residents located to the south of the Project area;
- Community Groups – including Ravensworth Community Consultative Committee (CCC);
- Environmental Groups – Hunter and Central Rivers CMA, Minewatch;
- Aboriginal Stakeholder Groups;
- Other Mining Operations – Xstrata, Coal and Allied, Ashton Coal and Integra Coal;
- Service Providers – TransGrid, Australian Rail Track Corporation (ARTC), Energy Australia;
- Corporate Stakeholders – Employees, Xstrata Corporate, Shareholders and Commercial Partners.

The consultation process for the Project will be undertaken in a number of definable phases that align with the key milestones of the EA process. The key phases of the consultation process for the Project include:

- **Phase 1** of the consultation program involves consultation with stakeholders during the early phases of the Project Approval process and the preparation of the EA for the Project. The main purposes of this stage of consultation are to inform stakeholders of the details of the Project and the proposed environmental assessment process, and to identify the issues that the stakeholders would like addressed in the EA.
- **Phase 2** of the consultation program involves consultation with stakeholders following the substantial completion of the environmental studies for the EA. The main purpose of this stage of the consultation program is to update the stakeholders on the status of the Project and provide feedback on the results of the EA.
- **Phase 3** of the consultation program will be undertaken prior to the lodgement of the EA for the Project and will focus on providing any additional feedback to stakeholders in relation to specific issues associated with the Project.

Phase 1 of the consultation process has commenced with the agency consultation undertaken to date (refer to **Section 3.2**), and will include the Planning Focus Meeting for the Project. In addition to this, initial Project briefings have been provided to Coal and Allied and Macquarie Generation, as they are landholders within the Project area. The Phase 1 consultation process with the community and other stakeholders is scheduled to commence in early 2009.

The methods of consultation proposed for the Project include the following mechanisms:

- community information sheets/brochures – incorporated into established community newsletters;
- individual meetings with surrounding landholders;

- Ravensworth CCC meetings;
- meetings with relevant community and environment groups;
- Aboriginal stakeholder consultation;
- presentations to employees and interest groups;
- government agency meetings and presentations;
- open day/s at Camberwell Village and/or on site; and
- media statements.

# 4.0 Preliminary Environmental Assessment

## 4.1 Environmental and Community Context

### 4.1.1 Land Use

The existing land use within the Project area has been primarily mining activities (refer to **Figure 1.2**). Prior to the establishment of mining operations during the 1970s, the primary land use in the Project area was characterised by a long history of agricultural land uses, with an emphasis on grazing and some cultivation along major creek lines.

The current Narama mine and RUM underground operations are located in the eastern extent of the Project area, along with the voids associated with the former Ravensworth South and Ravensworth No. 2 Colliery. The RUM surface facilities are located adjacent to the RCT facility in the northern extent of the Project area, Ravensworth West is located in the south-eastern extent of the Project area, and the current Cumnock No. 1 Colliery open cut operations are located in the north-east of the Project area, with previous underground workings located in the north.

The land surrounding the Project area is dominated by mining and power generation activities. A number of mines are located further south and are associated with Coal and Allied's Hunter Valley Operations including Carrington, North Pit, The Alluvial Lands, Cheshunt and Riverview Pits. The Mt Owen Complex (including Mt Owen, Ravensworth East and Glendell mines) is situated further east of the site. Ashton Coal is located to the south-east of the Project area. Liddell Colliery is located to the north while Liddell and Bayswater Power Stations are located on the western side of Lake Liddell.

The closest village to the Project is Camberwell which is located approximately 5 kilometres to the south-east (refer to **Figure 4.1**). The village of Jerrys Plain is located approximately 8 kilometres to the south-west of the Project area. The village of Ravensworth is located in the eastern extent of the Project area and contains no privately owned residences.

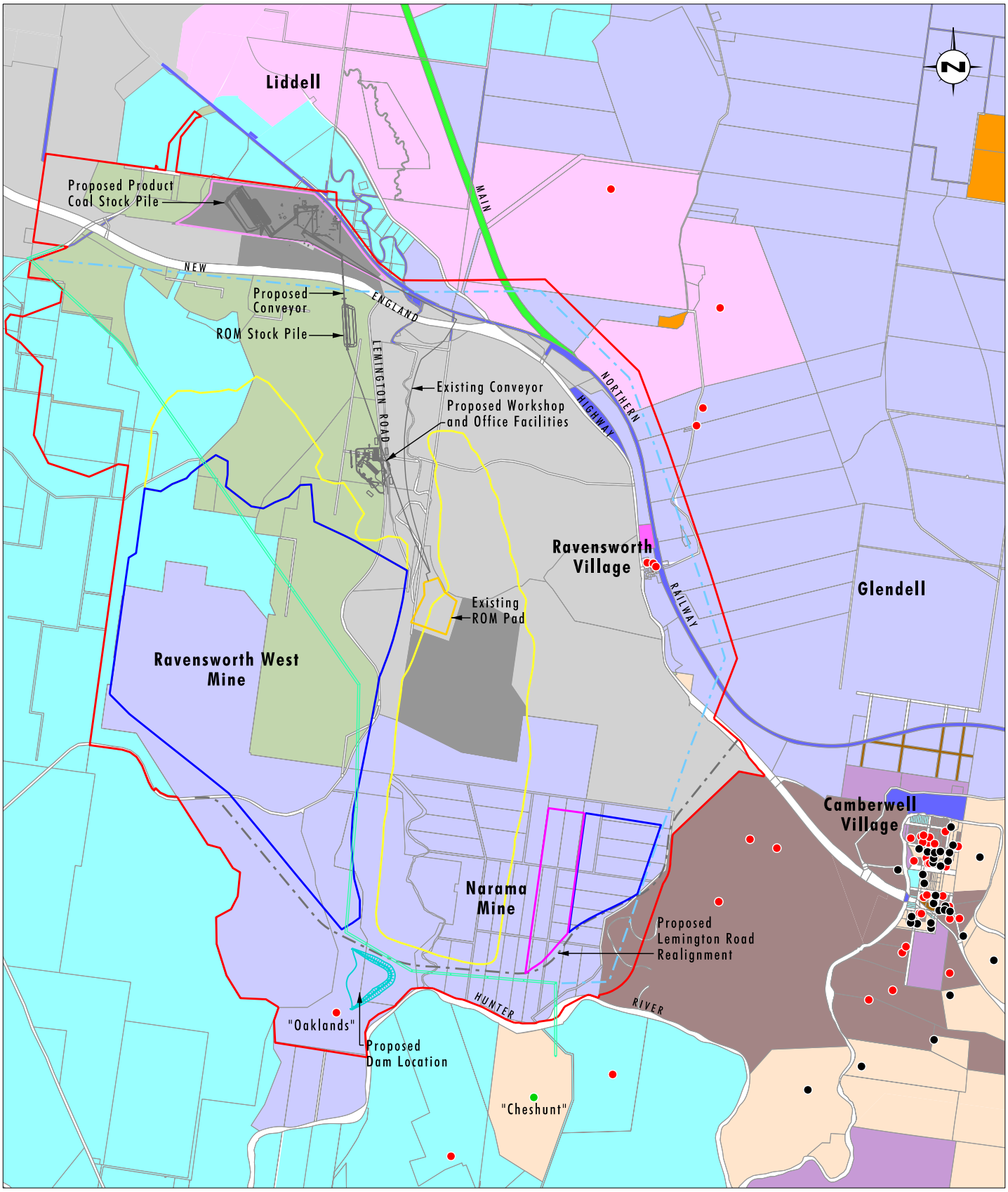
Until recently, the nearest privately owned residence south of the Project area was the 'Oaklands' property (refer to **Figure 4.1**). This property has since been acquired by Ravensworth Operations. A number of residences are located south of the Hunter River, such as the 'Cheshunt' property (refer to **Figure 4.1**). Ravensworth Operations has a private agreement in place with this landowner, and has also put an option to the landowner to acquire the property.

The properties adjacent to the 'Cheshunt' property (refer to **Figure 4.1**) have been purchased by Coal and Allied. The closest privately owned residence in this area is located approximately 5 kilometres south-east of the Project area (refer **Figure 4.1**).

### 4.1.2 Land Ownership

Detailed investigations of land tenure within and surrounding the Project area have been undertaken as part of the commencement of baseline environmental studies. In particular, private residences located in proximity to the Project area have been identified (refer to **Figure 4.1**).

Land ownership in the Project area and surrounds is shown on **Figure 4.1**. The area surrounding and including the proposed Ravensworth Operations site is dominated by mining operations which are the major landholders within the area. There are four known major landholders in the Project area, Ravensworth Operations, Cumnock, Macquarie Generation




Source: Ravensworth Operations (2007), LPI (2008)

0 1.0 2.0 3km
1:60 000

## Legend

- Project Area
- Indicative Pit Shell (Ravensworth North and Narama Pits)
- Out of Pit Dump
- Ravensworth Coal Terminal
- Narama Extended (subject to separate approval)
- Existing 330kV Transmission Line
- Proposed 330kV Transmission Line
- Coal & Allied
- Ravensworth Underground
- Xstrata or Subsidiary
- State Rail
- Unknown
- Boral Industries
- Macquarie Generation
- Cumnock No.1 Colliery
- Liddell
- Singleton Council
- Private
- Ashton
- Crown Land
- State of NSW
- Road and Traffic Authority
- Private Residence with Agreement
- Private Residence
- Mined Owned Residence

FIGURE 4.1

**Land Ownership**

File Name (A4): R05_V1/2383_062.dgn

and Coal and Allied. Ravensworth Operations has consulted with these landholders in relation to the Project.

The closest areas of privately owned land are located approximately 5 kilometres south-east of the Project and are associated with rural residences and Camberwell Village. Land ownership within Camberwell Village includes a number of mine owned residences (refer to **Figure 4.1**)

There are a number of parcels of Crown Land within the Project area associated with Crown Road reserves. As discussed in **Section 3.1**, Ravensworth Operations is investigating options to manage these Crown Road reserves in consultation with the Department of Lands.

## 4.2 Preliminary Environmental Risk Analysis

To assist in identifying the key environmental and community issues that require further assessment, a preliminary environmental risk assessment has been completed for the Project and is included in **Appendix 1**. The environmental risk assessment was undertaken in accordance with Xstrata Coal Risk Management Standard 1.02 - Environmental Assessments, which is consistent with the principles outlined in Australian Standard AS/NZS 4360:2004 Risk Management (Standards Australia, 2004). The risk matrix, consequence table and likelihood table used for the assessment are included in **Appendix 1**. Consistent with the Xstrata risk assessment matrix, environmental risks have been categorised as low, medium or high for the construction and operational phases of the Project.

The potential key environment and community issues identified as requiring further assessment in the EA for the mining operations and associated infrastructure are:

- disturbance of sites of European heritage significance;
- disturbance of Aboriginal places or objects;
- loss of threatened native flora and fauna;
- degradation of noise amenity;
- degradation of air quality;
- surface and groundwater management, including impacts on private water bores and impacts on the waterways;
- aesthetics of open cut mining;
- emission of greenhouse gases;
- blasting – noise and vibration; and
- rehabilitation and mine closure.

The scope of further assessment required for these issues as part of the EA is discussed in further detail in **Section 5.0**. Where appropriate, the proposed controls contained in the preliminary environmental risk analysis will be considered and refined in the detailed investigations and in the draft Statement of Commitments in the EA.

# 5.0 Key Environment and Community Issues

The key environment and community issues for this Project have been determined through the preliminary environmental risk assessment discussed in **Section 4.2**. These issues are discussed in **Sections 5.1** to **5.12** below, including a description of the proposed assessment methodology. The assessment of these issues will be completed as part of the EA for the Project.

## 5.1 Land Resources and Rehabilitation

### 5.1.1 Existing Land Resources

#### 5.1.1.1 Soils

The Singleton 1:100,000 Soil Landscapes Map Sheet (Matthei 1995) indicates that the Liddell (ld) and Hunter (hu) landscape units occur within the Project area. The Liddell Soil Landscape dominates the Project area, with a smaller area of the Hunter Soil Landscape present (refer **Figure 5.1**).

**Liddell Soil Landscape (ld)**

The Liddell Soil Landscape is predominantly comprised of Yellow Soloths and Yellow Solodic Soils on the upper slopes, with Earthy and Silicious Sands occurring on lower slopes with silicious parent rock. Less abundant soil types present include the Red Soloths, Red Solodic Soils and Red Podzolic Soils. The topsoil ranges from brown sand to brown loam, while the different subsoils may include sandy clay, light clay, sandy loam and loamy sand. The depth to bedrock typically ranges from 50 centimetres to 110 centimetres.

The soils of the Liddell Soil Landscape are susceptible to minor to severe sheet erosion and minor levels of rill erosion. In drainage lines, moderate levels of gully erosion up to 1.5 metres depth can occur and salting may be present. The Soloths and Solodic soils characteristically have higher erodibility (moderate to high) than that of the Sands (low). Similarly, soil salinity is higher for the Soloths and Solodic soils (high) in comparison to the Sands (low).

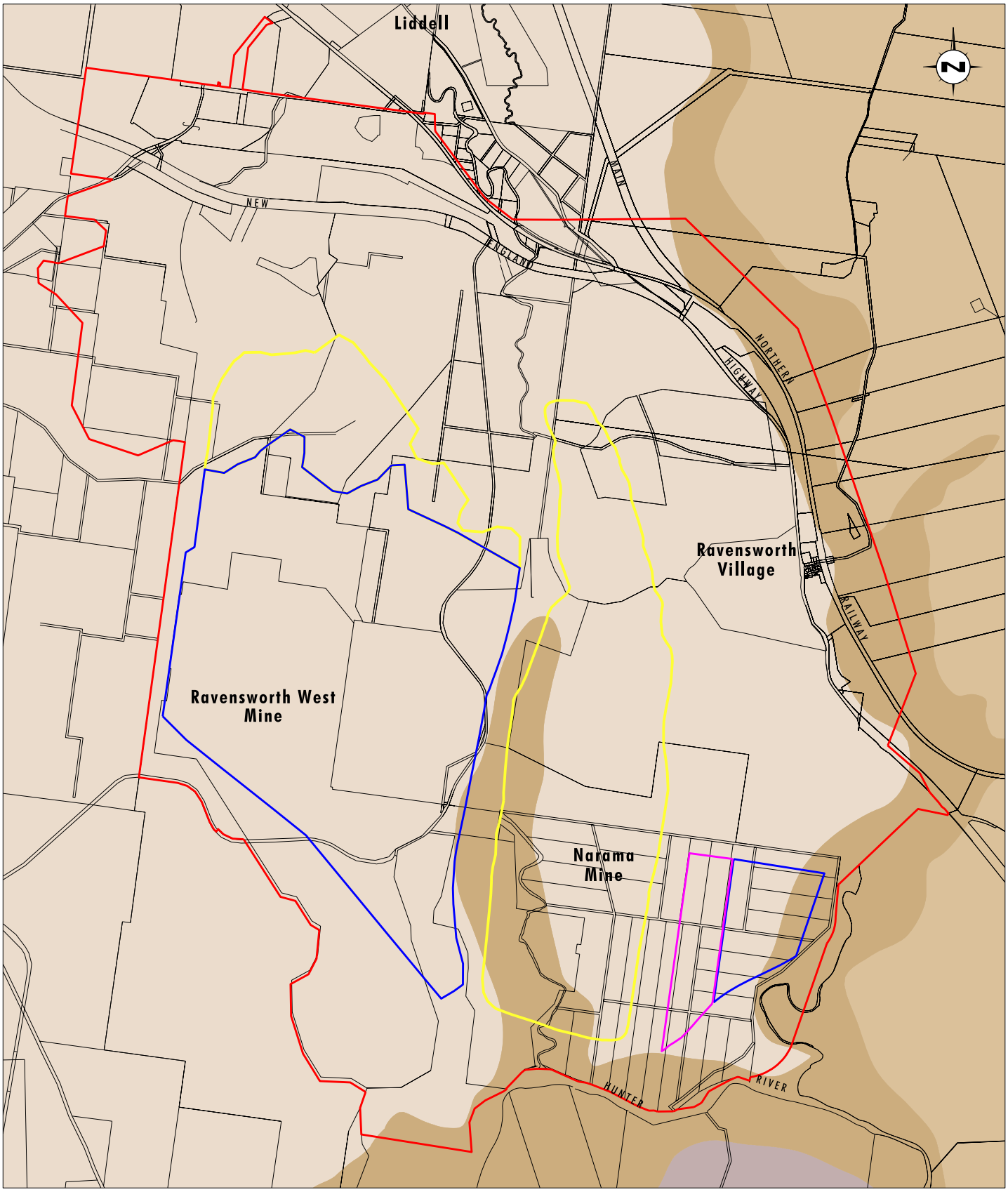
The soil types within the soil landscape have a low fertility, are poorly to well drained and have a low to moderate available water holding capacity. Typical soil pH varies between 6.0 and 6.5 and mass movement hazard is low.

**Hunter Soil Landscape (hu)**

The soils of the Hunter Soil Landscape occur throughout the floodplains of the Hunter River and its tributaries (Matthei 1995). The main soils are all formed in alluvium. The soils of the Hunter Soil Landscape are susceptible to erosion along stream banks with minor sheet erosion on the adjacent terraces.

The soil types within this soil landscape vary between moderately and rapidly draining, with moderate to low fertility levels. The available water-holding capacity is high throughout the landscape with the exception of sands and loams which have a low capacity. Typically soil pH varies between 5.5 and 7.5.

This preliminary review of the characteristics of the major soil types within the Project area indicates the Project is located on soils with a very high susceptibility to erosion and poor




Source: Soil Landscape: Department of Natural Resources 2005

0 1.0 2.0 3km
1:50 000

## Legend

- Project Area
- Indicative Pit Shell (Ravensworth North and Narama Pits)
- Out of Pit Dump
- Narama Extended (subject to separate approval)

Soil Landscape
- Liddell
- Bayswater
- Hunter
- Branxton

FIGURE 5.1

Soil Landscape

fertility. Based on this, open cut mining has potential to increase soil erosion in some areas. These soils will need to be effectively managed to reach final rehabilitation objectives. The soil descriptions also identify, however, that the majority of soils affected are of low fertility and consequently the Project will not impact on soils with potential for high agricultural productivity.

Further assessment on the suitability of soils for stripping, stockpiling and management for use in rehabilitation will be undertaken as part of the EA.

#### 5.1.1.2 Land Capability

Land capability is the ability of the land to maintain its productive potential under a specified use, without degradation. Climate, soils, geology, geomorphology, soil erosion, site and soil drainage characteristics and current land use data are all considered in determining land capability (Emery, undated). Rural land capability classes for NSW have been developed by the former NSW Soil Conservation Service (now DECC), each class outlines the types of land uses appropriate for a particular area of land and the types of land management practices needed to prevent soil erosion and maintain the productivity of the land. Eight classes of Rural Land Capability were defined by the then Soil Conservation Service for mapping rural lands, as shown in **Table 5.1**.

**Table 5.1 - Rural Land Capability Classes**

| General Capability | Land Capability Classes | Interpretations and Implications |
|---|---|---|
| Suitable for regular cultivation | I | Suitable for a wide variety of uses. Where soils are fertile, has the highest potential for agriculture. Includes 'prime agricultural land'. |
| | II | Usually gently sloping land suitable for a wide variety of agricultural uses. Includes 'prime agricultural land'. |
| | III | Sloping land suitable for cropping on a rotational basis. Soil erosion problems are often severe. Generally fair to good agricultural land. |
| Suitable for grazing and occasional cultivation | IV | Land not suitable for cultivation on a regular basis owing to limitations of slope gradient, soil erosion, shallowness or rockiness, climate, or a combination of these factors. Comprises the better classes of grazing land. |
| | V | Land not suitable for cultivation on a regular basis owing to limitations of slope gradient, soil erosion, shallowness or rockiness, climate, or a combination of these factors. Soil erosion problems are often severe. Production is generally lower than for grazing lands in Class IV. |
| Suitable for grazing but not for cultivation | VI | Productivity will vary due to soil depth and fertility. Comprises the less productive grazing lands. |
| Land best protected by green timber | VII | Generally comprises areas of steep slopes, shallow soils and/or rock outcrop. |
| Unsuitable for agriculture or pastoral uses | VIII | Cliffs, lakes or swamps and other lands unsuitable for agricultural or pastoral use. |

The classes identify limitations on the type and intensity of use as a result of interactions between physical attributes (soil type, slope, and climate) and the effects of specific land uses. The classification does not necessarily reflect existing land uses, rather, it indicates the potential of the land for different agricultural purposes.

The land capability within the Project area, as classified by the system according to Emery (undated), is presented in **Figure 5.2**. The Project area consists of predominantly Class V land, which is considered suitable for grazing and occasional cultivation. A small area of Class VI land also exists on the steeper slopes in the south-west and north-east of the Project area. Class VI land is only suitable for grazing purposes and is not considered suitable for cultivation.

#### 5.1.1.3 Agricultural Suitability

The agricultural suitability of land is based on the presence of physical and/or chemical limitations (Riddler, 1990). Factors considered include climatic and topographic factors, physical and chemical characteristics of the soil, ability to control erosion, drainage and flooding potential. All of these factors combine to determine the productive potential of the land and its capability to produce crops, pastures and livestock.

