MOOLARBEN COAL PROJECT

APPENDIX 17

Visual and Lighting Impact Assessment

MOOLARBEN COAL PROJECT

VISUAL & LIGHTING IMPACT ASSESSMENT

Prepared for

MOOLARBEN COAL MINES PTY LTD

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O'Hanlon Design Pty Ltd
ABN 003 755 986
60 Gladesville Road
Hunters Hill NSW 2110
qoh@qoh.net.au

Phone: **(02) 9816 5883**
Fax: **(02) 9816 4179**

Table of Contents

List of Tables, Figures, Drawings & Appendices

Tables:

Figures:

Drawings:

Appendices:

Section 1 Introduction

1.1 Objectives

The objectives of this Visual Impact Assessment report are:

- To analyse the visual character of the regional and local landscape with reference to the Study Area.
- To assess the visual impact of the Moolarben Coal Project (MCP) and the proposed ameliorative measures.

1.2 Methodology

This visual impact assessment has been divided into five sections:

1 Introduction
2 Landscape Assessment
3 Scenic Quality Assessment
4 Relevant Aspects of the Proposed Development
5 Visual Impact Assessment

The methodology outlined in **Figure 1.1** is based on the model developed by the Forest Commission of Victoria and the landscape assessment techniques of the U.S. Department of Agriculture (USDA), and has been adapted for the purpose of this project.

The method of assessment of visual impact has been the subject of professional discussion and analysis since the early 1970's. Much of the work on visual impact has been carried out by the United States Department of Agriculture (USDA) Forest Service. The USDA Forest Service has issued the following documents amongst others to describe an appropriate method of impact assessment:

- "Forest Landscape Description and Inventories A basis for Land Planning and Design" USDA Forest Service Research Paper PSW-49 R. Burton Litton Jr;
- National Forest Landscape Management Handbook No. 434 February 1973;
- USDA Forest Service, Agricultural Handbook No. 462, "National Forest Landscape Management" Volume 2 Chapter1 The Visual Management system - April 1974;
- "National Forest Landscape Management" Volume 2 Chapter 2 Utilities, USDA Forest Service - July 1975; and
- USDA Forest Service "National Forest Landscape Management" Recreation Volume 2 Chapter 8, Forest Service Agricultural Handbook No. 666 - December, 1987;

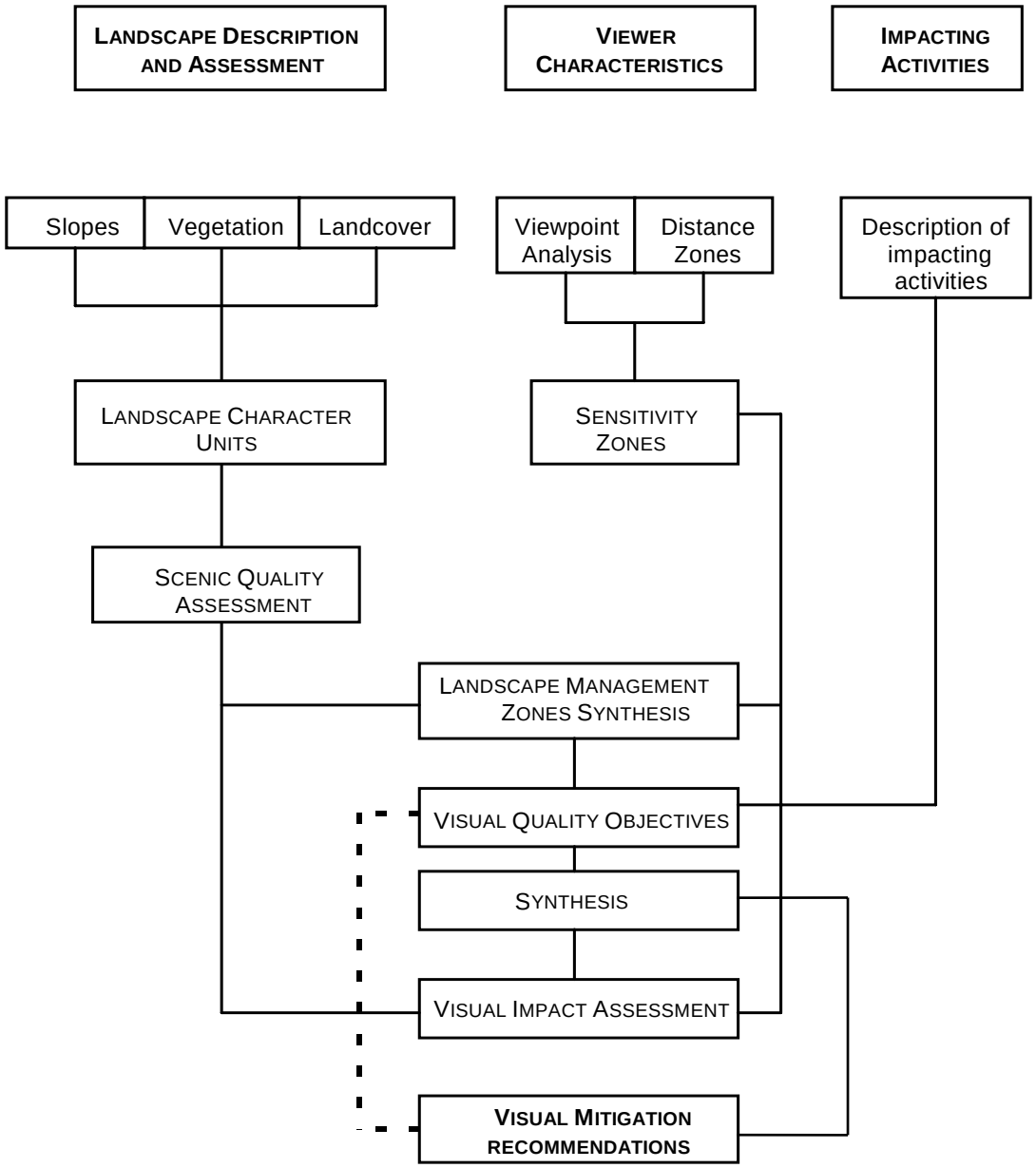
The scenic assessment method used by the USDA Forest Services is a systematic approach to visual assessment using quantitative measures. It assesses the influence of landform, vegetation, water and other landscape factors on scenic quality with refinement applied for the sensitivity levels of the viewers form various selected viewpoints.

Early attempts to assess visual impact contained a very high level of subjectivity. The search for a qualitative assessment of visual impact seeks a higher level of objectivity in determining visual impact of any particular project or development. The USDA Forest Service system has become a benchmark for the qualitative measurement and assessment of the visual impact.

The Forest Commission of Victoria (the Commission) has also developed a programme of scenic management policies and guidelines. As an initial basis for assessment The Commission has

adapted descriptive criteria used by the USDA Forest Service. This approach is described in the article entitled “Scenic Perceptions of Australian Landscapes” by Dennis Williamson in Landscape Australia published April, 1979.

Figure 1.1
Visual Impact Assessment Methodology



Section 2 Landscape Assessment

2.1 The Project

The MCP is located approximately 40 km north of Mudgee and approx 1km east of the village of Ulan and east of the Ulan-Cassilis Road. The project seeks to extract coal in a series of three open cut pits with associated overburden emplacement over a period of approximately 11 but possibly up to 21 years and an underground mine for approximately 14 years. The project also incorporates coal handling plant, stockpiles, rail loop infrastructure, underground access points and ventilation shafts. The project has a long north-south footprint of approx 18km and an overall width of approx 3km.

2.2 The Existing Environment

2.2.1 Regional Landscape Character

The regional landscape character in the area surrounding Gulgong and Mudgee varies considerably from the landscape of the Hunter Valley to the east. The area around Mudgee is dominated by the Great Dividing Range which passes approximately 18km north of Mudgee in a north westerly direction then turns to resume its progress north. As the Great Dividing Range transverses the area it sets the physical pattern for the visual quality. The uplift of the main ridge system is supplemented by extensive uplift and ridge formation predominantly to the east of the main ridge.