Agricultural suitability of land in NSW has been mapped at a scale of 1:50,000 by the former NSW Department of Agriculture and published by the former Department of Environment and Planning (1981). The five classes of agricultural suitability are:

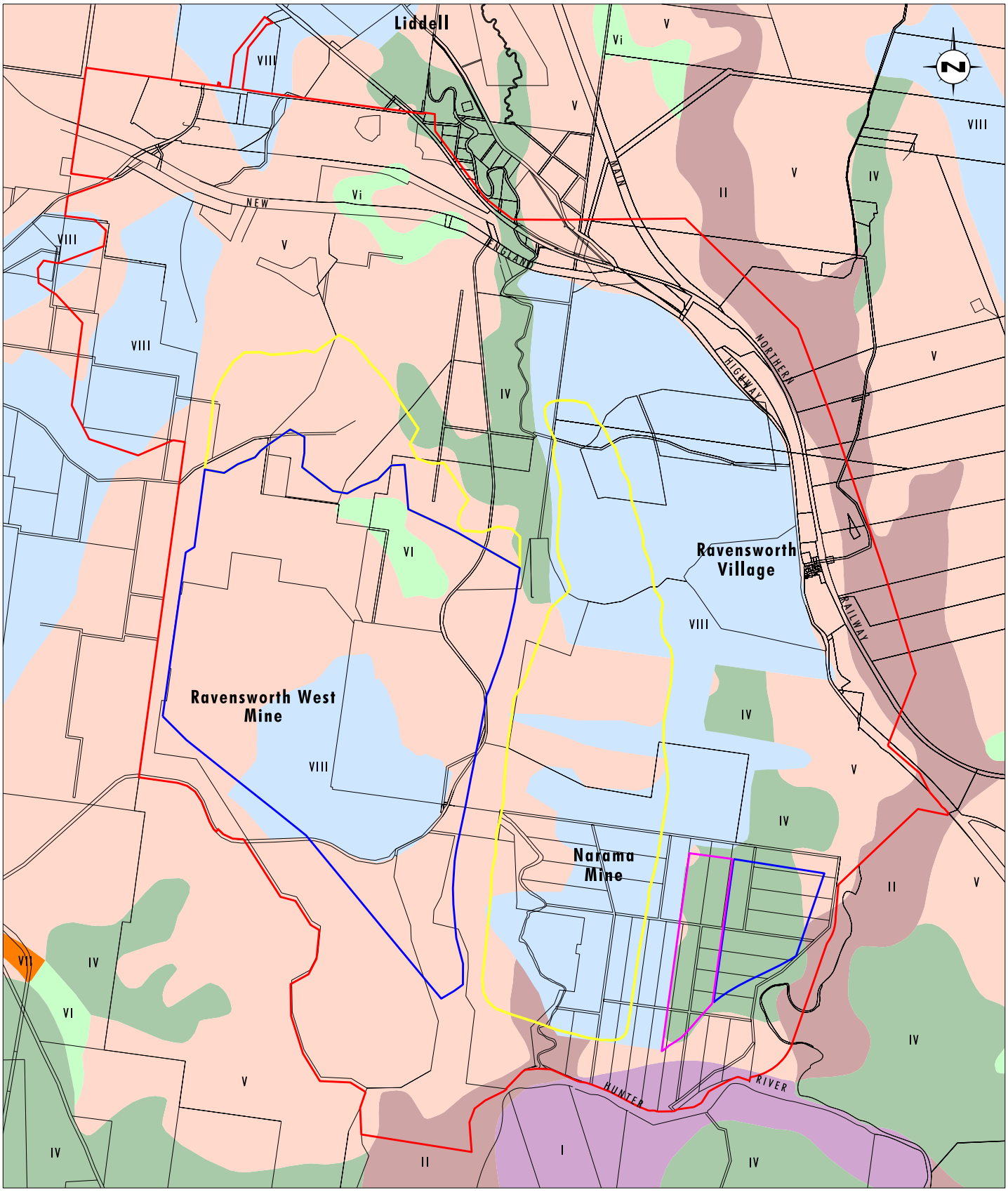
- Class 1 – suitable for intense cultivation;
- Class 2 – suitable for cultivation;
- Class 3 – suitable for grazing and pasture improvement;
- Class 4 – marginally suitable for grazing; and
- Class 5 – unsuitable for agriculture.

The Project area is predominantly Class 3 with some areas of Class 4 also present. Class 3 land which is suitable for grazing and pasture improvement, may be cultivated in rotation with pasture, however, production is moderate due to soil and environmental constraints. Class 4 land, which is present in small patches, generally has low overall production due to major environmental constraints.

### 5.1.2 Rehabilitation Strategy

Xstrata operations undertake a holistic approach to rehabilitation and mine closure planning from a conceptual Project planning phase through to the preparation of detailed rehabilitation and mine closure plans. Detailed rehabilitation design is undertaken as part of the preparation of a MOP for an operation and approved by DPI. The MOP approval also provides for the monitoring of performance against rehabilitation objectives over the life of an operation. The existing open cut mining operations within the Project area, including Narama, Ravensworth West and Cumnock, are being progressively rehabilitated in accordance with the approved MOP for each operation.

A conceptual rehabilitation strategy for the Project is currently being undertaken as part of further detailed Project planning and design process. The rehabilitation strategy for the Project will seek to provide for progressive rehabilitation of disturbed areas as soon as practicable over the life of the Project. Conceptual final land use, land form and mine closure criteria will also be identified for the Project.




Source: Department of Natural Resources 2007

0 1.0 2.0 3km
1:50 000

## Legend

- Project Area
- Indicative Pit Shell (Ravensworth North and Narama Pits)
- Out of Pit Dump
- Narama Extended (subject to separate approval)

Land Capability Class:

- I. Suitable for Regular Cultivation
- II. Suitable for Regular Cultivation
- IV. Suitable for Grazing with Occasional Cultivation
- V. Suitable for Grazing with Occasional Cultivation
- VI. Suitable for Grazing with No Cultivation
- VII. Land Best Protected by Green Timber
- VIII. Unsuitable for Agriculture or Pastoral Uses

FIGURE 5.2

**Land Capability**

The development of the rehabilitation strategy will continue as part of the detailed Project design phase and will consider a range of factors including, but not limited to, the following:

- characteristics of the Project area including the opportunities and constraints associated with existing land resources in relation to soils, land capability and agricultural suitability;
- key environmental features of the Project area, in particular, the ecological features and key water resources;
- the strategic land use objectives for the Project area and surrounds, including consideration of the DPI's Synoptic Plan for mine closure;
- maximisation of the integration of rehabilitation and final land use for the Project area with the rehabilitation processes of surrounding mining operations within the Greater Ravensworth area; and
- operational opportunities and constraints for the Project including overburden emplacement requirements and operational areas.

As outlined above, the rehabilitation strategy, including development of final land use, final land form and mine closure objectives, will be undertaken as part of the detailed design process for the Project. This will include consultation with key internal and external stakeholders, including relevant government agencies, throughout the preparation of the EA. A description of the proposed rehabilitation strategy for the Project will be included as part of the EA.

## 5.2 Ecology

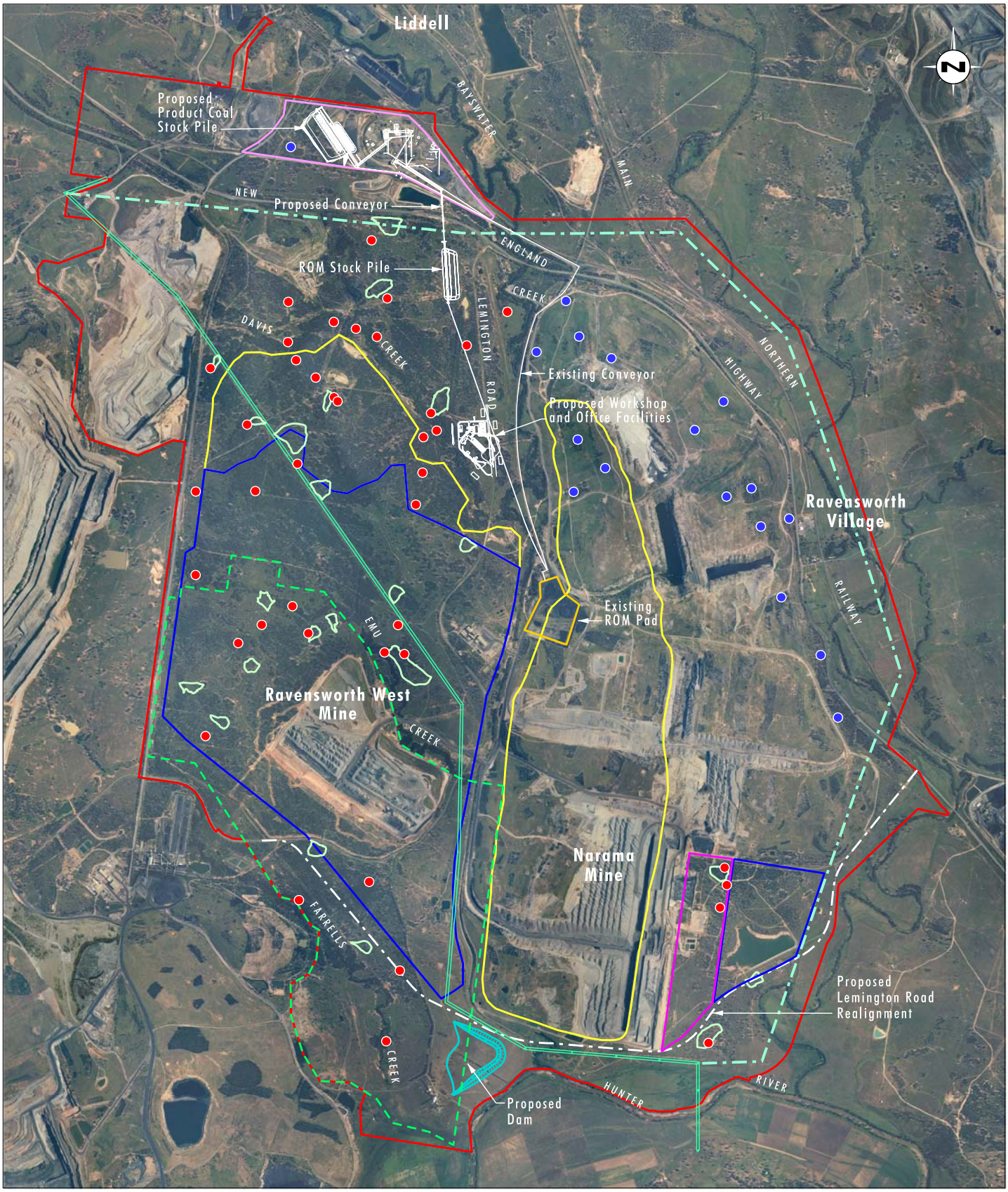
Ecology has been recognised as a key issue since the inception of the Project, and for this reason detailed baseline surveys were commenced in 2007 to identify the ecological features of the Project area. The surveys undertaken specifically targeted threatened species, endangered populations and threatened ecological communities (TECs) listed under the TSC Act and EPBC Act. The ecological constraints and opportunities arising from the baseline studies have been considered as part of the development of the conceptual Project design.

In response to the identification of a number of ecological constraints within the Project area, Ravensworth Operations has sought to minimise the area of disturbance associated with the Project. This has included restricting the proposed mining and overburden emplacement areas to minimise disturbance of vegetation and exclude the removal of Davis Creek within the northern extent of the Project area (refer to **Section 2.5** and **Figure 2.7**).

### 5.2.1 Existing Environment

#### 5.2.1.1 Baseline Surveys

Umwelt has recently completed a considerable amount of ecological survey within the Project area for the purposes of detailed vegetation mapping, and the identification of the flora and fauna species. **Figures 5.3** and **5.4** show the flora and fauna survey effort undertaken to date. An overview of the results of the detailed baseline surveys of the Project area is provided in the following sections.




Source: Ravensworth Operations 2007, HLA 2001 and ERM 1998

0 1.0 2.0 3km
1:50 000

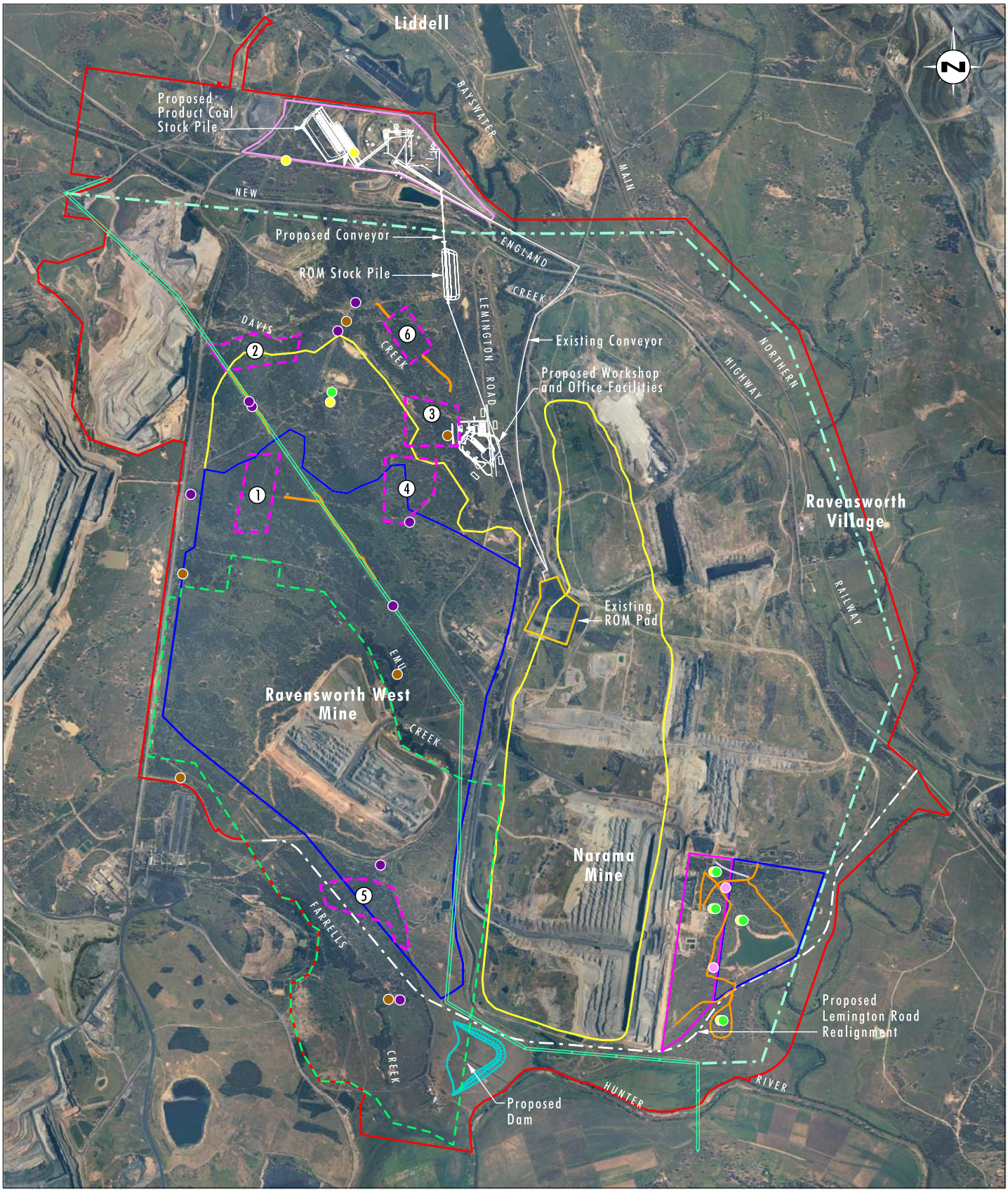
## Legend

- Project Area
- Indicative Pit Shell (Ravensworth North and Narama Pits)
- Out of Pit Dump
- Narama Extended (subject to separate approval)
- Ravensworth Coal Terminal
- Existing 330kV Transmission Line
- Proposed 330kV Transmission Line
- Flora Survey Site
- Rapid Assessment Point
- Ravensworth West Development Consent Boundary
- Targeted Diuris Tricolor Survey

FIGURE 5.3

Flora Survey Effort

File Name (A4): R05_V1/2383_051.dgn




Source: Ravensworth Operations 2007, HLA 2001 and ERM 1998

0 1.0 2.0 3km
1:50 000

## Legend

- Project Area
- Indicative Pit Shell (Ravensworth North and Narama Pits)
- Out of Pit Dump
- Narama Extended (subject to separate approval)
- Ravensworth Coal Terminal
- Existing 330kV Transmission Line
- Proposed 330kV Transmission Line
- Fauna Survey Location
- Ravensworth West Development Consent Boundary
- Spotlight Transect
- Hair Funnel Transect
- Diurnal Bird Survey
- Diurnal Herpetological Survey
- Green and Golden Bell Frog Survey Site
- Combined Aquatic and Green and Golden Bellfrog Survey Site
- Call Playback

FIGURE 5.4

**Fauna Survey Effort**

File Name (A4): R05_V1/2383_052dgn

### 5.2.1.2 Vegetation Communities

The Project area contains a large area of woodland. The vegetation of the study area is significant in its size (approximately 1200 hectares), and the presence of substantial regeneration of canopy species (Peake 2006). Based on the detailed baseline studies undertaken to date, nine native vegetation communities have been identified in the Project area, all of which have been previously identified as regionally significant. These communities are shown on **Figure 5.5** and listed in **Table 5.2**.

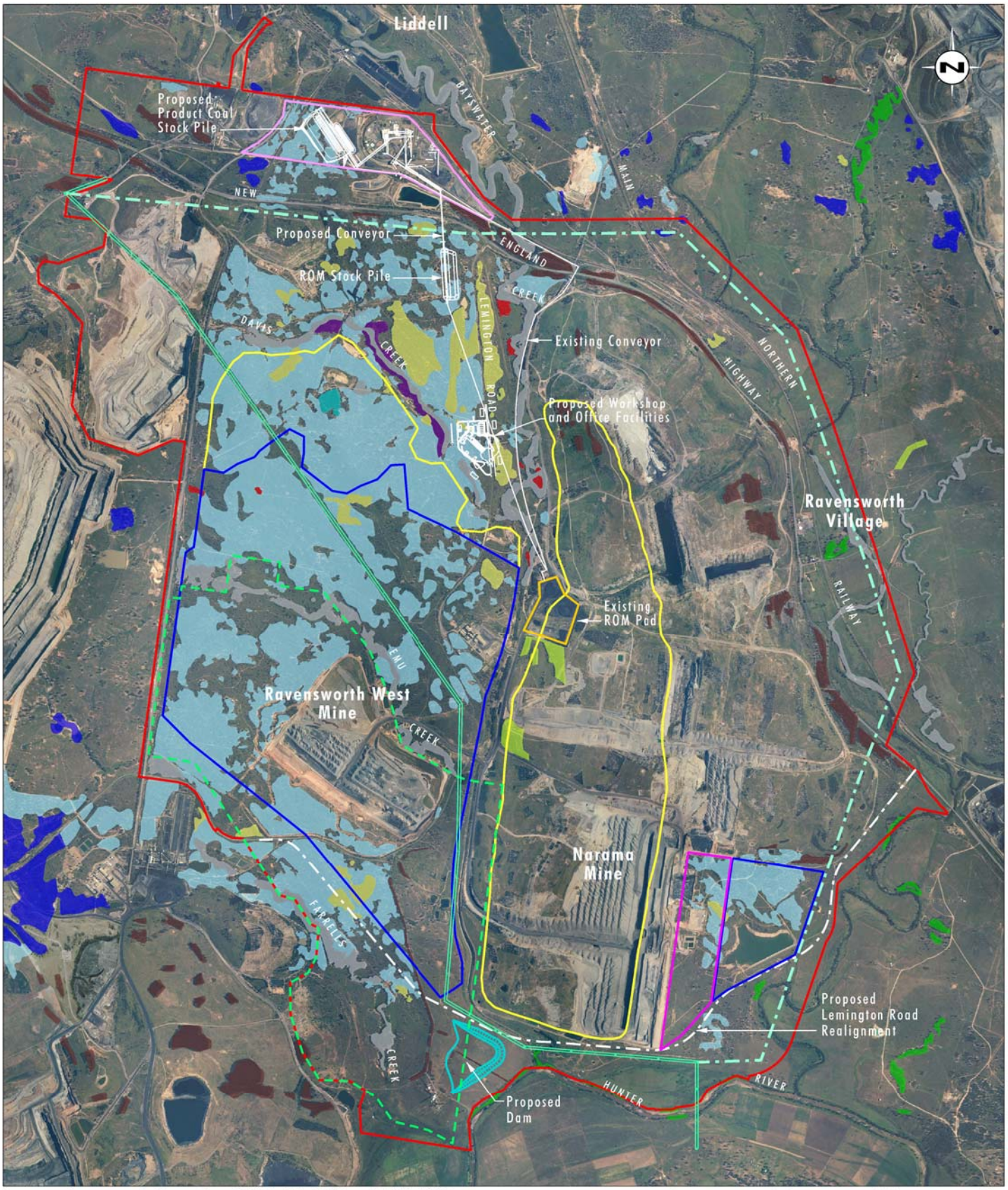
**Table 5.2 – Vegetation Communities within the Ravensworth Operations Project Area**

| Vegetation Community | Area of vegetation community within Project Area (ha) |
|---|---|
| Broad-leaved Ironbark Woodland | 4 |
| Central Hunter Box - Ironbark Woodland | 917 |
| Central Hunter Bulloak Forest Regeneration | 93 |
| Central Hunter Ironbark - Spotted Gum - Grey Box Forest | 5 |
| Central Hunter Swamp Oak Forest | 128 |
| Hunter Valley River Oak Forest | 4 |
| Planted areas | 73 |
| Rehabilitation | 13 |
| River-flat Eucalypt Forest | 12 |
| Rough-barked Apple Open Forest | 5 |
| **Total** | **1250** |

As shown on **Figure 5.5** and in **Table 5.2**, the vegetation of the Project area is dominated by regenerating box-ironbark-bulloak woodland and open forest. The vegetation along Davis and Emu Creeks is dominated by swamp oak riparian forest, and scattered areas of derived grassland occur throughout the Project area. Native vegetation in the Project area has been extensively cleared by historical agricultural land uses, which has resulted in the native vegetation communities within the Project area being characterised by extensive areas of regrowth. Cattle grazing continues to this day, albeit at lower stocking rates than historical levels. Similar habitats throughout the Upper Hunter region have been used for agricultural purposes for in excess of 150 years, leading to the highly fragmented woodland landscape that is present today. As a result, large areas of woodland habitats with larger trees and shrub understorey are limited in the region.

A review of historical aerial photos of the Project area has been undertaken to ascertain the history of the disturbance on the native vegetation communities in the Project area. This review has included aerial photos dating back 40 years, and the 1967 aerial and 1993 aerial of the Project area are shown on **Figure 5.6** and **5.7**, respectively. These historical aerial photographs highlight that the Project area was extensively cleared prior to approximately 40 years ago. This has led to native vegetation within the Project area being dominated by extensive areas of regrowth that is dominated by younger individuals and reduced mid to lower vegetation strata. These characteristics of the native vegetation within the Project area are depicted in **Plates 1** to **3**.

There are areas of known habitat for River Flat Eucalypt Forest Endangered Ecological Community (EEC) along parts of Davis Creek and Bayswater Creek within the Project area. The potential impacts of the Project on the identified EEC will be considered as part of the impact assessment process for the Project (refer to **Section 5.2.4**). As outlined in **Section 2.5**, Ravensworth Operations has limited the proposed mining to the south of Davis Creek, in order to minimise the impacts of the Project from the removal of this creek line.




Source: Ravensworth Operations 2007, HLA 2001 and ERM 1998

0 1.0 2.0 3km
1:50 000

## Legend

- Project Area
- Indicative Pit Shell (Ravensworth North and Narama Pits)
- Out of Pit Dump
- Narama Extended (subject to separate approval)
- Ravensworth Coal Terminal
- Existing 330kV Transmission Line
- Proposed 330kV Transmission Line
- Ravensworth West Development Consent Boundary

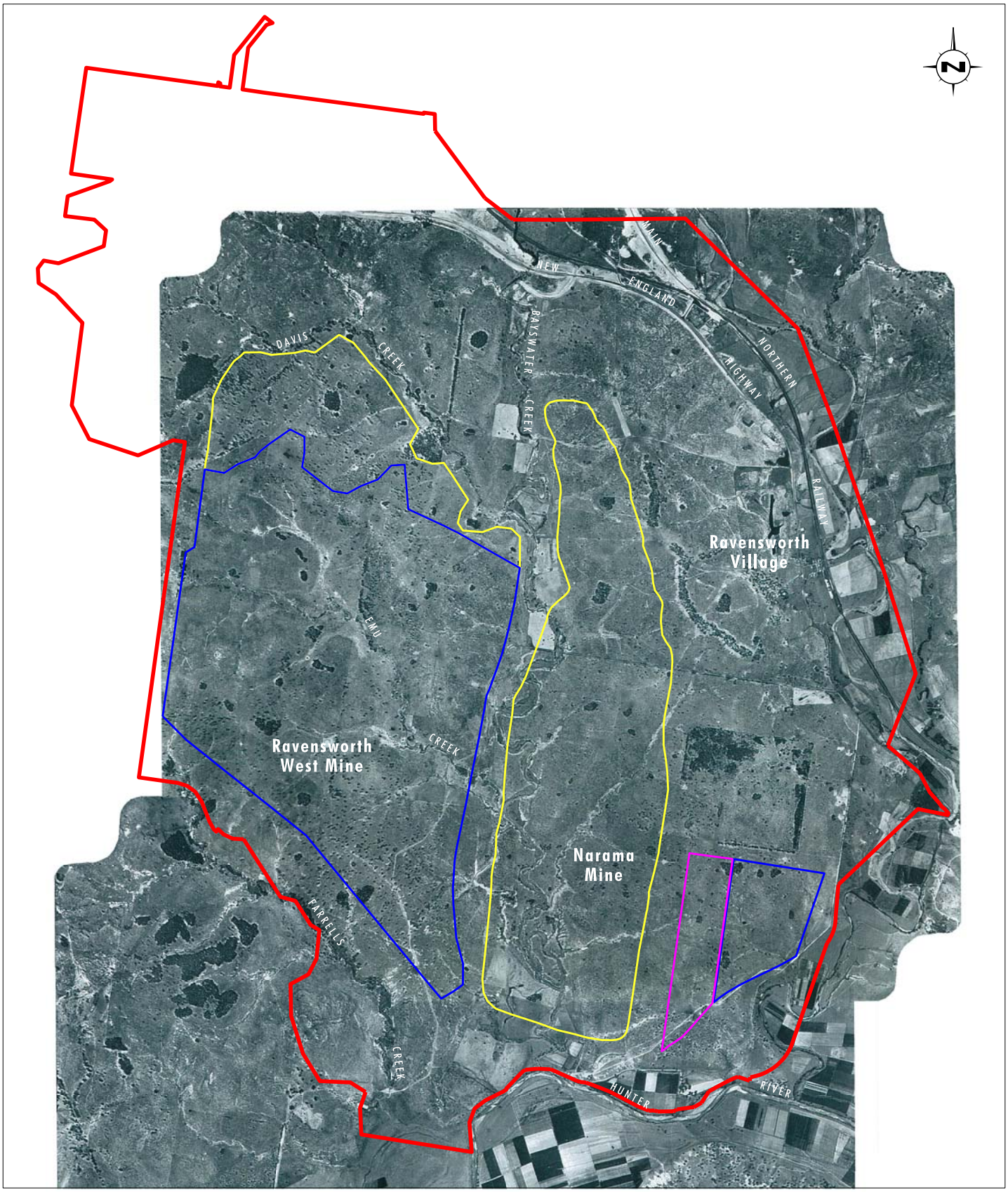
Vegetation Communities:

- Broad-leaved Ironbark Woodland
- Central Hunter Box - Ironbark Woodland
- Central Hunter Bulloak Forest Regeneration
- Central Hunter Ironbark - Spotted Gum - Grey Box Forest
- Central Hunter Swamp Oak Forest
- Hunter Valley River Oak Forest
- River-flat Eucalypt Forest
- Rough-barked Apple Open Forest
- Planted Areas
- Rehabilitation

FIGURE 5.5

**Vegetation Communities**

File Name (A4): R05_V1/2383_064.dgn



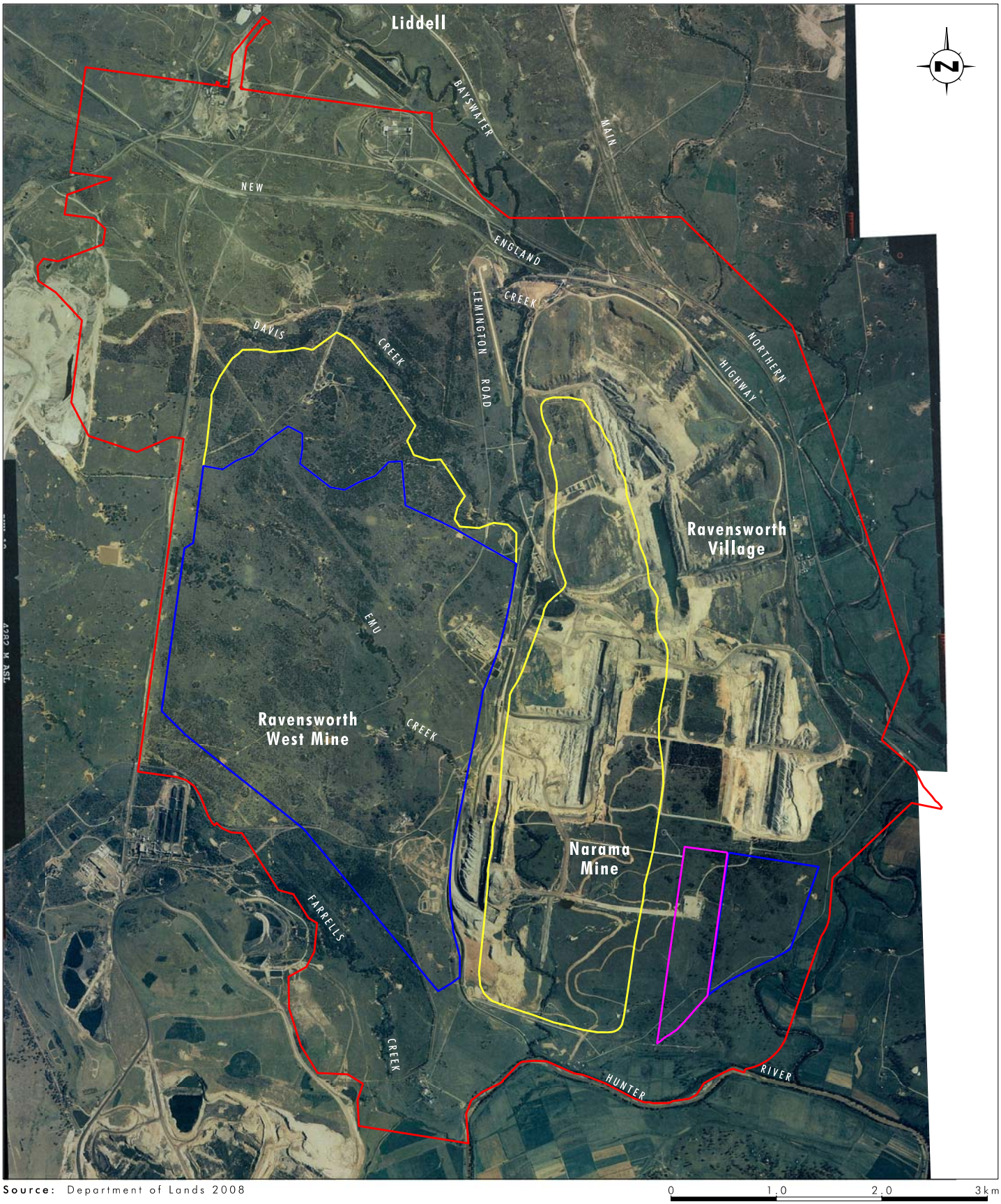

Source: Department of Lands 2008

0 1.0 2.0 3km
1:50 000

Legend
- Project Area
- Indicative Pit Shell (Ravensworth North and Narama Pits)
- Out of Pit Dump
- Narama Extended (subject to separate approval)

FIGURE 5.6

1967 Aerial Photograph




Source: Department of Lands 2008

0 1.0 2.0 3km
1:50 000

## Legend

- Project Area
- Indicative Pit Shell (Ravensworth North and Narama Pits)
- Out of Pit Dump
- Narama Extended (subject to separate approval)

FIGURE 5.7

1993 Aerial Photograph

PLATE 1
Native Vegetation of Project Area

PLATE 2
Native Vegetation of Project Area

PLATE 3
Native Vegetation of Project Area

In addition, as shown on **Figure 5.5**, there are a number of vegetated areas associated with rehabilitation of the current and previous mining areas. This includes an area of planted vegetation within the eastern extent of the Project area that includes *Acacia pendula*, a diagnostic species of the Weeping Myall *Acacia pendula* Endangered Population and the Weeping Myall Woodland EEC, as defined under the TSC Act. Given that the planted species demonstrate no evidence of natural recruitment during surveys, it does not comprise the Weeping Myall *Acacia pendula* Endangered Population or the Weeping Myall Woodland EEC.

#### 5.2.1.3 Flora Species

The baseline ecological surveys of the Project area undertaken since 2007 have identified over 300 flora species occurring within the Project area.

**Threatened Flora Species**

A number of threatened flora species have the potential to occur within the Project area based on the presence of suitable habitat. These are shown in **Table 5.3**.

**Table 5.3 – Threatened Flora Species with Potential to Occur in the Project Area**

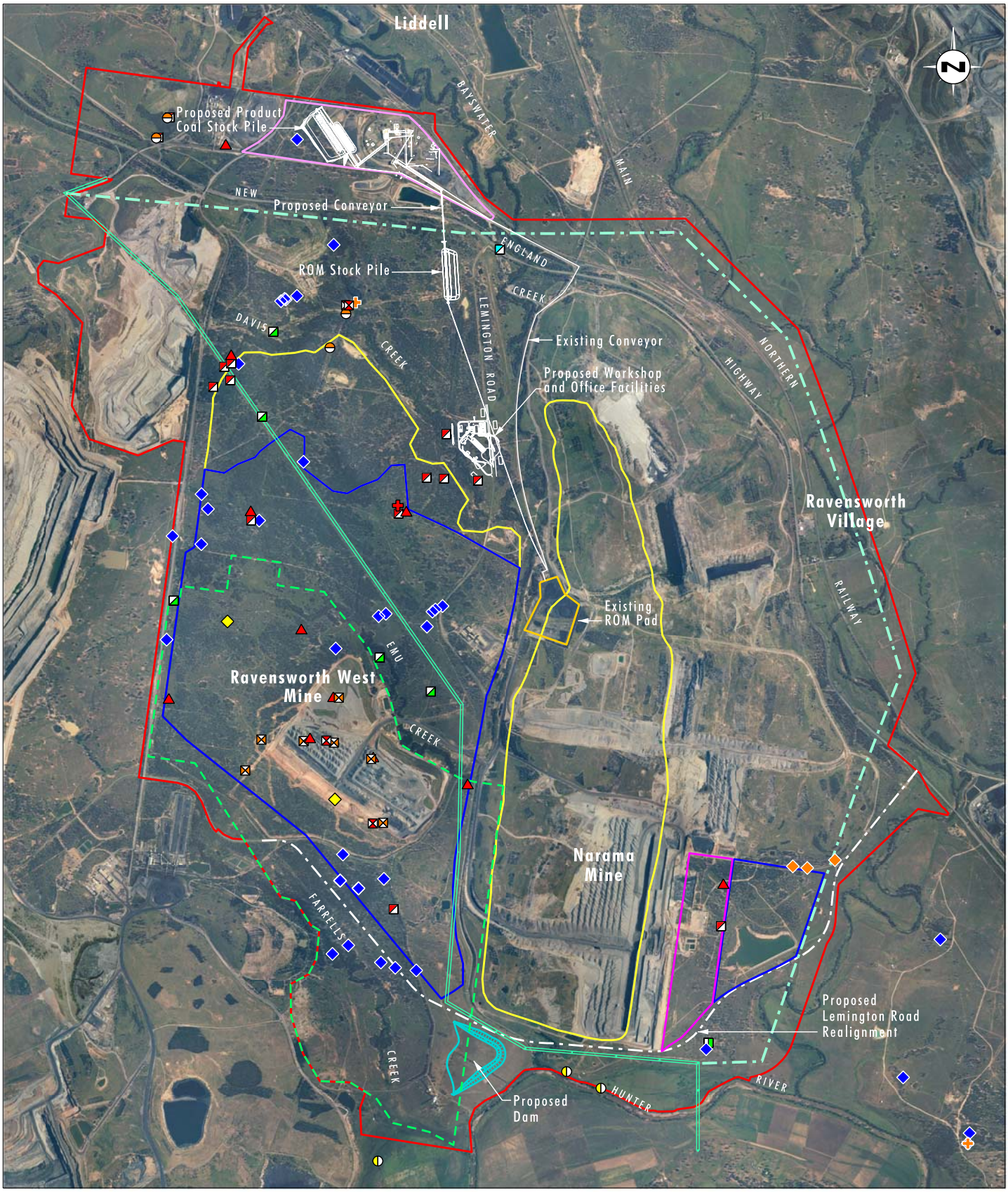
| Species | Legal Status | Preliminary Assessment of Likelihood of Occurrence in the Project Area |
|---|---|---|
| *Bothriochloa biloba* | V (EPBC) | Recorded |
| tricolour diuris<br>*Diuris tricolour* | V (TSC)<br>V (EPBC) | Low |
| *Lasiopetalum longistamineum* | V (EPBC)<br>V (TSC) | Low |
| *Isotropis foliosa* | Preliminary Determination<br>V (TSC) | Low |
| slaty red gum<br>*Eucalyptus glaucina* | V (TSC)<br>V (EPBC) | Low |

Key: E = endangered;
V = vulnerable;
TSC = TSC Act; and
EPBC = EPBC Act.

The threatened flora species with potential to occur within the Project area were specifically targeted as part of the baseline ecological surveys of the Project area. **Figure 5.3** shows the flora survey effort undertaken to date across the Project area, which included targeted surveys for *Diuris tricolour*. As shown on **Figure 5.8**, there was one threatened flora species, *Bothriochloa biloba*, found during baseline surveys of the Project area. *Bothriochloa biloba* is a threatened species listed as vulnerable under the EPBC Act. *Eucalyptus camaldulensis*, an endangered population listed under the TSC Act, was also found during baseline ecological surveys in the south of the Project area along the Hunter River.

#### 5.2.1.4 Fauna Species

The vegetation and general habitats present within the Project area are the result of long term modification by mining and agricultural activities. The baseline ecological surveys of the Project area undertaken since 2007 have identified over 60 fauna species occurring within the Project area. The fauna species identified are dominated by bird and bat species.




Source: Ravensworth Operations 2007, HLA 2001, ERM 1998 and Mt King 2007

0 1.0 2.0 3km
1:50 000

## Legend

- Project Area
- Indicative Pit Shell (Ravensworth North and Narama Pits)
- Out of Pit Dump
- Narama Extended (subject to separate approval)
- Ravensworth Coal Terminal
- Existing 330kV Transmission Line
- Proposed 330kV Transmission Line
- Ravensworth West Development Consent Boundary

Threatened Species

- Hooded Robin
- Grey Headed Flying Fox
- Speckled Warbler
- Grey-crowned Babbler
- Eastern Bentwing-bat
- Little Bentwing-bat
- Green and Golden Bellfrog
- Brown Tree-creeper
- Large-footed Myotis
- Eastern False Pipistrelle
- Masked Owl
- *Bothriochloa biloba*
- *Eucalyptus camaldulensis*
- *Acacia pendula*

FIGURE 5.8

**Threatened Species Location**

File Name (A4): R05_V1/2383_054.dgn

### Threatened Fauna Species

A total of 37 threatened fauna species are considered to have potential habitat within the Project area, have previously been recorded in the region or are considered to have potential to occur based on habitat modelling. A preliminary assessment of the likelihood of occurrence of the threatened fauna species within the Project area has been undertaken. Details of the threatened species previously recorded in the Project area and with a high likelihood of occurrence in the Project area are provided in **Table 5.4**. This table also notes those threatened species recorded during most recent surveys, since 2007.

**Table 5.4 - Threatened Fauna Species Recorded within the Project Area**

| Species | Legal Status | Previously Recorded | Previous Record Source | Recorded during Current Surveys |
|---|---|---|---|---|
| green and golden bell frog *Litoria aurea* | E (TSC) V (EPBC) | ✓ | ERM Mitchell McCotter 1998, HLA-Envirosciences 2001 | x |
| masked owl *Tyto novaehollandiae* | V (TSC) | ✓ | HLA-Envirosciences 2001 | x |
| brown treecreeper *Climacteris picumnus victoriae* | V (TSC) | ✓ | ERM Mitchell McCotter 1998 | ✓ |
| speckled warbler *Pyrrholaemus sagittatus* | V (TSC) | ✓ | ERM Mitchell McCotter 1998; Mount King & Gingra Ecological Surveys 2006a. | ✓ |
| hooded robin *Melanodryas cucullata cucullata* | V (TSC) | ✓ | ERM Mitchell McCotter 1998; Mount King & Gingra Ecological Surveys 2006a | x |
| grey-crowned babbler *Pomatostomus temporalis temporalis* | V (TSC) | ✓ | ERM Mitchell McCotter 1998; HLA-Envirosciences 2001; Mount King & Gingra Ecological Surveys 2006a; Mount King & Gingra Ecological Surveys 2006b | ✓ |
| grey-headed flying-fox *Pteropus poliocephalus* | V (TSC) | x | Not previously recorded | ✓ |
| large-footed myotis *Myotis adversus* | V (TSC) | ✓ | Mount King & Gingra Ecological Surveys 2006b | x |
| eastern bentwing-bat *Miniopterus schreibersii oceanensis* | V (TSC) | ✓ | ERM Mitchell McCotter 1998; Mount King & Gingra Ecological Surveys 2006b | ✓ |
| little bentwing-bat *Miniopterus australis* | V (TSC) | x | Not previously recorded | ✓ |
| eastern false pipistrelle *Falsistrellus tasmaniensis* | V (TSC) | ✓ | ERM Mitchell McCotter 1998 | x |

The threatened fauna species with potential to occur within the Project area were specifically targeted as part of the baseline ecological surveys of the Project area. **Figure 5.4** shows the fauna survey effort undertaken to date across the Project area. As shown on **Figure 5.8**, 11 threatened fauna species have been recorded within the Project area. Targeted surveys were conducted for the green and golden bell frog (*Litoria aurea*) in February 2007. During the targeted surveys undertaken to date, the species has not been recorded within the Project area.

### 5.2.2 Potential Impacts

The primary impact of the Project will be removal of native vegetation through the development of the proposed open cut mining, overburden emplacement and infrastructure areas. Based on the current conceptual mine plan a total of approximately 960 hectares of vegetation will be required to be removed as part of Project. It is important to note that approximately 300 hectares of vegetation has been previously approved for removal as part of the Ravensworth West development consent.

The Project will result in the removal of an additional 660 hectares of native vegetation within the Project area. The vegetation within the Project area to be disturbed is dominated by four primary vegetation communities including Central Hunter Box-Ironbark Woodland, Central Hunter Bulloak Forest Regeneration, Central Hunter Ironbark – Spotted Gum – Grey Box Forest, and Central Hunter Swamp Oak Forest. All of these native vegetation communities have been identified as being regionally significant.

**Table 5.5** provides an overview of the areas of each vegetation community to be disturbed as part of the Project. These areas are based on the calculated area of disturbance associated with the conceptual mine plan dated December 2008 and will continue to be refined as part of further Project design.

**Table 5.5 – Approximate Areas of Disturbance**

| Vegetation Community | Approximate Area of Disturbance (ha) |
|---|---|
| Central Hunter Box-Ironbark Woodland | 600 |
| Central Hunter Bulloak Forest Regeneration | 20 |
| Broad-leaved Ironbark Woodland | 4 |
| Central Hunter Swamp Oak Forest | 36 |
| **Total** | **660** |

### 5.2.3 Proposed Assessment and Management Methodology

The Ecological Assessment Report included in the EA will document the methods and results of all current and previous field surveys completed across the Project area. The report will also include a detailed assessment of the impacts associated with the Project, including an assessment of the significance of identified impacts on the ecological values of the Project area, including listed TECs, populations and species.

The need to effectively minimise and manage ecological impacts associated with the Project has been identified early in the Project planning process. As outlined in **Section 2.5**, the conceptual mine plan has been revised to exclude the removal of a large area of native vegetation to the north and along Davis Creek in response to identified ecological values.

A range of options are being investigated for the mitigation of ecological impacts associated with the Project including:

- further refinement of the conceptual Project design to minimise areas of disturbance where possible;
- options for mitigation of impacts within the Project area, including habitat re-creation;
- mine rehabilitation planning to include extensive areas of native vegetation and focus on ecosystem restoration; and
- development of a comprehensive Biodiversity Offset Strategy for the Project (refer to **Section 5.2.4**).

Where feasible, these mitigation measures will be integrated into further Project planning and detailed in the EA.

### 5.2.4 Biodiversity Offset Strategy

Due to the significant ecological values of the Project area, biodiversity offsetting will be an integral component of the impact mitigation measures designed for the Project. Ravensworth Operations has undertaken a preliminary review of Biodiversity Offset Options for the Project, which has focussed on the identification of options for offsetting and identification of areas for further detailed assessment as part of the EA.

This review has identified a number of potential options for the Biodiversity Offset Strategy for the Project, including:

- Option 1 - on site conservation;
- Option 2 - conservation on alternative Xstrata sites;
- Option 3 – conservation of large woodland remnants on land not owned by Xstrata; and
- Option 4 –potential opportunities for BioBanking.