The individual ridges are high particularly along the main range between RL 600 and RL 750. Ridges to the east peak at RL 450 to RL 500. The area is heavily dissected by streams that form the headwaters to several river systems. To the north the headwaters of the Goulburn River form around Ulan running east. Also in the north the headwaters of the Talbragar River form to flow west. To the west adjacent to Gulgong the confluence of several smaller creek systems forms the Wialdra Creek system flowing west. To the southeast Wollar Creek forms and flows north to ultimately also join the Goulburn River.

As the area is dominated by the ridges of the Great Dividing Range and associated uplifts the landscape is heavily dissected into a series of enclosed valleys surrounded by high escarpments and steep slopes. The valleys are often fed and shaped by deeply cut intermittent water courses. As a result of the nature of the terrain vegetation is often dense with few cultural modifications. The tops of the ranges and steep escarpments are heavily covered in native vegetation predominantly dry schlerophyll forest.

The region includes several areas of National Park, Sate Forest and Nature Reserve. The largest of these are the Munghorn Gap Nature Reserve and the Goulburn River National Park. These areas are predominantly located on the top of the ranges. Access beyond the camping areas in these parks and reserves is generally by 4 wheel drive along fire trails and much of the area is accessible only on foot.

To the west of the region the topography is less undulating although it is still elevated. The townships of Mudgee, Gulgong, Dunedoo and Tallawong are situated to the west of the Great Dividing Range on the junction of the ranges with the fertile western plains. These areas have been heavily cultivated and are more intensely populated. They therefore have a higher degree of cultural modification.

Major cultural modifications in the region include:

- the existing Ulan Coal Mine north of Ulan;
- the major town centres Mudgee, Gulgong, Tallawong and Dunedoo;
- a number of rail lines (active and abandoned);
- high voltage power lines and attachments; and
- the diversion of the Goulburn River at Ulan.
- The Wilpinjong Coal mine project to the east of the MCP

2.2.2 *Local Landscape Character*

The Landscape Character of the local area is similarly heavily influenced by the topography and underlying geology. As with the regional character the local landscape character differs from east to west. In the east beyond the Great Dividing Range the topography is rugged with many steep sided enclosed valleys. To the west the topography is more gently undulating with a higher proportion of cultural modification. Vegetation density generally matches topography. Remnant dry schlerophyll forest is dense along the ridges and the land is heavily cultivated in the valleys.

The local area is bounded by several key geographical features. To the South the locality is bounded by the ridge of the Great Dividing Range and the entry is via Cooks Gap. To the north and east the ridges of the Goulburn River National Park form a natural visual boundary. To the west, Round Top Mountain and the main ridge of the Great Dividing Range form the boundary. To the south the area is strongly undulating and visually enclosed between the Great Dividing Range and the Munghorn Gap Nature Reserve. The local public accessible viewing areas are predominantly at inferior viewing levels along the major traffic routes.

Recent subdivision throughout the area west of Dexter Mountain has heavily influenced the character. This area includes the subdivisions around Ridge Road, Winchester Crescent, Cypress and Yarrawonga Roads. The lots vary in size but are generally in the order of 6-7ha. The resultant clearing and development of dwellings sets a rural residential character west of Dexter Mountain with a significant reduction in remnant vegetation. This is particularly evident when travelling along the Ulan-Cassilis Road.

In contrast when travelling along Moolarben Road to the west, the residential development is less dense and the rural character is much stronger. Here the landscape is enclosed in a valley with Dexter Mountain to the west and the Munghorn Gap Nature Reserve to the east. Within this valley the modifications are rural elements such as sheds or silos and significantly less residential development. Remnant vegetation is concentrated in small pockets along roads, creeks and on small ridges. The foreground views are relatively open and consist of rural cameos – grazing land dotted with stock, fencing, yards and occasional residences.

2.3 The Study Area

The Study Area can be loosely defined as the visual catchment from Cooks Gap north to the ranges beyond Ulan and bounded by the Cope State Forest to the west and the Munghorn Gap/Goulburn River National Park to the east.

Within this area there are two predominant features, Dexter Mountain and the Moolarben Valley. The Valley is identified as the floodplain areas of Moolarben, Lagoon and Spring Creeks.

2.4 Landscape Description And Visual Character of the Study Area

The Study Area can be broken into broad homogenous landscape units of slope, vegetation type and landscape cover. The landscape units are described below in terms of their visual components of form, line, colour, texture and cultural modifications. Cultural modifications are assessed to ascertain the degree of change that has occurred to the predominant character of the area. See **Figures 02 and 04** for vegetation and slope analysis of the Study Area.

2.4.1 Ridgeline And Upper Wooded Slopes

This landscape unit forms a visually prominent backdrop to the southern and eastern boundaries of the Study Area. Slopes range from 20 to 40 % and the unit has a maximum height of approximately RL 745 at the Munghorn and within the study area RL 640 at Dexter Mountain which is approximately 200m above the site of the proposed mine.

Form: The steep slopes, rock outcrops and high elevation form the dominant visual element in this landscape unit, to the east a series of escarpments are visible.

The prominence of the ridgeline and upper slopes is accentuated by its contrast to more gentle slopes and alluvial plains.

Line: Line is a critical visual element for this unit as the ridgelines form the silhouettes against the skyline.

Colour & Texture: The dense vegetation particularly on and adjacent to the ridgelines results in a strong dark ragged edge silhouette and provides a contrast in colour and texture to the surrounding cleared areas and occasionally areas of escarpment. There is also a strong colour and textural contrast at the horizon line

Cultural The natural character is dominant in both areas and existing cultural elements appear to be insignificant.

2.4.2 Undulating Ridgelines (Vegetated And Cleared)

Undulating ridgelines are a significant unit of the study area. Consequently this unit contributes significantly to the overall character of the study area. This unit is comprised of slopes in the range of 10 to 20%.

Form: Form is also the dominant visual element of this landscape unit, although it is less distinctive than the steeper ranges and alluvial areas. With a significant diversity in shape, orientation and dissection, these undulating foothills provide a source of interest to the viewer as foreground elements.

Line: The undulations of the foothills also make line an important visual element in this unit, however due to the random nature of the line elements the overall form of the foothills visually dominates this landscape unit.

Colour & Texture: Vegetation contributes significantly to the colour and texture perceived in this unit. The extensive areas of remnant woodland provide a contrast to cleared pasture lands that predominantly run north/south through the Study Area. The variety of colour and texture often follows the undulations of the base topography

Cultural Modifications: In the west of the Study Area the ridges and slopes around Ridge Road, Spring Creek Road and the adjacent subdivision areas are heavily modified and are significant cultural elements related to the rural residential subdivision. This zone covers approximately 30% of the Study Area. Few other cultural modifications exist and most are limited to some rural residential properties and some obvious fencing. Some local roads with associated low level infrastructure also exist within the unit.

2.4.3 Valleys and Floodplain Areas (slopes less than 10%)

The main body of this unit is located throughout the centre of the Study Area surrounding Dexter Mountain on a north/south axis. It is a significant element of the Study Area. It encompasses the catchments of Moolarben, Lagoon and Spring Creeks. Several smaller creeks also have floodplain areas of reduced size.

Form: The form is relatively unimposing and due to the horizontal line of the landform, any vertical elements situated on this landform gain some

visual prominence in the landscape due to contrast with this flat form.

Line: The horizontal plane of the landform makes line a strong visual element in this landscape unit.

Colour & Texture: Colour is a distinctive visual element in this landscaped unit. The contrasting dark trees with light green grasses creates clear distinctions of vegetation. These contrasts create visual variety of the flood plain.

Cultural Modifications: Rural residential development is more concentrated in this area and is consistent particularly along the roadsides and in the smaller subdivision areas to the southwest. The rail line and roads in this stage are straight and prominent from some elevated viewing locations.

2.4.4 Water Bodies

The main water body within the Study area is the Goulburn River meandering through the northeast corner of the study area. The small creeks and tributaries of the Goulburn River are also significant items, however many only flow intermittently and are not easily visible from public locations. Moolarben Dam adjacent to the Ulan-Cassilis Road south of Ulan that feeds Moolarben Creek is also an identifiable element.

Line: The meandering courses of some creeks result in line being a low level visual element in this landscape unit. These linear elements are accentuated by vegetation, especially trees, along the water course and adjacent to dams.