An overview of the outcomes of this review is provided in **Table 5.6**.

**Table 5.6 – Overview of Preliminary Review of Biodiversity Offset Strategy Options**

| Biodiversity Offset Option | Outcome of Preliminary Review |
|---|---|
| Option 1 – on site conservation | Majority of smaller vegetation areas able to be offset on site<br>Limited offsetting opportunities for primary vegetation community (Central Hunter Box – Ironbark Woodland):<br>• Limited area of vegetation community available on site<br>• Likely difference in ecological value<br>Focus on ecological restoration as part of rehabilitation provides opportunities to offset impacts associated with the Project<br>Further detailed ecological surveys of these areas will be undertaken as part of the EA to determine suitability for offsetting |
| Option 2 – Conservation on Alternate Xstrata Sites | Identified a number of potential areas within the region suitable as offsetting areas associated with the Project, including:<br>• Areas of ‘like for like’ and related vegetation communities<br>• Areas of similar ecological value including habitat, condition, degree of fragmentation and connectivity<br>Further detailed ecological surveys of these areas will be undertaken as part of the EA to determine suitability for offsetting |

**Table 5.6 – Overview of Preliminary Review of Biodiversity Offset Strategy Options (cont)**

| Biodiversity Offset Option | Outcome of Preliminary Review |
|---|---|
| Option 3 – Other areas of Vegetation in the Hunter Region | Review of major remnants (greater than 100 ha) within Hunter Valley floor of 'like for like' and similar vegetation communities<br>• Majority of large remnants in private ownership, or owned by other mining companies<br>• A number of areas adjacent to existing Xstrata land resources<br>Further review of potential opportunities to be undertaken as part of development of Biodiversity Offset Strategy |
| Option 4 – Opportunities for BioBanking | Current roll out of the BioBanking program during 2009 may provide opportunity for the Project<br>Program is in early development phase and may not be an option within the Project timeframe |

Given the location of the proposed development, and the extent of cleared land surrounding the Project area, it is likely that the Biodiversity Offset Strategy will include a final offsets package that will be a mixture of available options. The offset package will be determined through detailed ecological values assessment to be undertaken as part of the EA. This will include detailed ecological surveys of potential offset areas to determine suitability of these areas to form an effective offset of the potential impacts of the Project on the ecological values of the Project area.

The development of the Biodiversity Offset Strategy will be undertaken in consultation with DECC and DoP throughout the preparation of the EA.

## 5.3 Aboriginal Archaeology

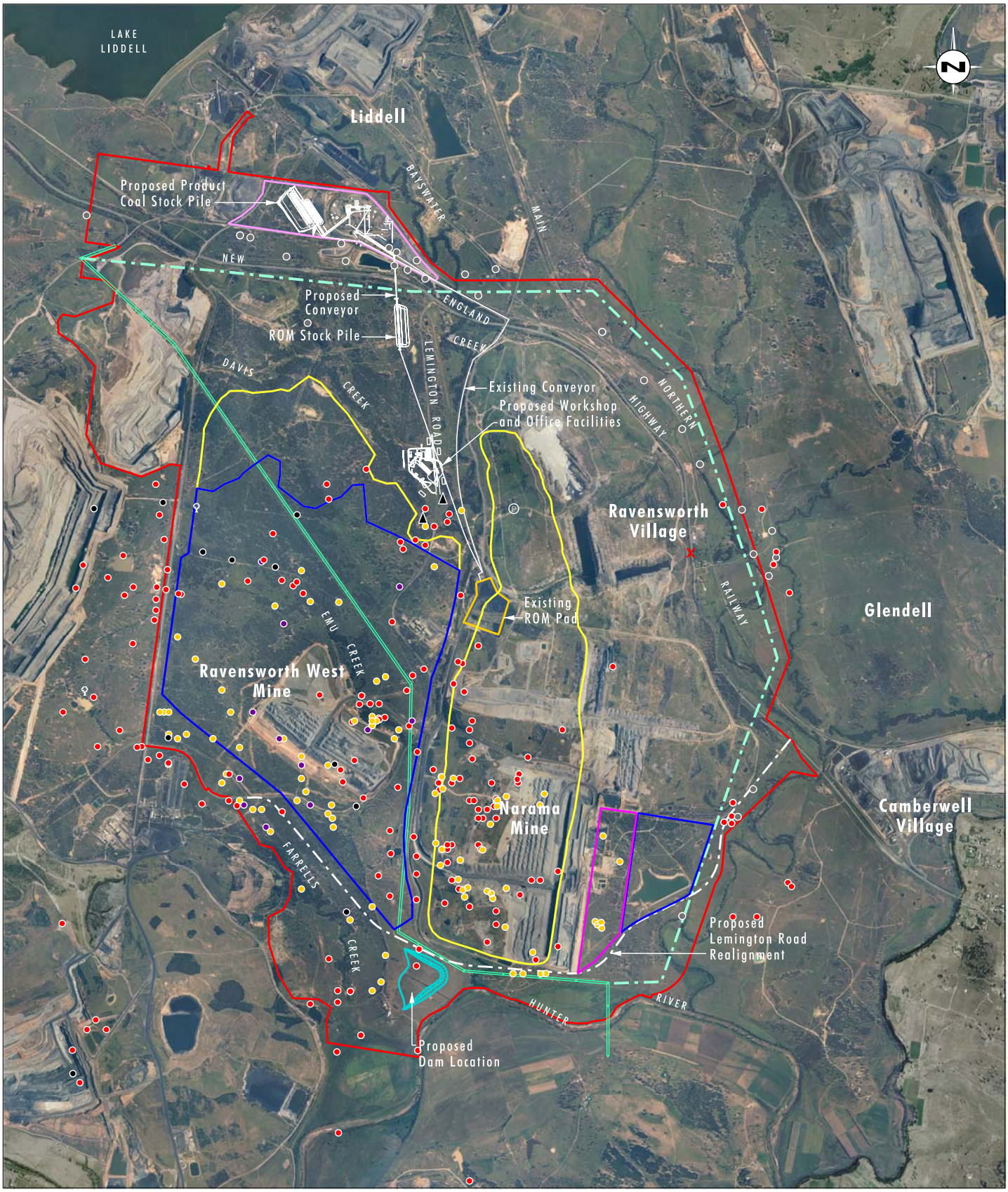
### 5.3.1 Existing Environment

Recorded archaeological sites within the Project area and its immediate surrounds that are listed on the DECC Aboriginal Heritage Information Management System (AHIMS) database are shown on **Figure 5.9**.

Sites are listed on the AHIMS database according to the site's feature and may include a number of different features. The feature AFT (artefact) records the presence of artefactual material including stone, bone, shell and metal artefacts. Sites with this feature are typically stone artefact scatters (if they contain more than one artefact) or isolated artefacts (if they contain a single artefact). The feature PAD (potential archaeological deposit) is used for areas in which it is considered likely that artefacts are present in a subsurface context. PADs are not strictly archaeological sites as the presence of archaeological material has not yet been demonstrated.

#### 5.3.1.1 Previous Studies

The Ravensworth area has been subject to extensive archaeological investigations for the Ravensworth West, Cumnock and Narama Mines, with archaeological surveys conducted by Brayshaw (1983), Godwin (1987), Rich (1990a and 1990b), Effenberger (1992), Ruig (1994), HLA (1996a, 1996b), ERM (1997) and HLA (2001), and archaeological excavations




Source: Ravensworth Operations 2007, HLA 2001 and ERM 1998

0 1.0 2.0 3km
1:60 000

## Legend

- Project Area
- Indicative Pit Shell (Ravensworth North and Narama Pits)
- Out of Pit Dump
- Ravensworth Coal Terminal
- Narama Extended (subject to separate approval)
- Existing 330kV Transmission Line
- Proposed 330kV Transmission Line
- Open Camp Site
- Isolated Find
- PAD
- Massacre Site
- Axe Grinding Groove and Open Camp Site
- Unregistered Open Camp Site
- Unregistered Isolated Find
- Unknown Site Type

FIGURE 5.9

**Previously Recorded Aboriginal Archaeology Sites in Project Area and immediate surrounds**

File Name (A4): R05_V1/2383_077.dgn

conducted by Brayshaw and Haglund (1984), Rich and McDonald (1992), ERM (2002) and Umwelt (2005).

The above studies have identified a large number of archaeological sites throughout the Ravensworth area, the majority of which have been registered on the AHIMS Aboriginal Sites Register (refer to **Figure 5.9**). In addition to the above registered sites, it is understood that there are a series of unregistered archaeological sites within the Ravensworth area, such as those recorded by ERM (1997) and some of those recorded by Godwin (1987). The locations of these sites have been sourced from original survey reports and included on **Figure 5.9**. Ravensworth Operations has obtained relevant Section 90 approvals for sites detected in approved mining areas associated with existing operations.

The previous Aboriginal heritage studies within the Ravensworth area provide coverage over the majority of the Project area. Given that the most recent assessment relating directly to the Project area was undertaken over five years ago and the remaining assessments are all more than nine years old, a detailed Aboriginal Archaeology assessment will be conducted for this Project. This will provide for an updated survey of the Project area and will involve the current Aboriginal stakeholder groups who have registered an interest in the Project (refer to **Section 5.3.3.1**).

## 5.3.2 Potential Impacts

The Project will impact on a number of Aboriginal archaeology sites directly through removal of sites associated with the proposed areas of disturbance. There is also potential for indirect impact of sites from the Project through activities such as blasting. Based on past archaeological studies within the Project area, there are a number of key archaeological features that may be potentially impacted by the Project. The key archaeological features of the Project area include:

- recorded extant Aboriginal archaeological sites outside of previous Section 90 approval processes;

- additional sites recorded during the proposed detailed survey of the Project area (refer to **Section 5.3.3**);

- areas of potentially high archaeological significance due to higher density of sites based on landform, including the major drainage lines within the Project area;

- outcomes of previous archaeological studies in relation to management and mitigation commitments for the currently approved mining operations within the Project area.

The detailed archaeological assessment to be undertaken as part of the EA (refer to **Section 5.3.3**) will provide an assessment of the impacts of the Project on the Aboriginal heritage values of the Project area, as well as develop appropriate management and mitigation controls in consultation with Aboriginal stakeholder groups.

### 5.3.2.1 Potential Management and Mitigation Measures

Mitigation and management activities may include complete or partial conservation of a site or complex of sites, detailed subsurface testing of sites or areas of PAD, archaeological salvage programs and/or the establishment of cultural offsets in the form of conservation areas or other means of mitigating the loss of cultural heritage for the Aboriginal stakeholders.

At present, the Aboriginal stakeholders are increasingly supportive of cultural heritage offsets that do not necessarily incorporate areas of land within active mine sites. It may be necessary to consider cultural heritage offset areas outside the active mine lease or to provide cultural heritage offsets in another form, as would be discussed with the community and DECC at a later stage, and may involve actions such as the provision of additional training programs or the contribution towards establishment of a keeping place for artefacts salvaged from the Project area.

Potential management and mitigation measures for the Project will be identified through the detailed Aboriginal archaeological assessment to be completed as part of the EA (refer to **Section 5.3.3**), and through consultation with DECC and Aboriginal Stakeholder groups.

### 5.3.3 Proposed Assessment and Management Methodology

Umwelt will prepare an Aboriginal archaeological assessment in accordance with current DECC policies, specifically: the *Interim Community Consultation Requirements for Applicants* (DEC 2004) or other equivalent guidelines that may be implemented by DECC prior to commencement of the assessment; and the *Aboriginal Cultural Heritage Standards and Guidelines Kit* (1997).

The detailed Aboriginal archaeology assessment will build on previous detailed investigations and assessments and involve the following:

- preparation of a review of relevant archaeological and cultural heritage literature, including a search of the DECC AHIMS (Aboriginal) Site Register and Archaeological Reports Register, the Australian Heritage Database (which includes Commonwealth and National Heritage lists) and the Register of the National Estate for listed sites within or adjacent to the Project area;

- undertaking a Native Title search;

- development of an Indigenous community participation strategy in association with Indigenous groups to be implemented throughout the remainder of the Project;

- undertaking Aboriginal consultation to DECC standards (refer to **Section 5.3.3.1**);

- obtaining comment on the Aboriginal significance (provided by the Aboriginal stakeholder groups) of the sites/PADs for inclusion within the report;

- preparation of a discussion of past environmental factors which may influence the likelihood of sites being present within the Project area;

- preparation of a predictive model for site location within the Project area;

- undertaking a field inspection of the Project area with identified Aboriginal stakeholders to identify sites/PADs which may be of archaeological significance/cultural heritage value;

- recording any new sites on DECC (NPWS) standard recording forms and submitting to the DECC AHIMS site register, and recording any artefacts located within the sites to DECC standards;

- preparation of an assessment of the archaeological significance of the sites/PADs found, according to established significance assessment criteria outlined by DECC (NSW NPWS Guidelines 1997);

- preparation of a statement of the likely effect of the proposed development on any sites/PADs discovered, known or predicted within the Project area and whether further investigation is warranted;

- preparation of a draft report in relation to the findings of the survey and assessment process that provides clear guidance in relation to the significance of the sites/PADs (if any) and identifies requirements related to their preservation, further investigation and/or destruction. The report will include relevant plans and diagrams, and will clearly identify the best management options from an Aboriginal and archaeological perspective;

- provision of the draft report to the Aboriginal stakeholder groups for their written comment;

- incorporating the comments of the Aboriginal stakeholder groups into the report; and

- finalising the report for inclusion in the EA.

#### 5.3.3.1 Aboriginal Stakeholder Group Consultation

Aboriginal stakeholders are the principal determinants of the significance of their heritage (Department of Environment and Conservation [DEC] 2004:3), and therefore the consultation process to be implemented as part of the Project will reflect the importance of Aboriginal stakeholder involvement in the identification, assessment and management of Aboriginal heritage objects/places. Specifically, the process will ensure that Aboriginal stakeholders have the opportunity to contribute to the assessment outcome through:

- involvement in the design of the cultural heritage assessment;

- participation in the identification of Aboriginal archaeological sites through involvement in fieldwork;

- assessing the cultural significance of archaeological sites identified, and providing input on the cultural values of the area in general;

- identifying the impact of development on sites/areas of cultural heritage significance;

- contributing to the development of cultural heritage management recommendations; and

- providing comment on draft assessment reports prior to their submission.

Involvement of Aboriginal stakeholders throughout this assessment has proceeded in accordance with the *Interim Community Consultation Requirements for Applicants* (DEC 2004), which took effect on 1 January 2005. This included a formal registration period during October 2008, which has resulted in 23 Aboriginal stakeholder groups registering an interest in the Project to date.

## 5.4 Historical Heritage

Past studies have identified a long history of European development within the general locality, dating back to approximately 1822 (Burton, Koettig and Thorp 1990:13). A regional assessment of European heritage was undertaken by Thorp (Burton, Koettig and Thorp 1990) and highlighted a number of significant items of historical heritage in the Singleton and Muswellbrook areas, including the Chain of Ponds Hotel (located on Coal & Allied land to the north of the Project area). Subsequent research regarding the Chain of Ponds Hotel resulted in this item being listed as state significant on the Register of the National Estate. The hotel

was constructed in the 1820s to service coach and horse traffic between Morpeth and Tamworth (Australian Heritage Database 16 April 2007). Previous research has identified two possible sources of stone for the Chain of Ponds Hotel including a creek named Davis's Creek (Dawson et al. 1990: 11). This may be a reference to Davis Creek, part of which is included in the Project area, and this issue will be further investigated as part of this assessment.

Searches of the Australian Heritage Database, State Heritage Register and State Heritage Inventory have been conducted for the Project area. No national or state listed heritage items were identified within the Project area. Similarly, parish maps dated to between 1886 and 1942 did not record the presence of any homesteads or other structures within the Project area.

A review of the historical context of the Project area indicates that it is likely to contain items of local historical heritage significance only. With the exception of a possible stone quarry on Davis Creek, it is not anticipated that historical heritage items or sites within the Project area will be of a sufficient level of significance to require complete conservation.

### 5.4.1 Proposed Assessment and Management Methodology

The potential impacts of the Project on historic heritage items will be considered as part of the EA. Based on existing knowledge of the area and the current layout of the Project, it is unlikely that any substantial historic heritage items will be found and/or affected by the proposal. As such the scope of works will consist of a desktop analysis and field observations by archaeologists where required.

The desktop analysis will include:

- a review of previous surveys of the site and its surrounds, including a search of relevant databases;
- a discussion of past factors which may influence the likelihood of sites being present within the Project area; and
- the preparation of a predictive model for site location within the Project area.

In the event that an item is discovered, the following tasks will be undertaken:

- record any artefacts located within the sites to the NSW Heritage Office standard;
- identify and define the historical archaeological sensitivity and values of the Project area in order to qualify the assessment of its significance; and
- prepare an archaeological assessment documenting the investigation of the precinct, supported by plans, photography and surface inventory.

All investigations and assessments will be conducted, and documents prepared, in accordance with the published standards and guidelines of the NSW Heritage Office, in particular the *NSW Heritage Manual* and the Local Government Heritage Guidelines. The heritage assessment report will be included in the EA.

# 5.5 Water Resources

## 5.5.1 Existing Environment

The Project area is located within the catchment areas of Emu Creek, Davis Creek, Farrells Creek, Bayswater Creek and Bowmans Creek, and the Ravensworth West and Narama Mine water management system. Emu Creek, Davis Creek and Farrells Creek are all tributaries of Bayswater Creek. Bayswater Creek flows in a southerly direction to its confluence with the Hunter River south of the Project area. Bowmans Creek is also a tributary of the Hunter River, with the confluence of this creek and the Hunter River located to the south-east of the Project area.

Emu Creek is a third order stream, Davis Creek a fourth order stream, Farrells Creek a third order stream and Bayswater Creek is a fourth order stream under the Strahler stream ordering system. All of these creeks are ephemeral. Bayswater Creek is highly modified due to an existing diversion channel which was constructed as part of open cut mining operations in Narama. The creeks within the proposed pit area consist of third and fourth order drainage lines.

The natural catchment areas of Davis Creek, Emu Creek, Farrells Creek and Bayswater Creek have all been reduced by open cut mining. The open cut mines located within the natural catchment areas include Cumnock, Ravensworth West, Narama and Howick.

The boundaries of the subcatchments and creeks within the Project area are shown on **Figure 5.10** and the subcatchment areas are listed in **Table 5.7**.

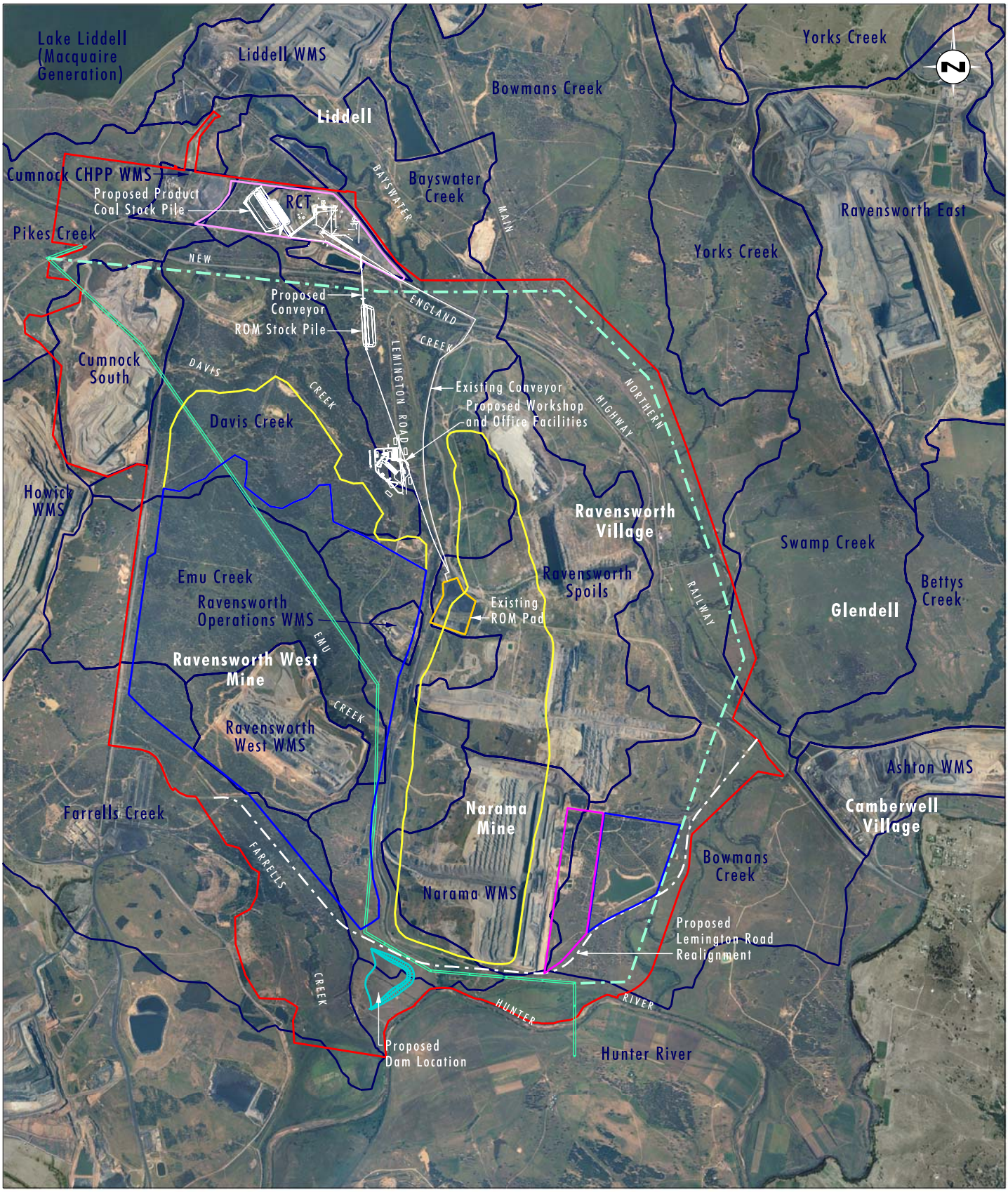
**Table 5.7 - Catchment Areas**

| Creek | Total Catchment Area (ha) | Catchment Area within Project Area (ha) |
|---|---|---|
| Emu Creek | 624 | 464 |
| Davis Creek | 678 | 673 |
| Farrells Creek | 1185 | 306 |
| Bayswater Creek | 1362 | 1020 |
| Bowmans Creek | 4180 | 940 |

### 5.5.1.1 Ravensworth West and Narama Water Management System

Ravensworth Operations operates an extensive water management system for the existing Ravensworth West and Narama mining operations. The key functions of these controls are to:

- minimise the contamination of clean water by mining activities;
- control the diversion of non-mine impacted waters away from mining activities to reduce the volume of mine impacted water;
- reduce the discharge of pollutants from the mine to the environment;
- segregate mine impacted water from better quality, disposable water and reduce the subsequent recycling of the mine impacted water;




Source: Ravensworth Operations 2007, HLA 2001 and ERM 1998

0 1.0 2.0 3km
1:60 000

## Legend

- Project Area
- Indicative Pit Shell (Ravensworth North and Narama Pits)
- Out of Pit Dump
- Ravensworth Coal Terminal
- Narama Extended (subject to separate approval)
- Existing 330kV Transmission Line
- Proposed 330kV Transmission Line
- Catchment Areas

FIGURE 5.10

**Catchment Areas within Project Area**

File Name (A4): R05_V1/2383_068.dgn

- manage approved water discharges to meet licence conditions; and

- minimise adverse effects on the creek and river systems (i.e. hydraulic and water quality impacts).

#### 5.5.1.2 Greater Ravensworth Water Sharing System

As outlined in **Section 2.4.4**, Xstrata operations in the greater Ravensworth area, including the existing Ravensworth Operations, Mt Owen Complex, Liddell Colliery, Cumnock Colliery and RUM, participate in the Greater Ravensworth Water Sharing System. The Greater Ravensworth Water Sharing System links the existing water management systems of Xstrata operations in the Ravensworth area to enable the sharing and beneficial re-use of water between operations. The operations are linked through a range of water transfer infrastructure and storages, including surface storages, voids and former underground workings. A schematic overview of the system is shown on **Figure 2.6**.

The current Ravensworth Operations water management system has an important role in the Greater Ravensworth Water Sharing System through its ability to discharge surplus water from the system (i.e. from 1000 ML dam) under the conditions of its EPL and the Hunter River Salinity Trading Scheme (HRSTS).

Xstrata is currently completing a comprehensive review of the Greater Ravensworth Water Sharing System to identify opportunities for improved management of the system and for future ongoing water demand planning within the Ravensworth area. This review has included the development of a water balance model for the regional system, and will also identify specific opportunities for the inclusion of the Project into the water sharing system.

### 5.5.2 Potential Impacts

The Project will impact on existing water resources through alterations to existing natural catchments through the development of open cut mining and overburden emplacement areas. As part of the Project it is proposed to remove the remaining sections of Emu Creek within the Project area. The management and mitigation of the impacts associated with the proposed removal of Emu Creek, including potential impacts on upstream and downstream catchments, will be considered in detail as part of the EA.

The Project has the potential to have a significant impact on the water quality of existing creek lines to be maintained with the Project area including Davis Creek, Bayswater Creek, Farrells Creek and Bowmans Creek. The reduction in catchment areas, potential diversions and significant disturbance within the catchment areas will need to be managed to mitigate these potential impacts. The management of mine water at the proposed site would require the construction of dams, pipelines and pumping stations. Further investigations of water management options for the Project will be undertaken as part of the development of the EA.

Substantial ongoing water storage and supply is anticipated to be a requirement of the Project. This will be required for proposed on site uses such as coal processing, dust suppression and equipment maintenance. Consideration as to the most sustainable way of sourcing the water is being undertaken as part of the detailed Project design process. As outlined in **Section 2.4.4**, the Project has a major opportunity to use the existing pipeline and water sharing system of the surrounding Xstrata mines. This beneficial re-use of mine water between mining operations has the benefit of minimising the requirement to access water from surrounding natural water bodies for on-site processes.

### 5.5.3 Proposed Assessment and Management Methodology

A detailed water resources assessment will be undertaken as part of the EA for the Project. The water resources assessment will include:

- a site water balance that will:
  - take into account available water sources (i.e. likely catchment yields, groundwater make and other potential off-site supplies);
  - take into account water demand for the Project including production, dust suppression requirements and water sharing arrangements;
  - be based on daily time step models developed to undertake a detailed assessment of the Project water balance;
  - enable demand and supply peaks and storage requirements to be explored under a range of rainfall/evaporation, groundwater make and production conditions;
  - allow a detailed risk analysis of operational water supply to be completed using available long term rainfall and evaporation data and groundwater modelling predictions; and
  - identify any additional water management infrastructure needs over the life of the Project.
- documenting the existing characteristics of the catchments within the Project area including:
  - drainage system including stream ordering;
  - channel depth, bed-slope and stability;
  - nature of the stream bed (e.g. alluvial bed, pool and riffle sequences, etc.);
  - extent of riparian vegetation;
  - existing land use impacts and water users (including a review of the DWE water licence database); and
  - interactions with the existing mine water management system.

Based on this information and with consideration of the conceptual mine plans, including major infrastructure and likely subsidence and depth of cover ranges, other detailed surface water assessment will include:

- likely impacts and stream remediation requirements;
- potential for surface water capture and/or diversions;
- potential for increased surface ponding;
- potential impacts on the local flooding regime; and
- potential for changes to surface water quality and potential erosion and sediment control measures required.

In addition to those aspects of the operation's water cycle listed above, the water component of the EA will address:

- water legislation, comprising both the Water Act and Water Management Act, and including the preparation of any Part 2 and Part 5 Permit(s) (Water Act) required; and

- water policies, including Water Sharing Plans.

## 5.6 Groundwater

### 5.6.1 Existing Environment

There are potentially two general aquifer types occurring within the proposed Project area. These consist of localised alluvial aquifers associated with the surface water of creek systems and the regional hardrock aquifer associated with the coal measures.

The proposed pit shell is located in proximity to old Cumnock underground workings. The previous underground mining is understood to be primarily within the Liddell and Upper Pikes Gully Seams. The former Cumnock underground workings contain significant volumes of mine water (up to approximately 1200 ML storage available), and form an important component of the Greater Ravensworth Water Sharing System.

Groundwater monitoring is conducted via the use of extensive monitoring piezometer networks (refer to **Figure 5.11**). The groundwater monitoring network has been installed to monitor a range of the parameters within the target coal seams in the Project area. The groundwater monitoring network includes the following:

- monitoring locations undertaking measurement of groundwater quality within the coal seams;

- vibrating wire piezometers which continuously monitor static pressure on a 12-hourly basis from eight different coal seams;

- monitoring locations between the Hunter River and the existing mining operations within the Project area, each with three bores targeting seams at variable depths.

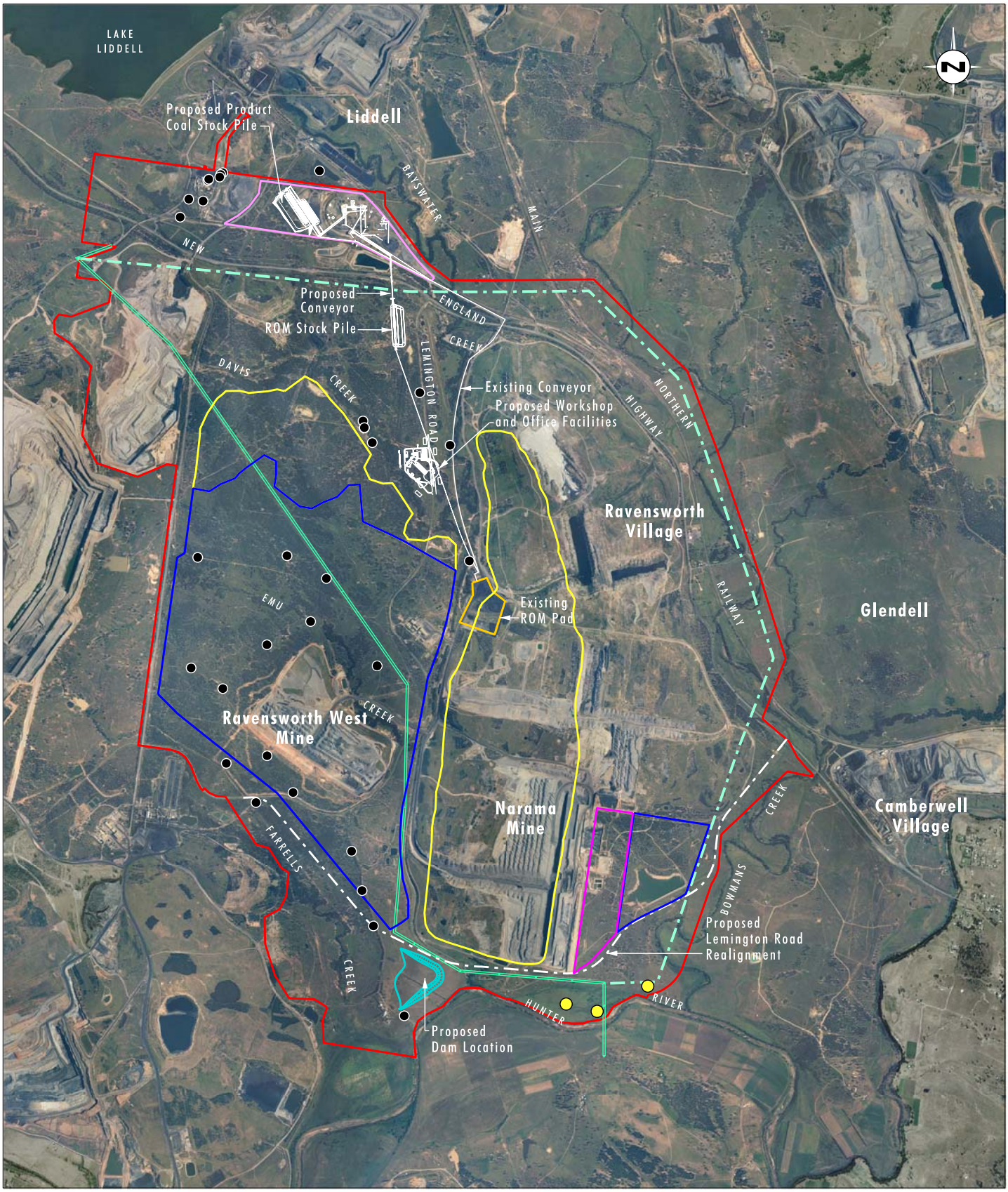
The groundwater monitoring results for the 2007 to 2008 period have indicated the following characteristics of the groundwater systems within the Project area:

- in proximity to mining operations the hardrock/coal measures aquifer water levels are influenced by depressurisation of coal seams associated with the coal mining activities. However, the gradual fluctuations in hardrock/coal measures aquifer water levels can be attributed to the recharge of the groundwater from rainfall events;

- the groundwater level contours for the 2007 to 2008 monitoring period, prepared from the available monitoring data, show a dip in the groundwater levels from the north-west to the south-east. This is consistent with the dip in rock strata towards the south-east;

- speciation results for all seams showed elevated electrical conductivity (EC) levels consistent with the elevated levels of salinity within the Hunter Coal Measures.

Ravensworth Operations has recently installed a number of additional piezometer locations in order to provide further characterisation of groundwater regime within the Project area and surrounds. This includes the installation of a number of piezometers in the vicinity of Bowmans Creek and the Hunter River in the southern extent of the Project area, in order to provide information on the characteristics of the alluvium systems associated with these waterways.




Source: Ravensworth Operations 2007, HLA 2001 and ERM 1998

0 1.0 2.0 3km
1:60 000

## Legend

- Project Area
- Indicative Pit Shell (Ravensworth North and Narama Pits)
- Out of Pit Dump
- Ravensworth Coal Terminal
- Narama Extended (subject to separate approval)
- Existing 330kV Transmission Line
- Proposed 330kV Transmission Line
- Existing Groundwater Monitoring Locations
- Planned Piezometer Locations

FIGURE 5.11

**Groundwater Monitoring Locations within the Project Area**

File Name (A4): R05_V1/2383_069.dgn

In addition to this, surrounding mining operations undertake extensive groundwater monitoring of the known aquifer system in the Ravensworth area. Ashton Coal undertakes extensive monitoring along Bowmans Creek to the south-east of the Project area. Ravensworth Operations is in the process of formalising data sharing arrangements with surrounding mining operations in order to utilise this additional data where possible.

### 5.6.2 Potential Impacts

As outlined in **Section 2.2.1**, the target coal seams for the Project include seams commonly mined within surrounding mining operations. As such, the aquifer system associated with the coal seam measures within the Project are likely to have been depressurised by the surrounding mining operations. The detailed groundwater assessment to be undertaken as part of the EA will include an assessment of the extent of depressurisation of coal seams, down to the Barrett Seam within the Project area. Investigations regarding the regional groundwater impacts will also be undertaken as part of the environmental assessment process.

The extent of the alluvial aquifers within the Project area is not fully defined but from the topography it appears unlikely that either Emu Creek or Davis Creek at the location of the proposed pit will have extensive alluvium. The extent of alluvium, particularly along Bowmans Creek, will be determined through the development of the EA. The assessment will also demonstrate that the Project will assess the impact on alluvial areas associated with the Hunter River, and the Project design will need to ensure no significant impact on these alluvials.

As the proposed mining area is located down dip of the old Cumnock workings, there is a high potential for seepage of water stored in the old workings into the proposed mining area. Interactions between the proposed development and the existing underground workings will be further considered as part of the EA.

### 5.6.3 Proposed Assessment and Management Methodology

The groundwater related impacts arising from the Project will be assessed by Mackie Environmental Research. This will include the development of a computer model which simulates the groundwater systems and interactions of the mining process. The aspects that the groundwater assessment will consider are outlined below:

- estimate the Project specific groundwater impacts for the proposed mining operations including:
    - groundwater inflow into the open cut workings including water quality;
    - interactions with old underground workings adjacent to the proposed open cut pits;
    - extent of depressurisation of the coal measures;
    - impact on aquifers;
    - potential loss of water supply to local and regional users;
    - post mining water level recovery; and
    - impacts on groundwater dependent ecosystems.
- estimate the groundwater contribution to the operation's water balance;
- provide recommendations relating to the management of the groundwater resource, management of groundwater inflows to the pit, and the impact groundwater may have on the operation's water balance.

The assessment will identify impacts on private bores, land uses, base flow in perennial streams, and develop threshold targets to identify potential adverse impacts. Groundwater management and monitoring requirements will also be detailed in the EA.

## 5.7 Noise

### 5.7.1 Existing Environment

To ensure that the mine generated noise levels at privately owned residences do not exceed relevant amenity criteria, Ravensworth Operations maintains a program of regular noise attended and non-attended monitoring at surrounding properties (refer to **Figure 5.12**). The noise monitoring locations are situated at Camberwell Village and the closest surrounding residences, one of which has recently been acquired by Ravensworth Operations and another property (Cheshunt) has an existing private agreement in place.

Recent noise assessments have been completed as part of EAs for the existing Narama Mine (Umwelt 2008) and Glendell Mine (Advitech 2007). Both of these assessments included monitoring programs designed to characterise the existing noise environment in surrounding receiver areas, including a number of private residences and Camberwell Village, located approximately 5 kilometres to the south-east of the Project area. Both assessments included the determination of a Rated Background Level (RBL) in accordance with DECC's Industrial Noise Policy (INP). The RBL is based on the determination of existing environmental noise levels in the absence of noise from the proposed Project subject to the noise assessment.

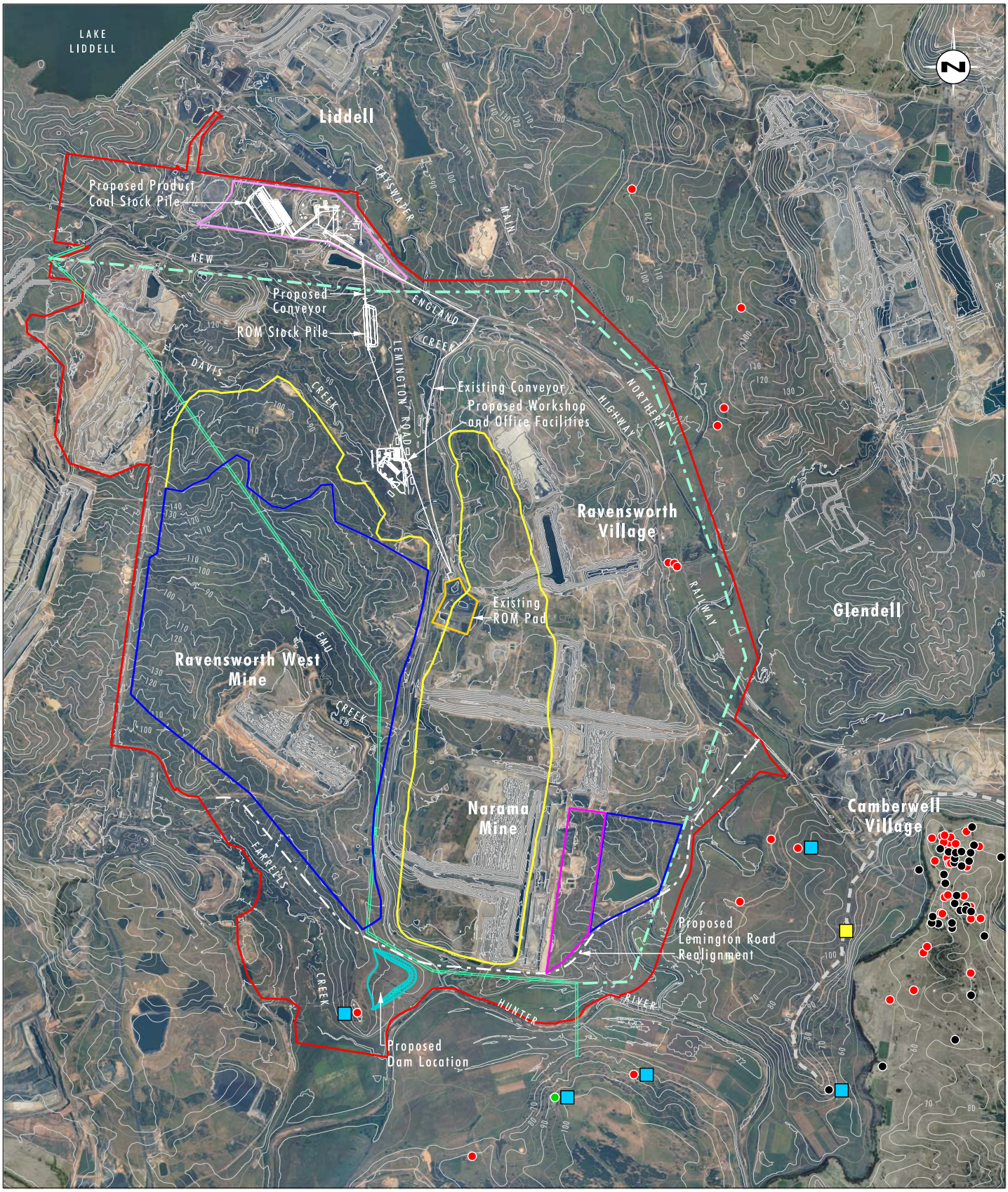
The Umwelt (2008) and Advitech (2007) monitoring results indicated that the applicable RBLs are generally around 30 dB(A) at the surrounding private rural residences and the areas surrounding Camberwell Village. The Umwelt (2008) noise monitoring program highlighted an elevated RBL to approximately 33 dB(A) during the evening period (6.00 pm to 10.00 pm), within surrounding areas. In addition, the results from the Advitech (2007) monitoring program show that road noise from the New England Highway has a measurable effect on the noise environment of Camberwell Village.

Noise monitoring programs undertaken within the key receiver areas for the Project have highlighted that the existing background noise is influenced by activities of the surrounding mining operations and traffic noise associated with the New England Highway. In addition, the elevated RBLs determined during the evening and night time periods were generally due to the enhancing effects of temperature inversions, which are more prevalent during these periods relative to the day time period.

In order to further characterise the noise environment of the surrounding key receiver areas, Ravensworth Operations will continue to implement its ongoing noise monitoring program. The existing noise monitoring system will be enhanced through the installation of a continuous noise monitor within receiver areas. The proposed continuous noise monitoring location is shown on **Figure 5.12**. In addition, surrounding Xstrata operations maintain an extensive noise monitoring network within the surrounding area, including continuous noise monitors located in Camberwell Village. Noise monitoring data collected from these monitors will also be used as part of noise impact assessment to be undertaken as part of the EA.

### 5.7.2 Potential Impacts

The key receiver areas are located approximately 5 kilometres to the south-east of the Project area. As outlined in **Section 4.1**, Ravensworth Operations and surrounding mining operations own significant areas of buffer land associated with existing mining operations




Source: Ravensworth Operations 2007, HLA 2001 and ERM 1998
Note: Contour Interval 5m

## Legend

- Project Area
- Indicative Pit Shell (Ravensworth North and Narama Pits)
- Out of Pit Dump
- Ravensworth Coal Terminal
- Narama Extended (subject to separate approval)
- Existing 330kV Transmission Line
- Proposed 330kV Transmission Line
- Mined Owned Residence
- Private Residence
- Private Residence with Agreement
- Existing Attended Noise Monitoring location
- Proposed Continuous Noise Monitoring location
- Ridge Line

FIGURE 5.12

**Ravensworth Operations Noise Monitoring Locations**

File Name (A4): R05_V1/2383_070.dgn

within the Ravensworth area. In addition to this, the intervening topography between the Project area and surrounding receivers, including the ridgeline that surrounds Camberwell Village (refer to **Figure 5.12**), is likely to act as an effective barrier to noise generated by the Project.

The key potential noise impact from the Project is the potential for cumulative noise to exceed the NSW INP guidelines within surrounding receiver areas. A detailed noise impact assessment will be undertaken to better understand noise impacts from the Project. This impact assessment will include an assessment of the potential noise impacts associated with the Project in the context of existing noise environment of receiver areas, which is influenced by a number of noise sources including surrounding mining operations and noise from the New England Highway.

Given the potential for a significant contribution to cumulative noise levels from the Project, feasible noise mitigation measures are being considered as part of Project design. Noise mitigation measures include noise attenuation of equipment and operational staging to enable operations to continue during noise enhancing conditions. Further details of the specific noise management and mitigation measures will be described and evaluated through the detailed noise impact assessment.