Form, Colour & Texture: Water by virtue of its liquidity forms a significant contrast to the surrounding land mass in terms of form, colour and texture and creates the dominant element in the landscape. The scale is however small and not a dominant form in the landscape.

Cultural Modifications: The most significant cultural modification to the water bodies is the realigned course of the Goulburn River. This element has a strong engineering influence and is obviously man made. At the time of inspection it was dry further reinforcing the man made shape and structure. This element is strongly discordant with the existing landscape in line, form and depth.

2.4.5 *Other Cultural Elements*

The other major cultural elements adjacent or within the Study Area are:

- Ulan Mine Infrastructure
  The elements of the Ulan Mine include coal stockpiles, CHPP, rail loop and associated infrastructure. These elements are highly visible from the Ulan-Cassilis Road and form a large discordant element in the landscape;
- Associated Mine Infrastructure
  The Ulan-Cassilis Road Bridge over the Gulgong-Sandy Hollow Railway Line is a significant element in the landscape; and
- Gulgong Sandy Hollow Railway
- The Wilpinjong Coal mine project to the east of the MCP

2.5 Existing Nightscape

The assessment of the existing nightscape was made from local travel routes and various locations around the Study Area. Background light levels, brightness and glare were compared to background and colour when the source is viewed from varying distances.

The basic assumption of the nightscape assessment is that the night lighting impacts of the MCP should be assessed in relation to the overall character of this section of the Study Area. The nightscape character of the Study Area is perceived as being rural in character with scattered residences and with small concentrations of light at villages such as Ulan. The lighting of the existing Ulan mine infrastructure and working areas stands out as a discordant element in the existing nightscape.

In order to understand the impact of the open cut area and the coal handling plant an assessment of the Ulan Coal Mine preparation areas and the Bengalla open cut was made at night. **Table 2.1** provides an assessment of the existing night lighting environment in the Study Area and a comparison to the existing effects of similar open cut and coal handling areas. It is assumed that the night lighting environment at Moolarben will be similar to that at Ulan around the coal handling and preparation plant areas. Impacts from the open cut areas will be more spread out, dynamic and diverse than the Bengalla open cut area due to the proposed truck and shovel nature of the extraction method, with three pits operating at different times throughout the mine life. Progressive rehabilitation and emplacement operations may also run concurrently at night in several areas. The night lighting assessment in Section 5 assumes that the open cut areas and infrastructure areas will be working 24 hours per day similar to the Ulan Coal Mine infrastructure areas.

Table 2.1
Visual Impact of Lighting in Existing Nightscape:

ASSESSMENT OF EXISTING STUDY AREA					
Nightscape Unit	Foreground <400/800m	Close Middleground 400m/800m - 2/3km	Distant Middleground 2/3km - 5/8km	Background 5/8km - infinity	Overall Rating
Upper ridges	Nil	Nil	Nil	Nil	Nil
Foothills with subdivision residences along local roads	Moderate	Moderate/Low	Low	Nil	Low
Ulan Village	Moderate	Moderate/Low	Low	Low	Low/ Moderate
ASSESSMENT OF FACILITIES SIMILAR TO THOSE PROPOSED					
Ulan Mine Coal Handling & Preparation Plant lighting	High	High/ Moderate	Moderate	Low	Moderate/ High
Bengalla Open Cut Assessment	High	High/Moderate	Moderate	Low	Moderate

See individual assessments under viewing point impacts for assessment from each selected location.

3.1 Assessment Criteria

The basic premise of visual quality assessment is that all landscapes have some value, but those with the highest diversity have the greatest potential for high scenic quality.

Scenic quality is the combination of elements used to identify the importance of the proposed development to potential viewers.

The assessment of scenic quality is performed by assessing the landscape character units in scenic quality classes eg. high, moderate, low. These classes are based on the diversity of form, line, colour and texture, prominence of landform, prominence of vegetation and geology, and water forms.

3.2 Scenic Quality Assessment

Based on the description of the landscape units in Chapter 2, the scenic quality assessment of the Study Area is summarised in **Tables 3.1 and 3.2**.

Table 3.1
Scenic Quality Assessment:

Landscape Rating Unit	SCENIC QUALITY CRITERIA Proportional Prominence of				**Scenic Quality Classes**
	Diversity of Landscape Elements	Landform	Vegetation	Water	**Result**
Ridgeline & upper wooded slopes	Moderate	High	High	-	**HIGH**
Undulating foothills and elevated outcroppings	Moderate	Moderate/ High	Moderate	-	**MODERATE**
Valleys & flood plains	Moderate/High	Moderate	Low	Low	**LOW/MODERATE**
Impact of Cultural modifications	Moderate	Low	Moderate	-	**LOW/MODERATE**

The scenic resource values are based on Williamson's (1979) findings for landscape dimension scenic quality relationships that are based on earlier research studies.

Those studies identify that scenic quality increases as:

- Topographic ruggedness and relative relief increase;
- Presence of water forms, water edge, and water areas increase;
- Patterns of grasslands and forest become more diverse;
- Natural and agricultural landscapes increase and man-made landscapes decrease; and
- Land use compatibility increases and land use edge diversity decreases
-

Refer **Figure 05** for scenic quality assessment of the Study Area.

3.3 Viewer Characteristics

Viewer characteristics of the landscape are specific to the MCP and are determined by individual viewing points, distance to the object and sensitivity of the viewer.

Visibility of individual landscape elements and visual prominence of items in the landscape is determined by the individual viewing points selected within the Study Area. Note that the impact can change with only slight modification to the viewing points. Locations have been selected from which the major views of the various open cut areas, and the emplacement areas will be prominent. The locations are considered representative of a general location or group of locations. They are grouped according to relative distance.

3.4 Viewpoints

The selection of viewpoints is specific to the MCP and is determined by the angle and elevation of the view and distance to the object. Distance definitions have been determined from those listed in **Table 3.2**. These distance zones are used throughout to group viewpoints or frequently travelled viewing corridors allowing more clarity in assessment.

Table 3.2
Distance Definition for Landscape Assessment

	Foreground	Close Middleground	Distant Middleground	Background
Distance	0-400/800m	400/800m-2/3km	2/3km - 5/8km	5/8km- infinity
Viewing capacity	Detailed	detail and general	general	general - no detail
Object viewed	rock outcrop	hill or small valley	entire ridge	ridge system
Visual characteristics	species of individual plants	textures (palms and hardwoods)	course textures (grass to tree cover)	patterns (light and dark)

Source: Forest Commission, Victoria, 1981 - Visual Absorption Capability in the Blue Range Study Area. Adapted by O'Hanlon Design Pty. Ltd.1997 to suit the Kayuga Study Area and subsequent studies.

THE VIEWPOINTS (Refer **Figure 03** for locations)
The selected viewpoints for the project area:

VP 1 - Ulan to Cassilis Road 1km north of rail bridge RL 430

VP 2 - Ulan to Cassilis Road at the rail bridge RL 430

VP 3 - Ulan to Cassilis Road adjacent to Ulan Stockpiles RL 425

VP 4 - Ulan to Gulgong Road 1200m west of Ulan RL 440

VP 5 - Ulan to Mudgee Road from Moolarben Rd to Toole Road

VP 6 - Ridge Road adjacent to Pine Haven RL 560

VP 7 - Winchester Crescent 80m north of Eulandra RL 530

VP 8 - Ridge Road 1000m from Mudgee Road RL 550

VP 9 - Moolarben Road north of Astalos property

VP 10 - Moolarben Road at Moolarben Creek Crossing RL 500

VP 11 - Wollar Road RL 440

3.5 Sensitivity Levels

Sensitivity levels are a measure of people's concern for the scenic quality of an existing environment. They are based upon the scenic quality of the landscape unit, distance, zone and type of travel routes or location of viewpoints, and the number and type of potential viewers.

Major roads and primary use areas carry a higher number of viewers than secondary roads and use areas. Generally, tourists and residents have a higher concern for visual quality than commuters. Residents have a high concern for the scenic quality of their visual catchment if it is threatened by perceived detrimental changes. Residents are generally more concerned with foreground and middleground impacts. Commuters are generally more concerned with foreground elements.

Very little valid research has been carried out in Australia to determine the public sensitivity to visual impacts generally or to the visual impact of coal mines specifically. Most assessments are based on U.S.D.A. research and anecdotal evidence.

We have assessed public sensitivity level against the criteria shown in **Table 3.3** and our estimate of viewer numbers, and our assessment of level of concern generally demonstrated in similar communities.

Table 3.3
Sensitivity Levels - General Criteria

	Sensitivity Level		
Use/viewer numbers	1	2	3
Primary Travel Routes, Urban Residential Areas	At least 25% of users have MAJOR concern for scenic qualities of the area	Less than 25% of users have MAJOR concern for scenic qualities of the area	
Secondary Travel Routes, Rural Residential Areas and Water Bodies	At least 75% of users have MAJOR concern for scenic qualities of the area	At least 50% and not more than 75 % of users have MAJOR concern for scenic qualities of the area	Less than 50 % of users have MAJOR concern for scenic qualities of the area
Rural roads and outlying individual property areas		At least 75% of views have MAJOR concern for scenic qualities of the area	Less than 75% of users have MAJOR concern for scenic qualities of the area

Given the locations and our assessment of the type of viewers, we have concluded that the sensitivity of each viewpoint is set out in **Table 3.4** below.

Table 3.4
Sensitivity Levels - Travel Routes & Urban Areas

Level 1	VP1, VP2, VP3, VP5
Level 2	VP4, VP6, VP7, VP8, VP11
Level 3	VP9, VP10.

3.6 Landscape Management Zones

The assessment of the degree of visual impact of the proposed open cut areas and the related facilities is based on the perceived severity of the developments within the landscape from selected viewpoints, the number of viewers expected to experience the changes and the capacity of the landscape to absorb the proposed changes.

In order to determine the absorption capacity of the landscape the areas affected have been divided into Landscape Management Zones (LMZ). These Landscape Management Zones as shown in **Table 3.5** are an indication of the perceived ability of the area to absorb visual change.

Table 3.5
Landscape Management Zones
O'Hanlon Design Pty Ltd 2006 (Moolarben Study)

LANDSCAPE MANAGEMENT ZONES								
		Sensitivity Level Distance Zone						
		1 Fg	1 Mg	1 Bg	2 Fg	2 Mg	2Bg	3
Scenic	**High**	A	A	A	A	B	B	B
Quality	**Moderate**	A	A	B	B	B	C	C
Class	**Low/Mod**	B	B	C	B	C	C	C

LMZ as noted in the above table are described as follows:

ZONE A - High concern for visual resources

In this zone the ability to absorb change without significant effect is low. If possible mitigation methods should be used to significantly reduce the impact of any change. This zone is primarily along residential access roads, along the ridgelines and the upper wooded slopes and includes local features such as the main ridge of the Great Dividing Range, Moolarben and Dexters Mountain. Also of concern are the vegetated areas south of open cut area N$^{o.}$ 1.

ZONE B - Moderate concern for visual resource

In this management zone the ability to absorb the change is moderate. Therefore greater levels of modification are possible before the new elements become intrusive. This zone comprises the bulk of the MCP area visible from secondary roads and rural residences, including the area of open cut 2 and 3.

ZONE C - Low concern for visual resource

In this zone the ability to absorb the proposed change is high, due to the lower number of viewers and/or their locations and the overlaying topography. This zone is comprised largely of the immediate foothills behind the ridgelines away from the secondary roads.

The compilation and distribution of landscape management zones is shown on figure 04.

Rating: **The MCP Area falls across all Landscape Management Zones depending on the viewer location.**

Refer to **Figure 06** for details of Landscape Management Zones when viewed from the public roads within the study area.

Section 4 Relevant Aspects Of The Proposed Development

4.0 General

This section describes the various visible elements of the Moolarben Coal Project (MCP) and the items that will affect visual quality and visibility. The proposed method and timing of mine and spoil emplacement operations are graphically displayed on the conceptual 'Progression of Mining' plans 1-5 prepared by Co-Resources Pty Limited and described in Volume 1 of the Environmental Assessment Report. The development of the MCP includes a number of distinct elements each of which have varying impacts related to the location of the viewer and year of progress.

4.1 Infrastructure Areas

4.1.1 Stockpile and CHPP Areas

The basic infrastructure, coal handling facilities and rail loop are works, which will be completed within the first year of the project construction. With the exception of the open cut area 3 (OCA 3) infrastructure, these facilities are static and will remain for the duration of the project.

The main infrastructure including the coal preparation plant (CPP) are located southeast of and adjacent to the Ulan-Cassilis Road to the north of the disturbance area. The base level of these facilities will be in the order of RL 420 to RL 430. The highest of the facilities will be the stockpile conveyor and the CPP. The coal stockpile conveyor unit work over the product stockpile at a height of around 24 metres. This indicates a likely coal stockpile height in the order of 20-22 metres with a variable length up to 700m depending on demand and availability of transport. This coal stockpile is a significant element in size and colour.

The MCP stockpile area is visually different to many other stockpile areas as it also has a separate underground ROM (run of mine) 100kt stockpile and plant feed stockpile. The plant feed stockpile will be 250m long and 18m high. The underground ROM stockpile will be approximately 45m high and conical in shape with a base diameter of approximately 80m and a discharge conveyor 50m above ground. The ROM stockpile is within 200m of the Ulan-Cassilis Road. Further north is an associated OCA ROM stockpile varying up to 300m in length and approximately 25m in height. This is located approximately 400m back from the Ulan-Cassilis Road. All stockpiles are fed by a series of conveyors and associated bins.

The coal preparation plant is a large rectangular building of approx 30m in height located adjacent to the northeast end of the coal stockpile and approximately 800m from the Ulan-Cassilis Road. These buildings and base heights indicate an overall development height allowing for design development of between RL 460 and RL 470.

Between the Ulan-Cassilis Road and the site facilities are two above ground conveyors. The closest to the road runs from the open cut dump hopper to the plant feed stockpile, the second runs from the CPP back to the rejects bin. These conveyors are strong lineal elements and their associated bins are significant elements in the landscape.

4.1.2 Underground Mining Infrastructure

It is proposed to integrate the main underground site facilities within the area of the main coal handling infrastructure. These facilities include the workshop, bathhouse, store, parking and offices. The overall height of the workshop largest structure is likely to be in the order of 10m high with the store and office structures approximately 5m high.

Most of the coal handling infrastructure for the underground mine is shared with the open cut mining operations. The underground stockpile noted in 4.1.1 is a separate large element.

Drift openings dip to the north commencing adjacent to the underground ROM stockpile. The commencement level is approximately RL 420 and they fall to approximately RL 400 at the portal. The western drift is a transportation drift. This is a box cut and will have a base width of approximately 10m with side battered slopes. The transportation drift is approximately 50m from the road and 150m long. The eastern drift will be the coal conveyor drift from the underground works to the above ground stockpile. This drift will be steeper and narrower than the western drift.

A main vent shaft is located north of the underground ROM stockpile. This shaft will have minimal associated bunding up to 1500mm high with security fencing surrounds.

4.1.3 Rail Loop

The rail loop and loading bins are located off the Gulgong - Sandy Hollow Railway Line. The rail loop will commence adjacent to the proposed 330kV power line. On the loop will be a 2000t rail load out bin fed by overland elevated conveyors from the coal product below ground reclaimer. The height of the rail load out bin is approximately 30m giving a level at the top of the bin of approx RL 450.

4.1.4 Open Cut Area 1 Infrastructure Area

The infrastructure for OCA 1 is located south of the Ulan-Cassilis Road and south of the remnant vegetation and 15m high bund. The area will include a bathhouse, workshop, offices, fuel store and employee parking area. The total height of buildings will not exceed 12m.

4.1.5 Raw Coal Stockpile and Processing Area

North east of the OCA 1 infrastructure are a series of bins, crushers and hoppers required to process the open cut coal from the mining operations. The main visual element will be the rejects bin with a height of approximately 15m above ground level. The other elements are located below ground level in an excavated processing area that runs north/south to reduce noise impacts.

Adjacent and south of the processing area is the 100 000t ROM stockpile. This stockpile will be less regularly shaped as it is fed and reclaimed by a truck and front end loader operation. Height is limited to 10m but it has a much larger footprint. This stockpile and the processing will be visible above the east end of the acoustic bund facing the Ulan-Cassilis Road.