### 5.7.3 Proposed Assessment and Management Methodology

A noise impact assessment will be undertaken in accordance with the NSW INP. The detailed noise impact assessment will include the following activities:

- measuring and determining existing background and ambient noise levels in the locality of the proposed development;
- determination of the Project specific noise levels based on the existing intrusive and amenity noise levels;
- preparation of computer noise models using Environmental Noise Model (ENM) for up to six stages of the proposed development. Iterative noise modelling is being conducted to minimise noise impacts as part of Project design;
- consideration of feasible and reasonable noise mitigation strategies where the Project Specific Noise Levels (PSNL) are exceeded;
- an overview of the cumulative noise impacts from the proposed development and other relevant nearby industrial operations;
- an assessment of the construction noise impact of the Project in accordance with relevant assessment procedures;
- an assessment of the road and railway noise impact in accordance with relevant assessment procedures based on the traffic movements associated with the Project.

Should the development exceed the NSW INP guidelines at any residential locations, relevant further mitigation measures will be considered in the EA.

# 5.8 Blasting

## 5.8.1 Existing Environment

Blasting is currently undertaken at all of the open cut mines which surround the Project area, including the existing Ravensworth West and Narama Mines within the Project area. Key considerations in the design of blasts include the off site impacts on receiver areas, including residences and other sensitive land uses, due to overpressure and vibration. In addition, potential impact of blasting vibration on infrastructure in proximity to a mining operation is an important blast management issue. Relevant blasting limits need to be considered when planning the Project blast sequences, strip widths and production rates.

The DECC set guidelines for blasting based on human comfort levels. The guidelines have been adapted from the ANZECC Guidelines *"Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration"* (ANZECC 1990). The ANZECC guidelines are based on human comfort levels and are much more stringent than those based on the potential for damage to structures. The fundamental criteria are that at any residence or other sensitive location, including Camberwell Church:

- The maximum overpressure due to blasting should not exceed 115 dB for more than 5 per cent of blasts in any year, and should not exceed 120 dB for any blast; and

- The maximum peak particle ground velocity (PPV) should not exceed 5 mm/s for more than 5 per cent of blasts in any one year, and should not exceed 10 mm/s for any blast.

Blast vibration and overpressure is monitored by Ravensworth Operations for blasting activities associated with existing mining operations at Ravensworth West, Cumnock and Narama. Ravensworth Operations utilises a real time blast monitoring network that monitors blasting at Camberwell Church, Camberwell village, and two residences within the surrounding area (refer to **Figure 5.13**). In addition to the monitoring of blasting impacts on surrounding areas, the blast monitoring system provides real time feedback in relation to blast design based on updated site laws.

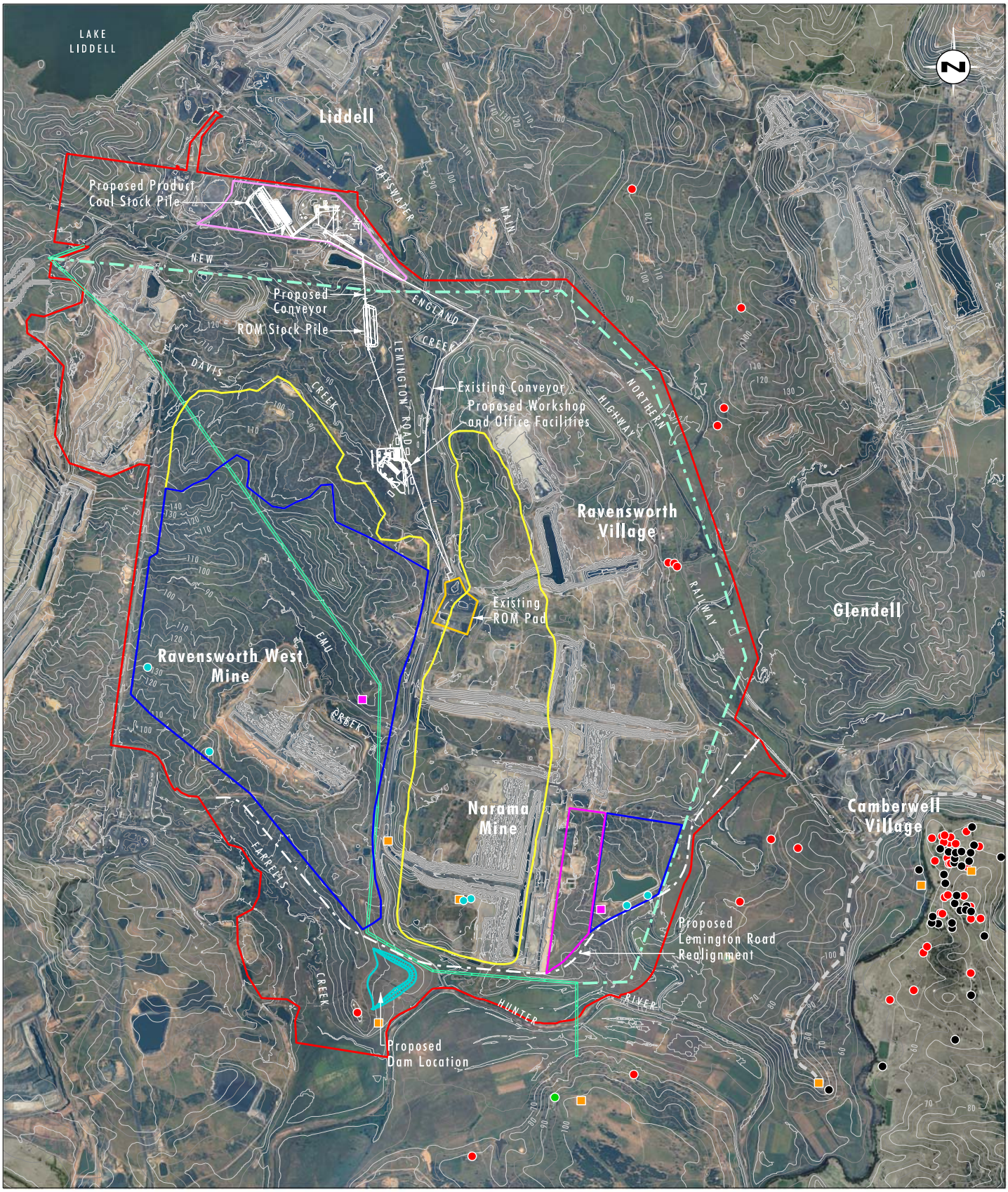
Further to the ANZECC guidelines, vibration criteria are also required for infrastructure within the surrounding area to ensure that potential impacts can be managed. The relevant criteria for blasting vibration on infrastructure will be determined in consultation with relevant agencies and/or the infrastructure owner through the development of private agreements. There is a range of infrastructure in proximity to the Project area including:

- coal handling infrastructure including coal stockpiles and conveyors from the adjacent Coal and Allied Hunter Valley Operations and the existing conveyors associated with existing Narama operations;

- water management infrastructure including the existing 1000 ML water storage dam located in the south-eastern extent of the Project area – relevant blast vibration criteria for the dam wall has been determined by the Dams Safety Committee (DSC);

- service infrastructure including electricity transmission lines within the surrounding area; and

- transport infrastructure including the Main Northern Railway and the existing and proposed surrounding road network.




**Source:** Ravensworth Operations 2007, HLA 2001 and ERM 1998
**Note:** Contour Interval 5m

## Legend

- Project Area
- Indicative Pit Shell (Ravensworth North and Narama Pits)
- Out of Pit Dump
- Ravensworth Coal Terminal
- Narama Extended (subject to separate approval)
- Existing 330kV Transmission Line
- Proposed 330kV Transmission Line
- Mined Owned Residence
- Private Residence
- Private Residence with Agreement
- Blast Monitoring Station
- Blast Early Warning Unit
- Portable Blast Monitors
- Ridge Line

FIGURE 5.13

Ravensworth Operations
Blast Monitoring Locations

**File Name (A4):** R05_V1/2383_071.dgn

### 5.8.2 Potential Impacts

As outlined in **Section 2.2.2**, it is proposed that blasting will be undertaken on a regular basis for both overburden removal and coal extraction. The proposed blasting practices to be undertaken as part of the Project have the potential to impact on surrounding receiver areas and on infrastructure in the surrounding area. The potential impacts of the Project on these features will be assessed as part of the detailed blast assessment undertaken as part of the EA (refer to **Section 5.8.3**).

The existing Ravensworth Operations mining operations currently operate within the blast criteria requirements for surrounding infrastructure areas. A number of recent detailed assessments of basting impacts on infrastructure have been undertaken in Ravensworth area to review the relevant blast vibration limits. This has included a recent ACARP study on the blasting vibration effects on coal handling infrastructure at Cumnock.

Detailed blast assessments are currently undertaken on an annual basis on Ravensworth Operations 1000 ML Dam, as directed by the DSC. Vibration limits on the dam wall are to be kept below 25 mm/sec. Recent assessments at Ravensworth Operations indicate that the current operations do not exceed the relevant blast limit criteria on the 1000 ML Dam wall set by the DSC. Vibration models on the dam wall, however, do show that 25 mm/sec may be exceeded by blasting activities during the life of the mine. Ravensworth Operations is undertaking further detailed assessment of the stability of the 1000 ML dam wall in relation to blasting vibration, in consultation with the DSC.

The outcomes of these recent detailed assessments will be utilised in the development of the conceptual blast design for the Project and form the basis of the detailed blasting assessment to be undertaken as part of the EA.

As outlined in **Section 5.3**, there are a number of potentially sensitive environmental features, including previously recorded archaeological sites, located outside of the proposed open cut and overburden emplacement areas. These features may be impacted indirectly by the Project through blasting vibration. The potential impacts of the proposed blasting practices on these sensitive environmental features will be considered as part of the EA.

During the design of blasting sequences, consideration of potential constraints of blasting being undertaken within 500 metres of a public road, and the cumulative impact of blasting with surrounding mining operations, will also be considered.

### 5.8.3 Assessment and Management Methodology

Modelling of blasting impacts (vibration and overpressure) will be undertaken to identify any potential impacts on surrounding residences, existing and proposed infrastructure and sensitive environmental features. This modelling will be based on the site laws established during previous operations, and used to develop blasting site rules to ensure blasting impacts are appropriately managed over the life of the Project.

## 5.9 Air Quality

### 5.9.1 Existing Environment

Dust levels are a key community concern within the Upper Hunter Valley region. The existing air quality in the area immediately surrounding the Project area is influenced by a number of factors, including prevailing meteorological conditions, topography, power generation activities, agriculture and extensive mining activities.

Ravensworth Operations maintains a network of 18 dust deposition gauges, 5 directional gauges and 4 High Volume Air Samplers (HVAS) to monitor dust levels surrounding the site. The existing air quality monitors are strategically located to monitor impacts from existing Ravensworth West and Narama operations within surrounding receiver areas. The locality of each gauge is shown on **Figure 5.14**.

Dust deposition monitoring indicates that the DECC's annual average target of 4 $g/m^2$/month is achieved at nearest private residences to the existing Ravensworth Operations. Monitoring at Camberwell Church, which is located more distant and approximately 5 kilometres east of the Project area has indicated an exceedance of the cumulative dust deposition criteria in 2007. Due to the distance of the existing Ravensworth Operations from the village (approximately 5 kilometres), it makes only a very minor contribution to dust levels at this location.

HVAS results reflect the ambient air quality experienced in the Hunter Valley associated with the persistent dry conditions across NSW, followed by subsequent improvements in air quality following the heavy rain in June, August and November/December 2007. Annual average TSP results are consistently below DECC's annual average target of 90 $\mu g/m^3$ at the three HVAS monitors that are located closest to Narama mine. The existing TSP monitor located at Camberwell Church has indicated a trend of existing TSP levels approaching and, under certain conditions, exceeding the relevant criteria within this area.

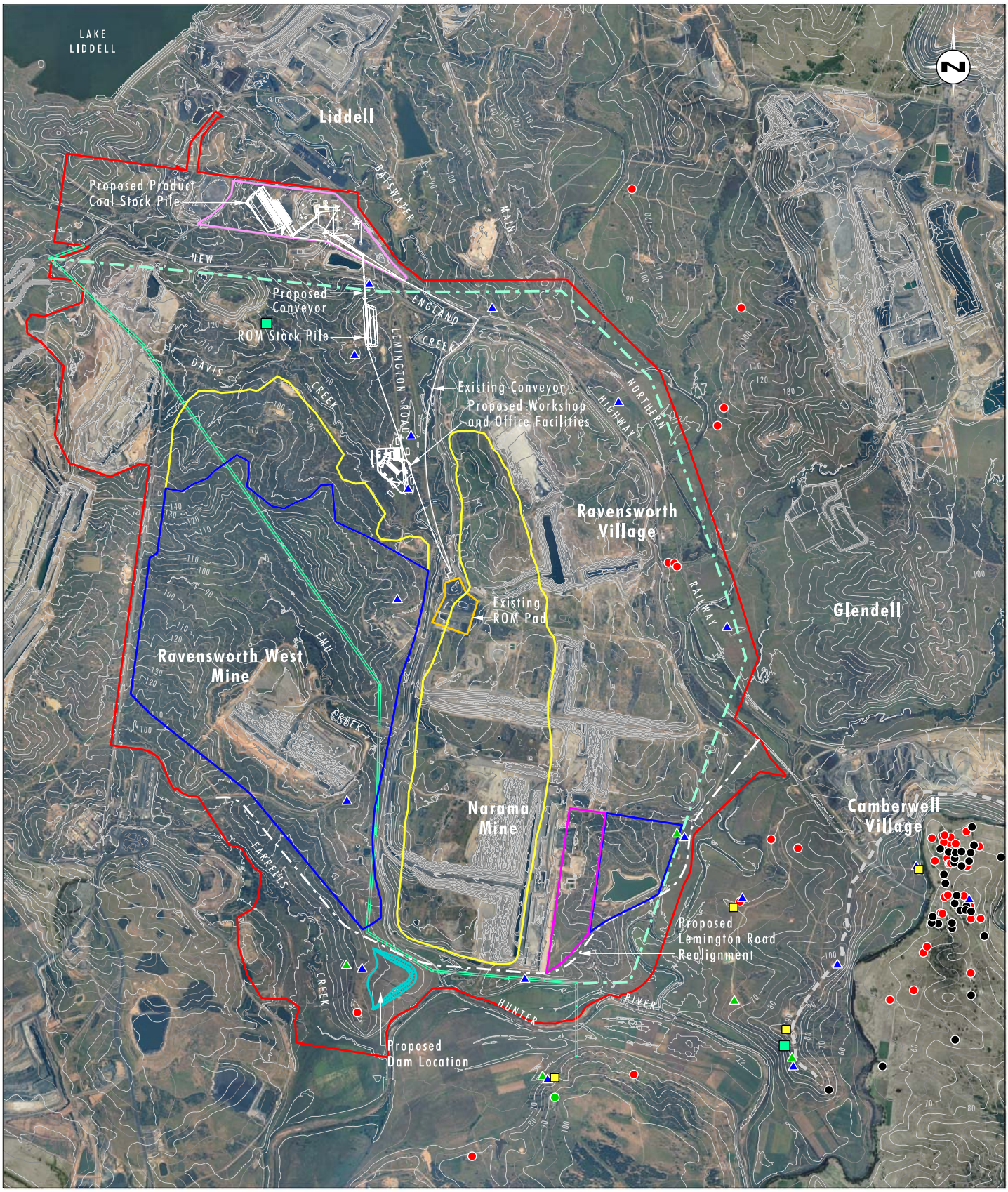
Surrounding mining operations also maintain an extensive network of air quality monitoring locations within the surrounding area, including an array of continuous $PM_{10}$ monitors within Camberwell Village. Data from these monitoring locations is generally consistent with the data collected by the Ravensworth Operations dust monitoring network. This monitoring has indicated that recent trends in $PM_{10}$ concentration within the surrounding area are approaching and exceeding the relevant criteria, under certain conditions.

In order to further characterise the air quality environment of the surrounding key receiver areas, Ravensworth Operations will continue to implement its ongoing air quality monitoring program. The existing noise monitoring system will be enhanced through the installation of a number of continuous $PM_{10}$ monitors within receiver areas. The continuous noise monitoring location is shown on **Figure 5.14**, and has been sited in order to determine the likely contribution of the Project to air quality levels within the surrounding area. In addition, surrounding Xstrata operations maintain an extensive air quality monitoring network within the surrounding area, including continuous monitors located in Camberwell Village.

### 5.9.2 Potential Impacts

The key receiver areas are located approximately 5 kilometres to the south-east of the Project area. As outlined in **Section 4.1**, Ravensworth Operations and surrounding mining operations own significant areas of buffer associated with existing mining operations within the Ravensworth area. In addition to this, the intervening topography between the Project area and surrounding receivers, including the ridgeline that surrounds Camberwell Village (refer to **Figure 5.14**), is likely to act as an effective barrier to dust generated by the Project.

The key potential air quality impact from the Project is the potential for an exceedance of relevant cumulative criteria within surrounding receiver areas. A detailed air quality impact assessment will be undertaken to better understand potential impacts on air quality from the Project. This impact assessment will include an assessment of the potential dust impacts associated with the Project in the context of existing air quality environment of receiver areas, which is influenced by a number of sources including surrounding mining operations, agricultural land uses and prevailing climatic conditions (e.g. drought).




Source: Ravensworth Operations 2007, HLA 2001 and ERM 1998
Note: Contour Interval 5m

## Legend

- Project Area
- Indicative Pit Shell (Ravensworth North and Narama Pits)
- Out of Pit Dump
- Ravensworth Coal Terminal
- Narama Extended (subject to separate approval)
- Existing 330kV Transmission Line
- Proposed 330kV Transmission Line
- Mined Owned Residence
- Private Residence
- Private Residence with Agreement
- Directional Dust Gauge
- Dust Deposition Gauge
- High Volume Air Sampler
- Proposed TEOM Monitoring location
- Ridge Line

FIGURE 5.14

Ravensworth Operations
Air Quality Monitoring Locations

File Name (A4): R05_V1/2383_072.dgn

Given the potential for a significant contribution to cumulative air quality impacts from the Project, feasible mitigation measures are being considered as part of Project design. Dust control mitigation measures include operational staging to enable operations to minimise the areas of disturbance and to continue under unfavourable meteorological conditions. Further details of the specific air quality management and mitigation measures will be described and evaluated through the detailed air quality impact assessment.

### 5.9.3 Proposed Assessment and Management Methodology

The Air Quality Assessment will be completed by Holmes Air Sciences and will follow the procedures outlined in the '*Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*' (DEC, 2005). The assessment will include the development of an air quality dispersion model for the Project and surrounding areas through the use of a recognised modelling system endorsed by the DECC.

The dispersion model predicts ground-level dust concentration and dust deposition levels due to the potential dust generating activities associated with the Project. The dispersion modelling will take account of local meteorology, terrain information and uses dust emission estimates to predict air quality impacts associated with the proposed Project.

The calculated emissions will take account of proposed air pollution controls and mitigation strategies including passive controls such as those built into the mine plan (for example stockpile size and alignment, and length of haul roads) and active controls such as the intensity of watering and extent of rehabilitation.

The air quality assessment undertaken as part of the EA process will include the following components:

- Development of an emissions inventory to provide predictions of the maximum 24 hour average $PM_{10}$ concentrations and annual average concentrations for TSP and $PM_{10}$ and deposited dust, associated with the proposed open cut operation;

- Assessment of the potential for the predicted levels to cause an exceedance of the relevant assessment criteria, using a judgement as to the likely background levels based on analysis of existing monitoring data and estimation of the potential impacts of other nearby mines (approved and potential);

- Detailed assessment of existing air quality in the proposed site area through a review of air quality monitoring data for dust deposition and concentrations of $PM_{10}$ and TSP;

- The assessment of impacts on nearest residences in accordance with the current DECC requirements using a dispersion model and relevant meteorological data to predict dust deposition rates and concentrations of $PM_{10}$ (24 hour and annual average) and TSP (annual average). The predicted values would be compared with DECC Guidelines (DEC 2005); and

- Assessment of the cumulative impacts associated with existing and proposed mining operations (including, but not limited to, Hunter Valley Operations, Mt Owen Complex and potentially other mines such as Liddell and Camberwell mines) by modelling expected dust emissions of the proposed Project with estimated dust emissions from nearby mines and comparing predicted values for deposition and concentration with the appropriate air quality goals.

The air quality impact assessment will describe the proposed mitigation and management measures to minimise the generation of dust and emissions, and propose a monitoring program to both determine the effectiveness of mitigation and to verify predictions.

## 5.10 Greenhouse and Energy

Greenhouse gas emissions from mining operations and combustion of product coal are a growing issue of concern for the wider community. Coal mining results in the emission of greenhouse gases through gas drainage, the combustion of diesel fuel used in diesel powered equipment, indirectly through the use of electricity to power mining equipment and through losses from mined coal. In addition, carbon dioxide is added to the atmosphere through the combustion of the coal produced by the Project.

As part of the EA process a detailed greenhouse gas emission assessment will be completed, including the calculation of predicted emissions and identification of appropriate mitigation measures to minimise greenhouse gas emissions from the operation. This assessment will be done in accordance with DoP requirements, including the requirement to consider the impacts associated with Scope 3 emissions associated with the Project.

## 5.11 Traffic and Transport

### 5.11.1 Existing Environment

The local road network within the vicinity of the Project area includes the New England Highway and Lemington Road (refer to **Figure 1.3**). The majority of the traffic associated with the current approved Ravensworth Operations accesses the site via Lemington Road. The existing Lemington Road route also provides the primary access route for many existing and proposed mining operations within the Ravensworth area. The existing Lemington Road and New England Highway intersection is located within the north-eastern extent of the Project area.

Export coal produced from Hunter Valley coal mines is transported to the Port of Newcastle for loading onto ships and transport to market via the Main Northern Railway line. Coal produced from the majority of the surrounding mining operations within the Ravensworth area, coal operations to the north of the Project area in Muswellbrook region extending to coal mining operations in the Ulan region, and those located south of the Project area utilise the Main Northern Railway line for product coal transportation to market. Coal is also transported to Macquarie Generation's Bayswater and Liddell power stations via the Main Northern Railway line and existing conveyor infrastructure.

### 5.11.2 Potential Impacts

As outlined in **Section 2.4.2**, the proposed open cut mining area will cover a large portion of the existing Lemington Road, and therefore the realignment of Lemington Road will be necessary. It is proposed to realign the existing Lemington Road to the south of the proposed mining area, which will require the construction of an intersection with the New England Highway, approximately 6 kilometres south of the existing intersection. The proposed alignment will be refined as appropriate during detailed mine planning and design work. Access to the proposed site for mine employees and delivery traffic is proposed to be via the New England Highway and realigned Lemington Road.

Potential impacts associated with the proposed construction of the Lemington Road alignment will be assessed in the EA. This includes assessment of any proposed infrastructure such as the proposed intersection with the New England Highway. This assessment will be undertaken in consultation with the RTA.

Coal produced by the Project will be transported to market via the upgraded RCT rail loop and Main Northern Railway line. Access to this transport infrastructure is essential to the Project to enable ready access to coal export markets. The potential cumulative impacts associated with increased rail traffic numbers will be assessed as part of the EA. The assessment will consider current and predicted rail traffic numbers as a result of the proposed development and other existing developments in the area.

### 5.11.3 Proposed Assessment and Management Methodology

Given the necessity of transport infrastructure and potential transportation impacts arising from the Project, a detailed transport assessment of the needs, options and existing infrastructure of the area will be undertaken. The transport assessment will involve the following:

- an assessment of the existing road and rail transport systems including the identification of any transport constraints or issues;
- an assessment of traffic generation (road and rail) due to the proposal and the likely impacts of this traffic on the existing traffic network. The assessment will also identify any transport infrastructure upgrade or maintenance works and costs required as a result of the Project; and
- consideration of the cumulative transport impacts (road and rail) associated with this Project and other existing developments.

## 5.12 Visual Impact

### 5.12.1 Existing Environment

The visual environment of the Hunter Valley is dominated by a combination of mining and industrial infrastructure. The industrial nature of the Hunter Valley is highly apparent from the New England Highway. The Liddell and Bayswater Power Stations are dominant structures in the horizon of the area. Conveyors, mined surfaces and high voltage power lines also contribute to the visual environment of the immediate region surrounding the proposed Project area.

The location of the proposed Project is surrounded by existing mines to the north, east, south and west. The view of the proposed site from the east is shielded from the New England Highway by the rehabilitated areas associated with former Ravensworth South and Ravensworth No. 2 mining operations.

### 5.12.2 Potential Impacts

The Project has the potential to impact on the visual amenity of the area. There are three main transit routes surrounding the Ravensworth Operations site: the New England Highway, Main Northern Railway line and Lemington Road, which may all offer views into the proposed operations. Whilst the area is dominated by mining, the likely visibility of the site from public roads warrants further assessment into the potential visual impacts of the Project.

Visual impact is likely to be greatest from the north. The users of the New England Highway are likely to have clear vision of the proposed overburden dump. However, the overburden dump would be likely to mask the view of the open cut pit. Although visual impact from the north is likely to be high, the location of the proposed site is particularly advantageous in reducing the visual impact from the east, south and west of the site. The view of the mine is

likely to be blocked by the existing topographical features and existing mining operations within the surrounding area. Visual impacts associated with the Project will be able to be effectively managed.

### 5.12.3 Proposed Assessment and Management Methodology

The visual assessment will address the changes in visual characteristics of the area over the life of the mine. The visual assessment will be undertaken from representative visual catchments, which will be determined as part of detailed visual impact assessment. The visual assessment is likely to involve the following:

- an assessment and description of the visual resource and identification of the landscape components contributing to the visual character of the region and local area surrounding the Project site;
- comprehensive site analysis to determine the landscape units and visual catchments of the area, including topography and drainage, water bodies, vegetation, aspect, land use patterns, heritage items and existing structures;
- evaluation of views, existing and proposed, from selected specified viewpoints surrounding the Project, including but not limited to the New England Highway, Lemington Road and other prominent viewing locations;
- examination of the incremental visual impact of the removal of existing vegetation, and the creation of the mine, stockpiles, rejects areas, washery, surface facilities and night lighting. Analysis of visual impact from specified viewpoints will be included, as well as implications of impacts for site management and planting schemes;
- preparation of site transects. These sections will show the layout of the proposed pit area, rehabilitation and infrastructure; and
- preparation of a rehabilitation plan and screen planting plan where required.

## 5.13 Utilities and Other Infrastructure

### 5.13.1 Existing Environment

Public utility infrastructure located within the immediate vicinity of the Project area includes the Main Northern Railway line, electricity transmission lines, telecommunication cables and public roads.

The Main Northern Railway line is situated to the north of the Project area. There will be no mining activities undertaken within approximately 2 kilometres of the Main Northern Railway line.

A 330 kV steel tower transmission line currently transects the proposed mining area from the north-west to south-east (refer **Figure 1.3**). In addition, electricity utilities within and in proximity to the Project area include 11 kV, 33 kV, 66 kV and 132 kV transmission lines and associated easements.

A buried optical fibre network cable, owned by Telstra, is located adjacent to the Main Northern Railway line. Furthermore, several copper telecommunication cables are also located within the vicinity of the Project area.

### 5.13.2 Potential Impacts

The utilities that exist within or in the vicinity of the proposed Project area predominantly service existing mining operations, therefore some augmentation and realignment of utilities will be required to enable access for mining operations.

The existing 330 kV steel tower transmission line will be a constraint on the proposal in its current location and therefore the line will require relocation as part of the Project. The proposed alignment of the 330 kV transmission line is shown on **Figure 1.3** and includes the relocation of the transmission line to the east of the proposed mining area. Other electrical transmission lines may require relocation in addition to minor sections being added to connect the proposed site infrastructure to the network.

Mining activities within the Project area have the potential to impact upon the Main Northern Railway line due to the effects of blasting (refer to **Section 5.8**). Given the distance to the railway line (2 kilometres), blast impacts should be readily managed. Appropriate blast limits will be developed as part of further blast assessment work during the EA process.

### 5.13.3 Proposed Assessment and Management Methodology

The relocation of the 330 kV steel tower transmission line that currently transects the site will require further investigation and consultation with appropriate authorities prior to the commencement of construction activities.

Further investigation into the locality of the telecommunication cables, including fibre optic and copper cables within the area, will be required. Once their current location has been established, the necessity and options for relocation will be explored with Telstra, prior to commencement of construction activities.

While mining activities are not proposed to be undertaken within 2 kilometres of the rail line, a blasting assessment will be undertaken to assess the likely impact of blasting activities on the Main Northern Railway line (refer to **Section 5.8**).

## 5.14 Socio-Economic Impacts

Socio-economic assessment is concerned with assessing and predicting the likely consequences of a Project in both social and economic terms. While economic assessment emphasises the monetary effects of a proposal, social impact assessment is concerned with assessing benefits and costs in non-monetary terms.

### 5.14.1 Existing Environment

Singleton is located adjacent to Muswellbrook approximately 76 kilometres north-west of Newcastle and covers an area of 4893 square kilometres. Singleton has a diverse economic base, dominated by mining, commerce and agriculture. In 2001, the Singleton Shire had a population of 20,384 who live predominantly within the major regional centre of Singleton (62%).

The mining industry provides the second largest employment base within the Singleton LGA, with 15.53 per cent of the workforce employed in the industry in Singleton (refer **Table 5.8**). However, there has been significant decline in the workforce participation in the mining industry since 1996. The influence of the Liddell and Bayswater Power Stations is significant for the LGA with approximately four times the number of people employed in the electricity,

gas and water sector within the Singleton LGA relative to the NSW average. This sector has also seen a decline within the Singleton LGA over the last ten years.

**Table 5.8 - Employment Sectors in Singleton LGA, the Hunter and NSW**

| Industry | Singleton (% of workforce) | | | Hunter (% of workforce) | | | New South Wales (% of workforce) | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1991 | 1996 | 2001 | 1991 | 1996 | 2001 | 1991 | 1996 | 2001 |
| Agriculture, forestry, etc | 8.0 | 7.88 | 6.80 | 3.4 | 3.13 | 3.01 | 3.9 | 3.60 | 3.36 |
| Mining | 19.9 | 18.76 | 15.53 | 5.0 | 4.40 | 3.09 | 1.0 | 0.86 | 0.54 |
| Manufacturing | 3.8 | 4.95 | 8.03 | 13.7 | 12.99 | 11.63 | 13.1 | 12.19 | 11.50 |
| Electricity, gas & water | 4.2 | 3.21 | 2.81 | 2.4 | 1.59 | 1.32 | 1.4 | 0.85 | 0.74 |
| Construction | 6.0 | 6.65 | 6.76 | 7.2 | 6.86 | 7.48 | 6.2 | 6.39 | 6.90 |
| Wholesale & retail trade | 14.8 | 16.45 | 18.53 | 18.6 | 20.10 | 21.29 | 18.9 | 19.59 | 19.78 |
| Accommodation & restaurants | N/A | 3.92 | 4.96 | N/A | 5.10 | 5.50 | N/A | 4.95 | 5.16 |
| Transport & storage | 2.9 | 3.00 | 3.29 | 4.2 | 4.07 | 3.90 | 5.0 | 4.73 | 4.58 |
| Communication | 0.3 | 0.73 | 0.66 | 1.2 | 1.22 | 1.19 | 1.7 | 2.11 | 2.00 |
| Finance, property & business | 6.1 | 7.90 | 8.55 | 8.6 | 10.61 | 11.22 | 12.7 | 15.38 | 16.96 |
| Administration & defence | 12.4 | 10.17 | 7.57 | 4.9 | 4.72 | 4.47 | 5.0 | 4.31 | 3.83 |
| Community services & education | 10.8 | 10.44 | 10.60 | 17.5 | 17.34 | 18.42 | 17.0 | 16.09 | 16.22 |
| Recreation, personal & other | 5.4 | 3.24 | 3.66 | 6.9 | 5.08 | 5.33 | 7.3 | 5.89 | 6.04 |
| Not classifiable/not stated | 5.4 | 2.80 | 2.25 | 6.3 | 2.79 | 2.16 | 6.8 | 3.06 | 2.38 |

Source: Australian Bureau of Statistics Census 1991, 1996 and 2001.

### 5.14.2 Potential Impacts

Given the large scale of the Project there are expected to be a range of associated socio-economic impacts which will be assessed as part of the EA. These include an assessment of the economic impacts of the Project on a regional and state scale, including consideration of the benefits and costs associated with the Project.

The area surrounding the Project area is dominated by mining activities and has few private residents within close proximity to proposed operations. The local environmental impacts of dust, noise, visual, blasting and water will be a primary focus for the local rural residents and residents of the nearby Camberwell Village.

It is likely that Aboriginal stakeholder concern and involvement in the Project will be high given the potential archaeological impacts associated with the Project (refer to **Section 5.3**). In addition, it is likely that regional issues such as cumulative dust impacts and global issues such as greenhouse gas emissions will be key issues with the local, regional and potentially wider community.

### 5.14.3 Proposed Assessment and Management Methodology

Consulting with the community is an important ongoing part of Ravensworth Operations. A comprehensive community consultation program and socio-economic impact assessment will be prepared as part of the EA. The community consultation program will incorporate local residents/landholders, special interest groups, functional groups and the wider community at

local and regional levels. The views of all stakeholders will be considered in the Project design and the environmental and social impact assessment process.

As outlined in **Section 4.0**, the consultation strategy will include engagement with stakeholders early in the preparation of the EA to ensure that relevant issues are captured and addressed throughout the preparation of the EA.

# 6.0 Project Schedule

The Planning Focus Meeting for this Project is scheduled for early 2009, with the Project Application planned to be lodged shortly after this meeting, with a request for DoP to issue the DGRs for the Project.

Based on current Project timing, Ravensworth Operations intends to lodge the draft Environmental Assessment for the Project with DoP for Adequacy Review in July 2009.

# 7.0 References


Advitech Pty Ltd, 2007. *Noise Impact Assessment - Glendell Mine Modifications to Development Consent*. Report prepared for Umwelt (Australia) Pty Limited.

ANZECC, 1990. *Technical Basis for Guidelines to Minimise Annoyance due to Blasting and Ground Vibration*.

Australian Bureau of Statistics, 1991. *Census of Population and Housing*

Australian Bureau of Statistics, 1996. *Census of Population and Housing*

Australian Bureau of Statistics, 2001. *Census of Population and Housing*

Australian Heritage Database. Accessed 16 April 2007. Chain of Ponds Hotel and Outbuildings, Old Singleton Rd, Liddell, NSW, Australia. http://www.environment.gov.au/cgi-bin /ahdb/search.pl?mode=place_detail;search=lga_name%3Dsingleton%3Bkeyword_PD%3Don%3Bkeyword_SS%3Don%3Bkeyword_PH%3Don%3Blatitude_1dir%3DS%3Blongitude_1dir%3DE%3Blongitude_2dir%3DE%3Blatitude_2dir%3DS%3Bin_region%3Dpart;place_id=1400

Brayshaw H, 1983. *Reconnaissance Survey of Ravensworth No. 2 Colliery Proposed Mining Extension and Diversion of Bayswater Creek*. Unpublished Report to Croft & Associates Pty Ltd.

Brayshaw H and Haglund L, 1984. *Archaeological Investigations Associated with Ravensworth No. 2 Southern Extension.*

Burton C Koettig M and Thorp M, 1990. *Regional study of heritage significance Central Lowlands Hunter Valley Electricity Commission holdings.* Report to the Electricity Commission of NSW.

Cumnock No.1 Colliery, 2004. *Annual Environmental Management Report, Period July 2003 to June 2004.*

Dawson Brown and Ackert Pty Limited (DBA), 1990. *Conservation Plan for Chain of Ponds Inn, Liddell.* Report to the Electricity Commission of NSW.

Department of Environment and Climate Change, 2007. NSW Threatened Species, internet access www.threatenedspecies.environment.nsw.gov.au/tsprofile/index.aspx (Accessed March 2007).

Department of Environment and Water Resources, 2007. Protected Matters Search Tool Results for a 10 kilometre radius search from the centre of the study area, (website) (20 March 2007).

Department of Planning, 1994. *Population Projections – Non-Metropolitan Local Government Areas in NSW 1991–2021.*

Effenberger S, 1992. *Archaeological Survey and Assessment of Stage One Cumnock South Open Cut Mine Singleton Shire*. Envirosciences Pty Ltd (unpublished report).

Environmental Resources Management Pty Ltd (ERM), 1997. *Extension of Mining Operations at Ravensworth Mine Environmental Impact Statement.* Report to Peabody Resources.

Environmental Resources Management Pty Ltd (ERM), 2002. *Ravensworth East Archaeological Excavation*. Unpublished report to Coal and Allied Pty Ltd.

Environmental Resources Management Pty Ltd (ERM), 2003. *Hunter Valley Operations West Pit Extension and Minor Modifications Flora and Fauna Study*. Report prepared for Coal & Allied Operations.

Envirosciences Pty Limited, 1990. *Environmental Impact Statement for Narama Coal Mine*. Report Prepared for Narama Joint Venture on behalf of the Nardell Colliery Pty Limited.

Emery KA, undated. *Rural Land Capability Mapping Scale 1:100,000.* Soil Conservation Service of NSW.

Godwin L, 1987. *A Preliminary Archaeological Survey of a Proposed Open-cut Coalmine at Ravensworth in the Hunter Valley of NSW*. Unpublished report to Croft and Associates Pty Ltd.

Hawley S and Brunton J, 1995. *Newcastle Coalfield.* NSW Department of Mineral Resources.

HLA-Envirosciences (HLA), 1996a. *Archaeological Survey and Assessment of the Impact of the Proposed Development on Archaeological Resources – Nardell Underground Coal Leases*. Report to Nardell Coal Corporation

HLA-Envirosciences (HLA), 1996b. *An Archaeological Survey of Cumnock Site, Liddell Central Lowlands Hunter Valley, NSW*. Report to Cumnock No. 1 Colliery.

HLA-Envirosciences (HLA), 2000. *Environmental Impact Statement for Ravensworth Waste Management Centre*. Report prepared for Thiess Environmental Services.

HLA-Envirosciences (HLA), 2001. *Archaeological Survey Cumnock No 1 Colliery, Ravensworth, NSW Mine Extension EIS*. Report to Cumnock No. 1 Colliery.

Hunter Research Foundation, 2003. *Newcastle and the Hunter Region 2002-2003*

Kovac M and Lawrie JW, 1991. *Soil Landscapes of the Singleton 1:250 000 Sheet.* Soil Conservation Service of NSW, Sydney

Matthei M.E. 1995 *Singleton 1:100,000 Soil Landscapes Map Sheet*

Mount King and Gingra Ecological Surveys, 2006a. *Biodiversity Monitoring – Cumnock No. 1 Colliery Flora and Fauna Studies*.

Mount King and Gingra Ecological Surveys, 2006b. *Biodiversity Monitoring at Ravensworth Operations – Ravensworth West and Narama Mines*.

NSW National Parks and Wildlife Service (NPWS), 1997. *Aboriginal Cultural Heritage: Standards and Guidelines Kit (Working Draft September).*

NSW Scientific Committee, 2005a. *Hunter Valley Weeping Myall Woodland of the Sydney Basin Bioregion: endangered ecological community listing: NSW Scientific Committee Final Determination,* internet resource: www.nationalparks.nsw.gov.au

NSW Scientific Committee, 2005d. *Hunter Lowland Red Gum Woodland of the Sydney Basin and North Coast Bioregions: endangered ecological community listing: NSW Scientific Committee Final Determination,* internet resource: www.nationalparks.nsw.gov.au

NSW Scientific Committee, 2005e. *White Box-Yellow Box-Blakely's Red Gum Woodland: endangered ecological community listing: NSW Scientific Committee Final Determination,* internet resource: www.nationalparks.nsw.gov.au

NSW Scientific Committee, 2005f. *Acacia pendula* (a tree) in the Hunter catchment *endangered population listing: NSW Scientific Committee Final Determination,* internet resource: www.nationalparks.nsw.gov.au

NSW Scientific Committee, 2005g. *Eucalyptus camaldulensis* Hunter Catchment Population: *endangered population listing: NSW Scientific Committee Final Determination,* internet resource: www.nationalparks.nsw.gov.au

NSW Scientific Committee, 2006a. *Cymbidium canaliculatum* in the Hunter Catchment *endangered population listing: NSW Scientific Committee Final Determination,* internet resource: www.nationalparks.nsw.gov.au

NSW Scientific Committee, 2007. *Leionema lamprophyllum* subsp. *obovatum* population in the Hunter Catchment proposed endangered population, internet resource: www.nationalparks.nsw.gov.au

Pacific Power, 1993. *Environmental Impact Statement Fly Ash Disposal in Ravensworth No. 2 Mine Void and Mine Rehabilitation*.

Peake TC, 2006. *The Vegetation of the Central Hunter Valley, New South Wales. A Report on the Findings of the Hunter Remnant Vegetation Project.* Hunter – Central Rivers Catchment Management Authority, Paterson.

Rich E, 1990a. *Proposed Narama Open Cut Coal Mine at Ravensworth, NSW: Supplementary Archaeological Survey for Aboriginal Sites.* Unpublished report for Envirosciences Pty Ltd.

Rich E, 1990b. *Proposed diversion of 330kV Transmission Line: Archaeological Inspection of Aboriginal Sites*. Envirosciences Pty Ltd (unpublished report).

Rich E and McDonald J, 1992. *Narama Salvage Project Lower Bayswater Creek Hunter Valley NSW*. Unpublished report for Envirosciences Pty Ltd.

Riddler AMH 1990. Agricultural suitability maps – uses and limitations, Agfacts, NSW Agriculture and Fisheries.

Ruig J, 1994. *Archaeological Survey of Cumnock South*. Unpublished report prepared for Australian Coal Industry Research Laboratories Ltd.

Standards Australia, 2004. *Australian Standard AS/NZS 4360:2004 Risk Management.*

Umwelt (Australia) Pty Limited, 2005. *Noise Management Plan for Ravensworth West Mine.* Report to Ravensworth Operations Pty Ltd.

Umwelt (Australia) Pty Limited, 2005a. *Research Design and Methodology to Accompany a Section 90 Consent Application for Aboriginal Sites within the Development Impact Area of the Approved Ravensworth West Mine*. Report to Ravensworth Operations Pty Ltd.

Umwelt (Australia) Pty Limited, 2007. *Preliminary Environmental Constraints Analysis – Emu Creek Open Cut Project*. Report to Ravensworth Operations.

Umwelt (Australia) Pty Limited, 2008. *Aboriginal Heritage Due Diligence Inspection: Borehole Works, Ravensworth Operations*. Report to Ravensworth Operations Pty Ltd.

Umwelt (Australia) Pty Limited, 2008. *Noise Assessment for Proposed Increase in Production – Narama Coal Mine*.

Umwelt (Australia) Pty Limited, in prep. *Archaeological survey and salvage program at Ravensworth West Mine, New South Wales*. Report to Ravensworth Operations Pty Ltd.