4.2 Mining Operations

4.2.1 OCA Design Development

During the course of the assessment changes to the layout of OCA 1 have resulted in the retention of significant stand of vegetation between the Ulan-Cassilis Road and OCA 1. This has enhanced the visual quality by providing a substantial screen to the 15m high acoustic bund and the pit area of OCA 1.

4.2.2 Mine Sequencing

The proposed open cut mining areas are shown in Appendix A. The proposal is to develop OCA 1 first followed by OCA 2 and OCA 3. Open cut mining will be undertaken using conventional truck and excavator techniques. However, as mining technologies advance and economies change, the provision of new or revised mining methods may be adopted.

4.3 Individual Open Cut Areas

4.3.1 Pit No.1

The initial focus of the mining operation in OCA 1 will be to establish an environmental bund between mining operations and sensitive receptors. The environmental bund will generally provide effective long-term mitigation of noise and visual impacts from the coal mining activities. The environmental bund will be approximately 6 metres high adjacent to the OCA 1 infrastructure areas, and gradually increases to 15m around the overburden emplacement associated with OCA 1. This environmental bund will be constructed in the first six months.

Following the initial environmental bund work is the construction of the out of pit emplacement. This will progress from south east to west with a height of approximately 15 metres in the south east and rising by benching slightly to the west. Construction will take up to 12 months. Following this work in pit emplacement will occur.

The working of OCA 1 is scheduled to take approx 7 years. The cut will progress from south to north and the in of pit emplacement is initially concentrated in the south west corner rising to RL 456 and then continuing up into the adjacent gullies to the east and grading up to RL 500.

The rehabilitation areas are generally large flat plateaus with relatively straight steep edges. These forms contrast to the heavily dissected edge of the tree covered ridges bounding the eastern edge of OCA 1. A final void approx 80m deep is located at the north end of OCA 1.

4.3.2 Pit No.2

The workings of OCA 2 progress from north to south in a thin slice following the line of the adjacent rdidge. The construction of the initial bund of 10m high running north-south provides a screen to the work area and defines the edge of the in pit emplacement. The final emplacement increases to the level of the rehabilitated areas close to the more rugged easement edge from RL 460 up to approx RL 470. A final void of 30m deep is proposed to be landscaped on completion.

4.3.3 Pit No.3

The works at OCA 3 commence around year 8 and will continue for approximately 3-4 years. The pit commences in the north-west corner and the initial out of pit dump commences north east of the OCA pit. . At the same time, the workshop and bathhouse area are constructed north of the OCA 3 pit and emplacement. The emplacement ultimately reaches a height of 15-20 metres.

The OCA 3 area works to the south generally following the line of the existing Moolarben Road. Similiarly to OCA 1 and 2, the resultant landform is a flat plateau at around RL500. This level is relatively close to the existing landform level. A final void of between 8 and 40m is located in the southern corner of OCA 3.

4.4 Design Considerations

The underlying philosophy of the visual mitigation strategy is to create the conditions for minimising impact during the mining activity. The identification of existing vegetation capable of providing a fully-grown screen is considered a significant tool. As noted earlier this process has resulted in the retention of a significant stand of vegetation west of OCA 1.

Revegetation should reflect the existing density and character of the adjacent landscape. Trees may be strategically planted along the edge of out of pit emplacements for OCA 1 and could mark

the new valleys and gullies. The revegetation strategy needs to compliment the future use of the mine area after mine completion.

4.5 Night Lighting Considerations

The proposed night lighting will be primarily concentrated on the open cut working area, the main infrastructure area and access roads. Lighting is anticipated to be locally concentrated within the pits at reduced heights due to the truck and shovel nature of the operations. Truck movement at night with associated headlight and warning lights are likely to be significant impacts as the light source may be flashing or moving.

The sequential nature of operation of the 3 open cut areas will reduce the area affected by lighting. The glow in the sky on overcast nights, commonly referred to as sky glow, is a significant element in the night environment at several other mines such as Ulan, Bengalla and Bulga.

Based on inspections of other mines the lighting elements that are likely to cause impacts are listed below:

- Direct views of High Pressure Sodium (HPS) floodlights on electric drills;
- Direct views of HPS safety lighting in the infrastructure areas;
- Views of lights moving on the working faces;
- Direct views HPS and Metal Halide (MH) floodlights on skid mounted lighting plant;
- Direct views of headlights on vehicles as they move up sloping mine roads, along level mine roads, and as they turn bends; and
- Direct views of lighting adjacent to, or part of conveyors and loading / surge bins.

The type of lighting described above is typical for open cut mines. Due to the nature of open cut mining there is limited scope to reduce the dynamic impacts of moving lights from vehicles.

The proximity of the infrastructure areas close to the Ulan-Cassilis Road will be a major contributor to the night lighting impacts. In this area the potential for screening is reduced and the site will be highly visible due to the topography and road geometry in that general area.

The creation of a number of infrastructural areas adjacent to the;

- Rail loop;
- OCA 1;
- OCA 3,

increases the spread of light throughout the area. This combined with the light from the existing Ulan Mine will spread the effects to a wider area.

5.1 General

The assessment of the degree of visual impact of the proposed open cut areas, the infrastructure and emplacements is based on the perceived severity of the works and facilities within the landscape from selected viewpoints and the number of viewers expected to experience the visual changes.

The sequential nature of the mining emplacement, rehabilitation process and the location of the emplacement areas and associated infrastructure require these to be individually assessed throughout the mine life.

Factors included in the assessment are as follows:

(a) Selection of viewpoints, which offer prominent, views from the north, south, east and west of the Study Area. These viewpoints do not represent all possible views attainable from each direction; the visual impact would vary according to the stage of operation, viewing position and specific site conditions.

(b) Consideration of the various landscape components in relation to the visual impact.

Visual impact ratings are ranked in decreasing order of severity on a scale between 8 and 0 as follows: Severe, High, Moderate, Low and Nil.

5.2 Open Cut Area (OCA)

The open cut areas are the most complex of the mine elements to assess due to their sequential dynamic nature. This is reflected in the impact ratings for each viewpoint that may decrease or increase over time due to the directional shift of an open cut area and/or the proposed emplacement and topographical changes, which will allow or impede views to each of the pit areas at different times.

In order to assess the impact of the open cut areas we have assessed the impact in relation to the key parameters used in **Section 2.4** to assess the visual characteristics of the Study Area. The assessment of the visual landscape components is shown below in **Table 5.2**.

Table 5.2
Description of Landscape Components for Open Cut Areas

LANDSCAPE COMPONENTS	GENERAL DESCRIPTION OF IMPACT
Form	Major changes to topography - extensive excavation and at varying times.
Line	The edge of the worked surfaces would provide strongly contrasting elements to the surrounding landform.
Colour	Exposure of coal seams, associated geological strata and spoil emplacement, would provide a severe contrast to adjacent pastoral grasslands and vegetated areas.
Scale Contrast	The extent of the open cuts are a significant element and has a significant contrast in scale to other landscape features during construction of each pit.
Spatial Dominance	The open cuts would be perceived as a prominent spatial element of the local landscape particularly when viewed from elevated locations and from foreground locations. The size, scale and colour of the overburden emplacements will vary with time in the landscape. These will combine to create a form, which will be spatially dominant to its surroundings.

5.3 Emplacement Areas (EA)

The overburden emplacement works themselves will become significant permanent elements in the landscape.

Similarly the analysis of the visual impact of both in the pit and out of pit emplacement areas is shown below in **Table 5.3** and assessed against the same visual landscape components.

Table 5.3
Description of Landscape Components for the Emplacement Areas

LANDSCAPE COMPONENTS	GENERAL DESCRIPTION OF IMPACT
Form	The forms are lineal and smooth faced. This is a contrast in form to the surrounding edge of the ridgelines and upper wooded slopes. The existing edges are heavily dissected and ragged. This produces a variety of shadow and lighting effects that contrast with those of the smooth faced emplacements.
Line	Potentially a significant visual element.
Colour	Proposed progressive rehabilitation measures will reduce potential impacts.
Scale Contrast	The scale will be compatible with other adjacent topographical elements however the faces are likely to be less modelled and more machine made.
Spatial Dominance	The elements are dominant when read at a distance.

5.4 Assessment of Visual Impacts

5.4.1 VP 1 Ulan-Cassilis Road

Viewers at VP1 travelling south on the Cassilis Road travel over a small ridge and cutting adjacent to the Goulburn River at an approximate level of RL430 to RL 435, from this location the main infrastructure area and coal stockpiles are visible at distances of between 400m and 800m as foreground elements. The main workshops, offices and bathhouses are proposed within 50m of the road as the traveller proceeds south toward the rail overpass. Further to the east the rail loop infrastructure and load out bin will be visible at a distance of 150m.

The existing relatively flat grazing area in the foreground will be completely changed to an industrial landscape. Viewers are at slightly superior levels so the total layout of the ground level elements will be visible. Coal stockpiles and conveyors up to RL450 will form significant elements of line, form and colour in the foreground. These elements will be extremely discordant with the background of rugged range elements. These impacts last for the full duration of the mine life.

During year 1 of the project some of the works in OCA 1, the vegetation removal at the south end of OCA 1, prestripping and out of pit emplacement erection of conveyors adjacent to the Ulan Road, will be visible at distances of around 2500m or less. As OCA 1 extends and moves north in Year 2 the unrehabilitated surface of the In pit overburden emplacement up to RL460 and the rear face of the pit will be visible as an element approximately 2000m distant and of varying length up to 1500m. This element moves toward the viewer for approximately a 7 year period. A view onto the final emplacement face and into the final void will be possible on completion of OCA 1 at a distance of 1000m. On completion a view into the southern end of the void left for underground access will also be possible. Any unrehabilitated surfaces in or on the slopes into the voids will be visible. All infrastructure and conveyors remain. Due to the viewers superior location much of the work on the northern end of OCA 1 will be visible during the project at inferior levels. Similarly the final voids, drift access and rehabilitated areas are relatively straight sided, those elements may be obviously man made. No views of the works in OCA 2 or OCA 3 are possible.

The duration of the view at VP1 is short. The viewer travelling south passes through a cutting to the north of the main infrastructure area. The infrastructure area is then visible to the east for approx 20secs.

5.4.2 VP 2 Rail Overpass

Viewers on the rail overpass have views in both easterly and southerly directions of the Moolarben project. To the northeast views of the underground infrastructure

similar to VP 1 are possible. Adjacent to the road the office/workshop complex will be highly visible and further to the east the conical ROM stockpile and the product stockpiles at distances varying from 500m to 1200m will be dominant elements in the landscape. A limited view down and into the top of the transport portal to a potential underground mine will also be possible.

To the south from the overpass views of the OCA 1 will be possible throughout the life of the mine. In Years 1 and 2 the work area will be at a distance of approx 2500 to 2800m. As the OCA progresses it will move north toward the view. Both the open cut areas and the overburden emplacement will be visible throughout the mine life. Rehabilitated areas in the distance will be at levels around RL 460. At distances of 300-500m, rehabilitation will be just above the viewers' eye level around RL 435.

The final overburden emplacement face of OCA 1 will be visible at a distance of 200 to 300m from around Year 9. The rehabilitation strategy for the final void of OCA 1 is important and will be addressed as part of the Mine Operating Plan. Views onto the southern face of the final void will be possible from the overpass bridge and along the proposed deviation of the Ulan-Wollar Road.

Significant views of all the infrastructure and conveyors connecting the CHPP and OCA1 infrastructure area will be possible throughout the mine life. Conveyors close to the viewpoint and into the distance will be significantly discordant lineal elements cutting across the landscape.

Similar to VP1, viewers travelling in either direction will have views of only short duration of the mine infrastructure or open cut areas. Views of the open cut area to the south will be visible for approx 30secs.

Views of OCA 2 and OCA 3 are not possible from this viewing location.

5.4.3 VP 3 Ulan Road adjacent to Ulan Stockpiles

Viewers travelling east along Ulan Road adjacent to the Ulan stockpiles will be screened from views of the adjacent OCA 1 works to the southeast by the existing vegetation between Ulan Road and the new bund until approx Year 5 of the development.

After Year 5 viewers travelling east will have views of the OCA and overburden emplacement over and beyond the 15m high environmental bund at distances exceeding 1km.

Views of the underground ROM pad and the product stockpiles will be visible throughout the mine life at distances beyond 3km. The infrastructure for OCA 1 will not be visible beyond the remaining vegetation.

Views of OCA 2 and 3 are not possible from this location.

5.4.4 VP 4 Gulgong Road

Viewers travelling east along Gulgong Road and viewers within the precinct of Ulan Village will have views of the upper levels of the 15m acoustic bund during the six month construction period. These views will be ameliorated by revegetation and the impact will reduce with time. Viewing levels and distances vary as do overall impacts, however the average distance will be between 1000 and 1200m making these close middleground elements.

Similarly the emplacement works on the east side of the south end of the OCA 1 that spread up into the existing valleys of the local ridge (N 6423 000 and E 760 000) will be visible where located above RL 450. The prestripping of these valleys, the top edge of the initial cut, the emplacement and final rehabilitation of these gullies will be as a cut edge at around RL 490 to 500. This will be a strong lineal element defined by both texture and colour. It will be most visible in the later afternoon as shadows fall from the northwest and the sun penetrates into the gullies revealing the textural and colour variations.

Limited views of the north end of OCA 1 will be possible from Gulgong Road but not possible from Ulan Village toward the end of the pit life. These however will be less significant as they are close to eye level at a distance of 4000m.

Very limited views of the emplacement at OCA 2 may be visible from Gulgong Road at distances exceeding 4km. As the emplacement works run northwest to southeast along the viewing plane these impacts will be very low.

5.4.5 VP 5 Ulan Rd – Moolarben Rd to Toole Rd

Viewers travelling along Ulan Road between Toole Road and Moolarben Road have primary views to the north and south following the road alignment. Viewers will see no infrastructure or open cut activity in these view catchments.

In the vicinity of Lagoon Road viewers looking directly east may be able to view the emplacement works of OCA 2 at a distance of approx 3000m depending on the density of intervening tree cover. These impacts would be very low and imperceptible after rehabilitation is completed.

5.4.6 VP 6 Ridge Road (north)

Viewers along Ridge Road north are predominantly screened from mine activities by intervening topography and tree cover adjacent to the road. However adjacent to Pine Haven at around RL 560 some views of mine activities will be possible.

Viewers will have views both northeast toward Moolarben Dam and the south end of OCA 1 at a distance of approx 4200m. In this area the early noise bund construction will be visible in limited sections. The construction of the overburden emplacement and rehabilitation at around RL 440 and above. The superior elevation of the viewer at RL 560 will also allow views further north across the overburden emplacement of rehabilitation of OCA 1 for the duration of the mine life. These views extend out to a distance of 7000m.

Views of the Infrastructure Area of OCA 1 may be possible depending on the amount of vegetation removed immediately adjacent to the buildings.

Distant views of the main infrastructure area, stockpiles and rail loop area will be possible at a distance of approx 8 to 10km. At this distance the infrastructure can only be read in large detail as a background element. Therefore the most likely visible element would be the stockpiles. These would be difficult to identify due to the dark colour of the heavily wooded hillsides north of the stockpiles.

Views of the construction of the northern end of OCA 2, the construction of the acoustic bund and rehabilitation will be possible at a distance of approx 4200m. The viewer will again be at a superior viewing level of RL 560 viewing elements at levels around RL 450 to RL 470. Views of the haul road between OCA 1 and POCA 2 are restricted due to the intervening topography and tree cover.

Views of the main infrastructure area and the out of pit emplacement area of OCA 3 will be possible at a distance of approx 6000m to 7000m depending on the viewer location and vegetation immediately adjacent. These views are background views and the elements can only be identified as large scale elements. The out of pit emplacement will only be identifiable by colour and will become imperceptible in the landscape when the rehabilitation works are complete.

5.4.7 VP 7 Winchester Crescent

Viewers at VP7 located around RL 530 will have potential views northwest toward OCA 1 and the southern end of the acoustic bund and overburden emplacement.