# APPENDIX 1

# Preliminary Environmental Risk Analysis

# Appendix 1

## Ravensworth Operations Project

## Preliminary Environmental Risk Analysis

| Activity | Aspect | Potential Impact | Status and Proposed Control | Risk Assessment | | | Further Assessment Requirements | Key Issue |
|---|---|---|---|---|---|---|---|---|
| | | | | C | L | R | | |
| **CONSTRUCTION PHASE** | | | | | | | | |
| Construction of site infrastructure (including coal handling, MIA, dams, roads) | European Heritage | Disturbance of sites of European heritage significance. | A review of the historical context of the Project area indicates that it has the potential to contain items of local historical heritage significance only.<br>No state listed heritage items were identified within the Project area. Similarly, parish maps dated to between 1886 and 1942 did not record the presence of any homesteads or other structures within the Project area. | 3 | C | M | An assessment of the potential impacts of the project on European heritage will be undertaken. | Yes |
| | Ecology | Loss of native flora and fauna. | The majority of surface facilities will be constructed within previously undisturbed areas. A full assessment of the potential impacts of the project on ecological values will be completed. | 2 | B | H | An assessment of the potential impacts of the project on ecological values will be undertaken. | Yes |
| | Cultural Heritage | Disturbance of Aboriginal places or objects. | The majority of surface facilities will be constructed within previously undisturbed areas. A full Aboriginal Archaeology Assessment is being completed for the Project. | 3 | B | H | An assessment of the potential impacts of the project on Aboriginal Archaeology of the site will be undertaken. The assessment will be completed in consultation with the local Aboriginal community. | Yes |
| | Erosion and sediment runoff | Sedimentation of local waterways. | Appropriate erosion and sediment controls will be designed and constructed for all construction areas in accordance with *Soils & Construction* (Landcom, 2004). | 4 | D | L | Due to effective mitigation of this potential impact further assessment is not required. | No |

| Activity | Aspect | Potential Impact | Status and Proposed Control | Risk Assessment | | | Further Assessment Requirements | Key Issue |
|---|---|---|---|---|---|---|---|---|
| | | | | C | L | R | | |
| Construction of site infrastructure (including coal handling, MIA, dams, roads) (cont) | Clean Water Management | Contamination of clean water. | Diversion drains will be constructed to divert clean waters away from major construction areas. Dirty water will be segregated from clean water. The drains will be designed and constructed in accordance with *Soils & Construction* (Landcom, 2004). | 4 | D | L | Due to effective mitigation of this potential impact further assessment is not required. | No |
| | Groundwater | Degradation of natural groundwater flow and quality (including depressurisation). | Ground disturbance associated with construction activities has potential to impact on groundwater aquifers. Ground disturbance will be minor relative to surrounding mining operations. | 4 | D | L | No further assessment required | No |
| | Dust Generation | Degradation of air quality (cumulative). | The construction program will not involve significant ground disturbance in the context of the adjacent open cut mining and therefore modelling of construction phase air quality impacts is considered unnecessary. | 4 | D | L | Due to effective mitigation of this potential impact further assessment is not required. | No |
| | Noise Generation | Degradation of noise amenity (cumulative). | The construction program will result in minor noise impacts when considered in the context of the adjacent operations, particularly considering the distance from the majority of infrastructure from receiver locations. Construction will be primarily in daylight hours. Therefore modelling of construction phase noise impacts is considered unnecessary. | 4 | D | L | Due to effective mitigation of this potential impact further assessment is not required. | No |
| | Visual Amenity | Aesthetics of exposed earthworks and construction works. | The construction phase will be relatively short in duration, with the majority of construction locations distant from residential receivers and shielded by topography. No further assessment of construction phase visual impacts is therefore considered necessary. | 4 | D | L | No further assessment is required. | No |

| Activity | Aspect | Potential Impact | Status and Proposed Control | Risk Assessment | | | Further Assessment Requirements | Key Issue |
|---|---|---|---|---|---|---|---|---|
| | | | | C | L | R | | |
| Construction of site infrastructure (including coal handling, MIA, dams, roads) (cont) | Land capability and agricultural suitability | Loss/deterioration of land capability and agricultural suitability. | Some previously unmined land will be impacted by proposed infrastructure. These areas will be relatively small and are considered unlikely to significantly impact on land capability or agricultural suitability. Areas disturbed for infrastructure will be rehabilitated post mining. | 4 | D | L | No further assessment is required. | No |
| | Soils | Loss of productive topsoil. | Soil stripping and management will be undertaken in accordance with best practice management techniques which will ensure effective recovery and storage of topsoil prior to re-use. Erosion and sediment controls will be implemented in accordance with *Soils & Construction* (Landcom, 2004). | 4 | D | L | Due to effective management of this potential impact further assessment is not required. | No |
| | Traffic | Supply of materials for construction project resulting in increased traffic. | Construction activities will result in increased traffic movements during the construction phase of the Project. This has the potential to impact upon traffic on surrounding roads during peak traffic periods. | 3 | B | H | An assessment of traffic generation due to the proposal and the likely impacts of this traffic on the existing traffic network will be undertaken. | Yes |
| **MINE SURFACE FACILITIES & SERVICES (office, workshop, bathhouse, roads etc)** | | | | | | | | |
| Operation of surface facilities | Erosion and sediment runoff | Sedimentation of local waterways. | Appropriate erosion and sediment controls will be designed and constructed for all surface facility areas in accordance with *Soils & Construction* (Landcom, 2004). | 4 | D | L | Due to effective mitigation of this potential impact further assessment is not required. | No |
| | Clean Water Management | Contamination of clean water. | Diversion drains will be constructed to divert clean waters away from surface facility areas. Dirty water will be separated from clean water. The drains will be designed and constructed in accordance with *Soils & Construction* (Landcom, 2004). | 4 | D | L | Due to effective mitigation of this potential impact further assessment is not required. | No |

| Activity | Aspect | Potential Impact | Status and Proposed Control | Risk Assessment | | | Further Assessment Requirements | Key Issue |
|---|---|---|---|---|---|---|---|---|
| | | | | C | L | R | | |
| Operation of surface facilities (cont) | Surface Water Flows | Alteration of flow/flood in surrounding drainage lines. | The Project has the potential to have a impact on the water flow and flooding of existing creek lines to be maintained with the Project area including Davis Creek, Bayswater Creek, Farrells Creek and Bowmans Creek. | 3 | C | M | An assessment of the potential impact of the project surface water flows will be undertaken. | Yes |
| | Dust Generation | Degradation of air quality (cumulative). | The operation of proposed infrastructure will not generate significant dust emissions in the context of the adjacent open cut mining operations and therefore modelling of air quality impacts associated with proposed infrastructure is considered unnecessary. | 4 | D | L | No further assessment is required | No |
| | Noise Generation | Degradation of noise amenity (cumulative). | The operation of proposed infrastructure will not generate significant noise emissions in the context of the adjacent open cut mining operations and therefore modelling of noise impacts associated with proposed infrastructure is considered unnecessary. | 4 | D | L | No further assessment is required | No |
| | Visual Amenity | Aesthetics of mine surface facilities. | The locations of proposed infrastructure are distant from residential receivers and shielded by topography. No further assessment of visual impacts associated with proposed infrastructure areas is considered necessary. | 4 | D | L | No further assessment is required | No |
| | Energy Use | Emission of greenhouse gas emissions. | The operation of surface facilities will require use of electricity, diesel and petrol. The greenhouse gas emissions resulting from this energy consumption will be assessed. | 3 | B | H | An assessment of energy use and greenhouse gas emissions will be undertaken. | Yes |

| Activity | Aspect | Potential Impact | Status and Proposed Control | Risk Assessment | | | Further Assessment Requirements | Key Issue |
|---|---|---|---|---|---|---|---|---|
| | | | | C | L | R | | |
| Operation of surface facilities (cont) | Water Demand | Water demand for on site purposes. | A site water balance model will be completed to determine the project water balance and assess the adequacy of water supplies and potential discharge requirements. | 2 | C | H | A water balance will be undertaken. | Yes |
| **OPEN CUT MINING OPERATIONS** | | | | | | | | |
| Open Cut Mining Operations (including overburden emplacement) | European Heritage | Disturbance of sites of European heritage significance. | A review of the historical context of the Project area indicates that it has the potential to contain items of local historical heritage significance only.<br>No state listed heritage items were identified within the Project area. Similarly, parish maps dated to between 1886 and 1942 did not record the presence of any homesteads or other structures within the Project area. | 3 | C | M | An assessment of the potential impacts of the project on European heritage will be undertaken. | Yes |
| | Ecology | Loss of native flora and fauna. | Open cut mining operations will impact on ecological values of the project area through native vegetation clearance and habitat loss. A full assessment of the potential impacts of the project on ecological values will be completed. | 2 | B | H | An assessment of the potential impacts of the project on ecological values will be undertaken. | Yes |
| | Cultural Heritage | Disturbance of Aboriginal places or objects. | Open cut mining operations have the potential to impact on aboriginal archaeological values through disturbance of items of archaeological and cultural heritage significance. A full assessment of the potential impacts of the project on aboriginal archaeology values will be completed. | 2 | B | H | An assessment of the potential impacts of the project on aboriginal archaeological values of the project area will be undertaken in consultation with the local Aboriginal community. | Yes |
| | Dust Generation | Degradation of air quality (cumulative). | Open cut mining operations have the potential to impact air quality. | 3 | B | H | A detailed assessment of dust impacts associated with the project will be completed. | Yes |

| Activity | Aspect | Potential Impact | Status and Proposed Control | Risk Assessment | | | Further Assessment Requirements | Key Issue |
|---|---|---|---|---|---|---|---|---|
| | | | | C | L | R | | |
| Open Cut Mining Operations (including overburden emplacement) (cont) | Noise Generation | Degradation of noise amenity (cumulative). | Open cut mining operations have the potential to impact noise amenity. | 3 | B | H | A detailed assessment of noise impacts associated with the project will be undertaken. | Yes |
| | Blast Overpressure and Vibration | Exceedances of criteria / damage to structures | Site laws will be developed for the Project during the EA and continually reviewed. Predicted air blast and ground vibration levels at the nearest residential receivers will be assessed for compliance with relevant criteria. | 3 | B | H | A detailed blast impact assessment will be undertaken for the Project. | Yes |
| | Blast Overpressure and Vibration | Damage to heritage structures | Site laws will be developed for the Project during the EA and continually reviewed. Predicted air blast and ground vibration levels at the nearest heritage structures will be assessed for compliance with relevant criteria. | 3 | B | H | A detailed blast impact assessment will be completed. | Yes |
| | Blast Overpressure and Vibration | Damage to other infrastructure (eg conveyors) | Site laws will be developed for the Project during the EA and continually reviewed. Predicted air blast and ground vibration levels at the nearest infrastructure location will be assessed for compliance with relevant criteria. | 3 | B | H | A detailed blast impact assessment will be completed. | Yes |
| | Erosion and Sediment Runoff | Sedimentation of local waterways. | Appropriate erosion and sediment controls will be designed and constructed for all surface facility areas in accordance with *Soils & Construction* (Landcom, 2004). | 4 | D | L | Due to effective mitigation of this potential impact further assessment is not required. | No |
| | Clean Water Management | Contamination of clean water. | Diversion drains will be constructed to divert clean waters away from surface facility areas. Dirty water will be separated from clean water. The drains will be designed and constructed in accordance with *Soils & Construction* (Landcom, 2004). | 4 | D | L | Due to effective mitigation of this potential impact further assessment is not required. | No |

| Activity | Aspect | Potential Impact | Status and Proposed Control | Risk Assessment | | | Further Assessment Requirements | Key Issue |
|---|---|---|---|---|---|---|---|---|
| | | | | C | L | R | | |
| Open Cut Mining Operations (including overburden emplacement) (cont) | Surface water flows | Alteration of flow/flood in surrounding drainage units. | The Project has the potential to have an impact on the water flow and flooding of existing creek lines to be maintained with the Project area including Davis Creek, Bayswater Creek, Farrells Creek and Bowmans Creek. | 2 | C | H | An assessment of the potential impact of the project on surface water flows will be completed. | Yes |
| | Water Demand | Water demand for on site purposes (dust suppression). | A site water balance model will be completed to determine the project water balance and assess the adequacy of water supplies and potential discharge requirements. | 2 | C | H | A site water balance will be undertaken. | Yes |
| | Groundwater | Degradation of natural groundwater flow and quality (including depressurisation). | Open cut mining operations will impact on groundwater resources through intersection of aquifer systems. This has the potential to impact on local and regional groundwater aquifers. | 2 | C | H | A groundwater impact assessment will be undertaken. | Yes |
| | Visual Amenity | Aesthetics of open cut mining areas | Views of the proposed open cut mining areas may be possible from a number of locations external to the site. An assessment of visual impacts will be completed. | 3 | C | M | An assessment of the visual impact of the project will be undertaken. | Yes |
| | Land use and agricultural productivity | Impact on land use, land capability and agricultural suitability. | Open cut mining operations will result in disturbance of land resulting in a loss of agricultural productivity. The majority of land potentially affected is owned by Xstrata. Further assessment of the potential impacts of open cut mining on land use will be included in the Environmental Assessment report. | 3 | C | M | Assessment of land use impacts associated with the project will be undertaken. | Yes |

| Activity | Aspect | Potential Impact | Status and Proposed Control | Risk Assessment | | | Further Assessment Requirements | Key Issue |
|---|---|---|---|---|---|---|---|---|
| | | | | C | L | R | | |
| Open Cut Mining Operations (including overburden emplacement) (cont) | Soils | Loss of productive topsoil. | Soil stripping and management will be undertaken in accordance with best practice management techniques which will ensure effective recovery and storage of topsoil prior to re-use. Erosion and sediment controls will be implemented in accordance with *Soils & Construction* (Landcom, 2004). | 4 | D | L | Due to effective management of this potential impact further assessment is not required. | No |
| | Energy Use | Emission of greenhouse gas emissions. | Open cut mining operations will require use of electricity, diesel, explosives and petrol. The greenhouse gas emissions resulting from this energy consumption need to be assessed. Fugitive emissions of greenhouse gases will additionally be assessed. | 3 | B | H | An assessment of energy use and greenhouse gas emissions will be undertaken. | Yes |
| | Mine Closure | Inadequate mine closure leaving post mining liability. | A conceptual closure plan will be developed to demonstrate that the proposed open cut mine can be effectively closed at the end of mine life. | 3 | C | M | A conceptual closure and rehabilitation plan will be discussed in the Environmental Assessment. | Yes |
| **COAL HANDLING PREPARATION & PRODUCT COAL TRANSPORT** | | | | | | | | |
| Coal handling infrastructure (including crushing plant, stockpiles, conveyors and CHPP) | Dust Generation | Degradation of air quality (cumulative). | The operation of coal handling infrastructure have the potential to impact air quality. | 4 | B | M | A detailed assessment of dust impacts associated with the project will be undertaken. | Yes |
| | Noise Generation | Degradation of noise amenity (cumulative). | The operation of coal handling infrastructure has the potential to impact noise assessment. | 4 | B | M | A detailed assessment of noise impacts associated with the project will be undertaken. | Yes |
| | Erosion and Sediment Runoff | Sedimentation of local waterways. | Appropriate erosion and sediment controls will be designed and constructed for all surface facility areas in accordance with *Soils & Construction* (Landcom, 2004). | 4 | D | L | Due to effective mitigation of this potential impact further assessment is not required. | No |

| Activity | Aspect | Potential Impact | Status and Proposed Control | Risk Assessment | | | Further Assessment Requirements | Key Issue |
|---|---|---|---|---|---|---|---|---|
| | | | | C | L | R | | |
| Coal handling infrastructure (including crushing plant, stockpiles, conveyors and CHPP) | Clean Water Management | Contamination of clean water. | Diversion drains will be constructed to divert clean waters away from surface facility areas. Dirty water will be separated from clean water. The drains will be designed and constructed in accordance with *Soils & Construction* (Landcom, 2004). | 4 | D | L | Due to effective mitigation of this potential impact further assessment is not required. | No |
| | Water Demand | Water demand for on site purposes (CHPP operation and dust suppression). | A site water balance model will be completed to determine the project water balance and assess the adequacy of water supplies and potential discharge requirements. | 2 | C | H | A site water balance will be undertaken. | Yes |
| | Visual Amenity | Aesthetics of coal handling infrastructure | Some aspects of coal handling infrastructure will be visible at locations external to the site. The proposed conveyor bridge will be visible from New England Highway. The upgrade proposed at RCT will not result in significant additional visual impacts. | 3 | B | H | An assessment of the visual impact of the project will be undertaken. | Yes |
| | Energy Use | Emission of greenhouse gas emissions. | The operation of coal handling infrastructure and CHPP will require use of electricity. The greenhouse gas emissions resulting from this energy consumption need to be assessed. | 3 | B | H | An assessment of energy use and greenhouse gas emissions will be undertaken. | Yes |
| | Spontaneous Combustion | Potential for spontaneous combustion. | Xstrata has existing coal stockpile management systems to reduce the potential for spontaneous combustion events. These existing systems will be implemented for stockpiles at the operation. Characteristics of the target coal resource demonstrate a low propensity for spontaneous combustion | 4 | D | L | Due to effective mitigation of this potential impact, no further assessment is required. | No |
| Coarse reject and tailings management and disposal | Ecology | Loss of native flora and fauna. | The proposed conceptual rejects and tailings emplacement areas will be located in previously disturbed areas associated with existing voids. | 4 | D | L | No further assessment required | No |

| Activity | Aspect | Potential Impact | Status and Proposed Control | Risk Assessment | | | Further Assessment Requirements | Key Issue |
|---|---|---|---|---|---|---|---|---|
| | | | | C | L | R | | |
| Coarse reject and tailings management and disposal (cont) | Cultural Heritage | Disturbance of Aboriginal places or objects. | The proposed conceptual rejects and tailings emplacement areas will be located in previously disturbed areas associated with existing voids. | 4 | D | L | No further assessment required | No |
| | European Heritage | Disturbance of European heritage sites. | The proposed conceptual rejects and tailings emplacement areas will be located in previously disturbed areas associated with existing voids. | 4 | D | L | No further assessment required | No |
| | Water Management | Contamination of waterways and aquifers. | Coarse reject and tailings emplacement areas will be designed to contain all materials. All emplacement areas will be rehabilitated. | 3 | C | M | An assessment of the proposed coarse reject and tailings emplacement areas will be undertaken as part of groundwater assessment | Yes |
| Product Coal Loading and Transportation (incl. rail facility and train movements) | Noise Generation | Degradation of noise amenity (cumulative). | The existing rail facility will be utilised with an increased number of trains required. The noise impacts of product coal transportation will be assessed. | 3 | C | M | A detailed assessment of noise impacts associated with the project will be undertaken. | Yes |
| | Dust Generation | Degradation of air quality (cumulative). | The existing rail facility will be utilised with an increased number of trains required. The dust impact of additional trains will be minimal, and a detailed assessment is considered unnecessary. | 4 | B | M | A detailed assessment of dust impacts associated with the project will be undertaken. | Yes |
| | Energy Use | Emission of greenhouse gas emissions. | The transport area and end use of product coal will result in production of greenhouse gas emissions. Current policy requires those emissions to be assessed as part of an EA. | 3 | B | H | An assessment of greenhouse gas emissions associated with product coal transportation and end use of coal will be undertaken. | Yes |

| Activity | Aspect | Potential Impact | Status and Proposed Control | Risk Assessment | | | Further Assessment Requirements | Key Issue |
|---|---|---|---|---|---|---|---|---|
| | | | | C | L | R | | |
| **ANCILLARY ACTIVITIES AND ISSUES** | | | | | | | | |
| Waste Management | Waste disposal (including sewage) | Pollution and/or contamination due to incorrect disposal.<br>Inefficient use of resources. | All wastes generated as part of this project will be managed by an integrated waste management system and in accordance with the Xstrata EMS. | 4 | D | L | Due to effective mitigation of this potential impact, no further assessment is required. | No |
| | Waste oil and grease storage | Soil and/or water contamination from spills or leaks. | All fuels, oils, grease etc will be collected and handled using systems designed and operated in accordance with relevant legislation and Australian Standards. | 4 | D | L | Due to effective mitigation of this potential impact, no further assessment is required. | No |
| Materials supply and storage | Oil, fuel and grease supply and storage | Soil and/or water contamination from spills or leaks. | All fuels, oils, grease etc will be handled using systems designed and operated in accordance with relevant legislation and Australian Standards. | 4 | D | L | Due to effective mitigation of this potential impact, no further assessment is required. | No |
| | Dangerous goods supply and storage | Soil and/or water contamination from spills or leaks.<br>Explosion hazard | All dangerous will be handled using systems designed and operated in accordance with relevant legislation and Australian standards. | 4 | D | L | Due to effective mitigation of this potential impact, no further assessment is required. | No |
| Workforce and Amenities | Transport and access of employees to site | Increase in traffic. | The project will employ approximately 450 people plus contractors when operational. An assessment of traffic impacts is required. | 3 | C | M | An assessment of traffic impacts will be undertaken. | Yes |
| | Increased local population | Impact on services/local infrastructure. | The project will employ approximately 450 people plus contractors. Impacts associated with workforce demand for services and on local infrastructure requires further assessment. | 4 | C | M | A detailed social impact assessment for the project will be completed. | Yes |

## XCN Risk Assessment Matrix Tool

| Potential Consequences | | | | | Probability | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **MRC Score** | **People** | **Property** | **Environment** | **Community** | **A Almost certain to happen (everyday /weekly event)** | **B Likely to happen at some point (typically 1 a month)** | **C Moderate: possible, heard of so might happen (typically 1 a year)** | **D Unlikely: not likely to happen (typically once every 5 years)** | **E Rare: practically impossible (typically once every 25 years)** |
| 1 Catastrophic impact | Multiple fatalities<br><br>Major permanent negative health impacts on a large number of people | Unplanned mine closure<br><br>Greater than $10M | Disastrous environmental impact, with long term effect, requiring major remediation, regulatory intervention or premature closure of the operation | Public international condemnation<br><br>Major breakdown of social order in affected community | 1 | 2 | 4 | 7 | 11 |
| 2 Severe negative impact | Single fatality<br><br>Severe irreversible disability or impairment (PDI) | Could cause major damage $1M - $10M | Serious environmental impact, with medium term effect, requiring significant remediation or resulting in prosecution | Loss of community's economic viability<br><br>Significant damage to reputation of the operations | 3 | 5 | 8 | 12 | 16 |
| 3 Major negative impact | Major injury to one or more persons<br><br>Severe health impacts on a number of people | Could cause major damage $100K - $1M | Moderate, reversible environmental impact with short term effect, requiring moderate remediation, such as a reportable incident not likely to result in prosecution, eg a minor water discharge | Significant public criticism, eg community complaints<br><br>NGO or Media "taking up the issue"<br><br>Major negative impact on economic viability | 6 | 9 | 13 | 17 | 20 |
| 4 Negative impact | Significant reportable injury (MTI, or less than 5 days RWI or LTI)<br><br>Major impact on health of several people | Could cause moderate damage $10K - $100K | Minor, reversible environmental impact, requiring minor remediation such as a non reportable environmental incident, eg a minor oil spill | Flare up of issues in affected communities<br><br>Media criticism | 10 | 14 | 18 | 21 | 23 |
| 5 Minor negative impact | Minor injury<br><br>Slight negative impact on individual health | Could cause minor damage < $10K | Negligible, reversible environmental impact, requiring very minor or no remediation | Slight negative impact on individuals in local community | 15 | 19 | 22 | 24 | 25 |

**Risk Classification**

| | |
|---|---|
| **High Risk (H)** | **1 – 10 (Red)** |
| **Medium Risk (M)** | **11 – 19 (Yellow)** |
| **Low Risk (L)** | **20 – 25 (Green)** |

**Classify the Hazard**

| | | | |
|---|---|---|---|
| **Catastrophic Hazard** | **MRC=1** | **1,2,4,7 (Red)** | **11 (Yellow)** |
| **High Hazard** | **MRC=2** | **3,5,8 (Red)** | **12,16 (Yellow)** |

**Umwelt (Australia) Pty Limited**
**2/20 The Boulevarde**
**PO Box 838**
**Toronto NSW 2283**

**Ph. 02 4950 5322**
**Fax 02 4950 5737**