The works will be a background element at a distance of approx 5200m. Due to the superior elevation of the viewer some extended views toward the OCA 1 infrastructure area are possible. These would reveal the emplacement area and OCA 1 infrastructure at a distance of approx 7000km. The likely visible element

would be the unrehabilitated emplacement area. This would be completely mitigated by rehabilitation.

Some views of the northern end of OCA 2 are possible around the northern ridge of Dexter Mountain from this general locality. These views are limited to the tree stripping and emplacement of material above RL 480 within the gullies east of the north end of OCA 2. The exposure is limited to a 2 or 3 year period. The views are of a lineal colour element at a distance of approx 5500m.

No views of OCA 3 or its infrastructure are possible from this area.

5.4.8 VP 8 Ridge Road

Views of the southern end of OCA 1 are possible but at distances exceeding 10km. As a result it is unlikely these works will be visible except where a colour change is highly discernable over a large area of rehabilitation or prestripping. Detailed elements of the work would not be visible.

Views of OCA 2 will be shielded by Dexter Mountain except for a small section of the southern corner of OCA 2 around Year 7-8. Again the element is a background element at a distance exceeding 7000m and the elements will become unobtrusive once rehabilitation is complete.

Views to the east along the line of Moolarben Road for viewers along Ridge Road at levels exceeding RL 600 will include views of the infrastructure area of OCA 3, the north end of OCA 3 and the overburden emplacement of OCA 3. These elements will appear as background elements at a distance of approx 7000m. Impacts will vary depending on viewer elevation and residences above RL 650 will have slightly superior views.

5.4.9 VP 9 and 10 Moolarben Road

Viewers along Moolarben Road are generally screened from view of the infrastructure and OCA 3 areas until the road turns east just north of the Astalos property.

From these locations, travelling east, views across to the OCA 3 infrastructure will be possible as close middleground or foreground elements depending on the final relocation of Moolarben Road. These elements will be in place from approximately Year 8. Views north along the noise and emplacement bund of OCA 2 will also be possible.

Due to the superior height of the viewer at RL 500 the progressive cut and overburden emplacement of OCA 2 will be visible as a middleground element.

Moving east along the realigned Moolarben Road the viewer will have unrestricted views of the out of pit emplacement and the open cut area for the full life of OCA 3. For the bulk of the journey the viewer is in an inferior viewing location. This results in views of the face of OCA 3 and the out of pit emplacement. These views are at varying distances from 50m to 200m. Some views of the cut and emplacement up into the gullies west of OCA 3 will also be possible. These views are most prominent around VP10 and looking south from Moolarben Road adjacent to the infrastructural area.

The valley in which OCA 3 is located is open and lineal to the north. The OCA 3 bunds, overburden and works will completely change the character of the valley for the duration of the work from rural to semi-industrial. A large percentage of the valley will be disturbed and the final landform of the OCA lacks significant modulation.

The contrast of the sharp edges of the rehabilitated areas with the existing heavy vegetation on the ridges and gullies to the west will also change the character of the valley for at least 10 to 15 years or until a more dense tree cover can be re-established.

Views of OCA 1 are not possible from Moolarben Road.

5.4.10 VP 11 Wollar Road

Viewers travelling along the realignment of Wollar Road from the west will have unrestricted views of the rail loop, infrastructure, coal stockpiles and CHPP as foreground elements at distances varying from 200 to 500m. Views will become progressively more open starting around the bridge at Wilpinjong Creek approx 2km south of the rail loop.

Views of OCA N$^{o.}$1 and the final void will also be possible as close foreground elements from the realigned section of Wollar Road.The total distance of the impact will be in the order of 4500m. At a travel speed of 60km/hour, this results in a travel exposure of approx 4.5minutes.

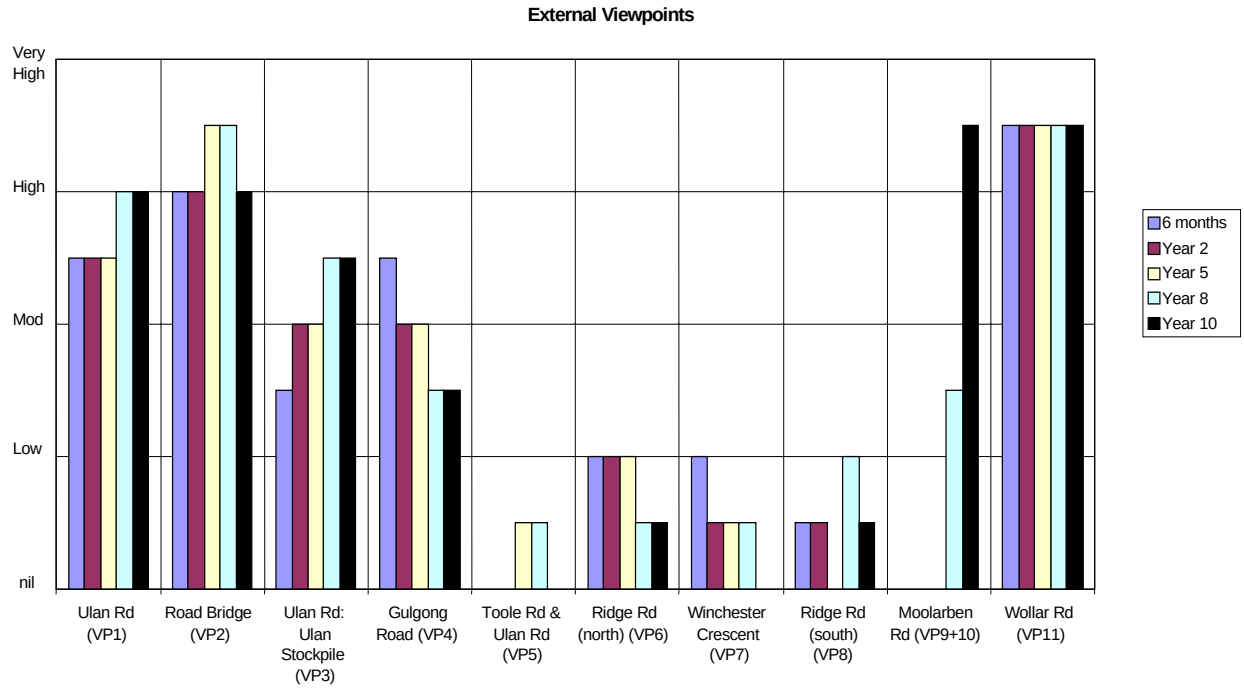
The landscape will be totally altered and the resultant impacts will affect colour, bulk, scale, line and spatial dominance. All elements will be strongly discordant with the surrounding landscape. These impacts will endure for the full length of the mine life. Some limited screening from existing vegetation will be available adjacent to the rail loop area.

5.4.11 Infrastructure Areas

It should be noted that the impacts identified for the main infrastructural areas in this report, particularly in relation to the high degree of impact at VP1, VP2, VP3 and VP11 are similar to those that would have been anticipated when the original main infrastructure associated with the previously approved Underground No.4 work was assessed and approved in 1985.

To assist with an understanding of the nature of the visual impacts, the impacts assessed above for each viewpoint have been ranked on a scale nil, low, moderate to high in **Figure 5.4** below. The impacts are adjusted to demonstrate the changing nature of the impacts due to time, movement of open cut areas and emplacement areas and the proposed rehabilitation strategy.

Figure 5.4
Degree of visual impact of open cut areas and mine infrastructure



5.5 National Parks and Nature Reserves

5.5.1 Goulburn River National Park

The Goulburn River National Park is situated approximately 7km east of the infrastructure area of the Moolarben Coal Project. The western edge of the National Park is roughly defined by the course of Wilpinjong Creek. The key visitor facilities and access areas are located approximately 17km to the east off Mogo Road and Spring Gully Road.

The Lees Pinch lookout and Mount Dougan provide extensive views over the park to the east and south only. Views are not possible toward the Moolarben area to the west. The proposed mine infrastructure and facilitites will not be visible from any of the main lookouts, picnic areas or camping grounds.

5.5.2 Munghorn Gap Nature Reserve

The Munghorn Gap Nature Reserve is located to the south, west and southwest of open cut area No 3. Entry to and through the park is via the Mudgee-Wollar Road. Visitors to the park accessing Moolarben Road from the south will have views of the south end of OCA 3 from approximately year 10 to 11.

The main visitor facilities are at the Moolarben Picnic Area located 6km southeast of the south boundary of OCA 3. No views of the open cut area or infrastructure are possible from this location or from the Gulgong-Wollar Road. The main walking trial in the park is the Castle Rock Trail. The Castle Rock Trail lookout area is approximately 10km southeast of the boundary of OCA 3 and views into the OCA are not possible.

Parts of the Munghorn Gap Nature Reserve are located east-northeast of OCA 3 at a distance of 1-2km. These areas are at approximately RL600. From the edge of the escarpment, extensive views of OCA 3 would be possible. The current mapping shows no 4 wheel drive access into the area and the topographical map indicates the terrain is rugged. Viewer numbers along the escarpment are likely to be very low. The impact on any viewer would be limited to between year 8 and 11 of the project.

5.6 Mitigation Measures

The following measures if implemented will reduce the overall impacts of the open cut mining areas, the overburden emplacement works and the infrastructural elements from various viewpoints as shown above:

- Create a 6m high bund along the north and northwest edge of OCA 1 adjacent to the final void as part of initial works and landscape in the first 6 months;
- Create a mixed vegetative screen 4 rows (10 metres) of quick growing acacia species and eucalypts along the north edge of the realignment of Wollar Road as close as reasonable to the road alignment. This will reduce the impacts of the infrastructure area to moderate within 5 years. Plants to be selected relative to final road levels and adjacent topography to screen at eye level between 1m and 2.5m above road level;
- Where the OCA N$^{o.}$1 acoustic bund is not screened by trees, modify the face of the bund by creating a deep gulley or an extended toe to create a more natural landscape element;
- Modify the tree removal and emplacement strategy along the mid slopes of the east/southeast ridgeline to prevent the removed tree line from forming a horizontal line when viewed from similar elevations. This is relevant along the east edge of OCA N$^{o.}$1, the east edge of OCA N$^{o.}$2 and the west edge of OCA N$^{o.}$3;
- Along the bund edge of OCA N$^{o.}$1 and OCA N$^{o.}$2 modify the junction to existing topography to moderate the edge and reduce the straightness on the bund. This can be achieved by filling to match the existing contours and creating a more natural transition from existing ground levels where saddles and ridges exist;

- When a land access agreement is reached with the land owner plant an advanced tree screen (5-6 rows deep) around the proposed open cut facilities area for OCA N$^{o.}$3. This will form a screen to viewers in the east and along Moolarben Road when operations commence in this area;
- Consider re-contouring or increasing density of vegetation of rehabilitated bench areas in OCA N$^{o.}$1, 2 and 3 to reduce the apparent flatness of the benches long term. This reduces potential long term impacts when viewed from elevated locations. This is particularly relevant for OCA N$^{o.}$3 where long term development or users in Munghorn Gap Nature Reserve may overlook the final rehabilitation from viewing locations around RL 500 to RL 600; and
- Implement a revegetation strategy for each rehabilitation area to mirror the existing vegetation removed from the rehabilitated areas.

5.7 Night Lighting Impacts

The night lighting impacts for the Moolarben Coal Project fall into two parts

- Direct lighting effects; and
- Sky glow

5.7.1 Direct Lighting Effects

The potential direct lighting impacts from the various pits of the OCA and pre-stripping would be visible from a range of viewing points.

Viewpoints and surrounding areas that will be impacted by direct lighting effect at various parts of the life of the open cut areas are assessed in **Table 5.2** below. Generally the impacts will reduce with distance from the viewer.

The impacts will vary greatly with time depending on the working sequences and emplacement locations. Impacts are likely to be progressive across the landscape following the working areas.

Most impacts will be intermittent in duration. For example, emplacement may occur in an area for 1-2 months each night depending on weather conditions and then move on to another adjacent location. The degree of impact will vary depending on screening, elevation and distance from each potential viewer.

Generally areas that can view the works of the open cut pits and OEM will be affected by direct lighting at various stages of the work.

The direct lighting impacts of the infrastructure and rail loop areas will be visible from areas to the north of the Study Area, Ulan village, along Ulan-Cassilis Road and adjacent residences. The likely effects of these impacts are shown by viewpoints 1-4 in **Table 5.2** below.

Impacts for other viewpoints from 5 to 8 are reduced by the distance from the viewer. The individual sensitivity of each viewer will determine the degree of impact. In some cases when viewed from distances greater then 6 or 7km the night views of the infrastructure could be considered to enhance the landscape with a group of small distant twinkling lights.

The impact will vary in intensity depending on positions and working level within the OCA.

A continuing effect will be created by the lighting of the infrastructure and coal handling areas.

5.7.2 Sky Glow

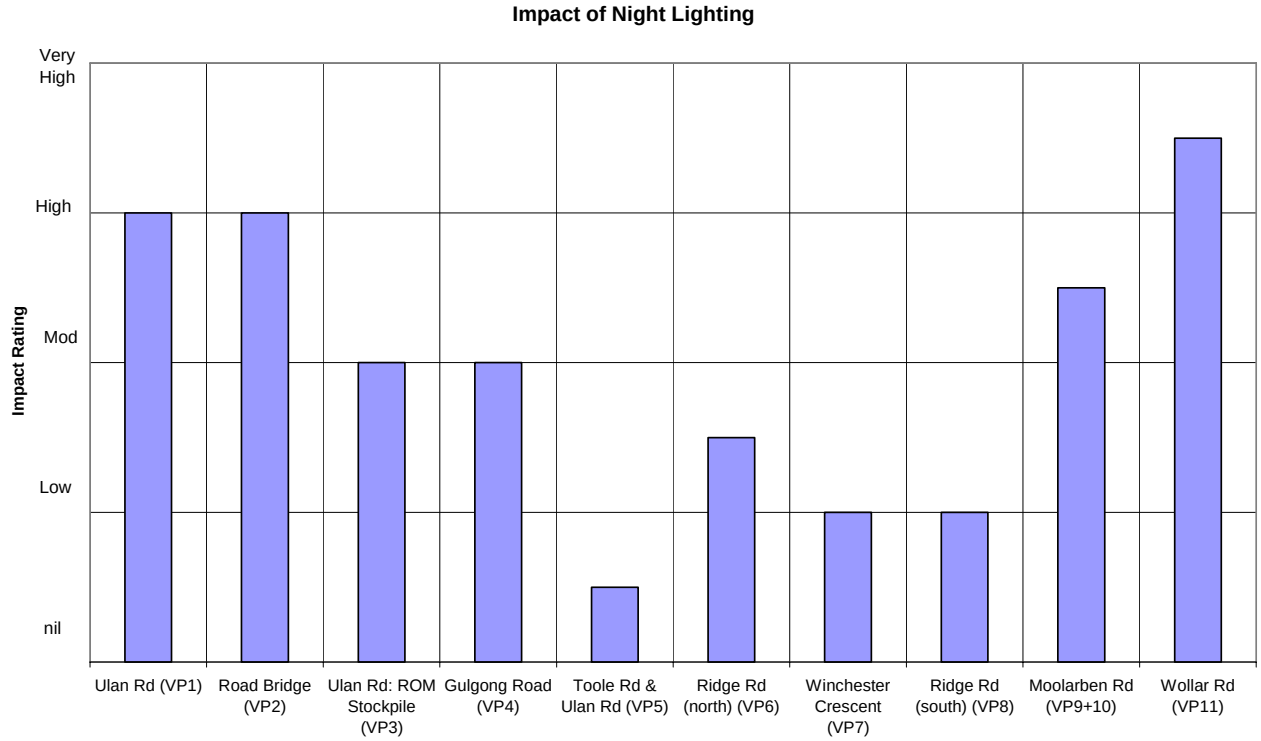
The sky glow component of the night lighting impact is most severe when there is a solid low cloud cover. At that time light reflects off the clouds creating the sky glow effect.

Shielding lighting with hoods and louvers would significantly reduce sky glow. Further the use of low brightness lights in the infrastructure area with horizontal floodlight bodies and sharp cut off angles can also reduce stray light. Because of the location of the mine and the dark background levels of luminance it will be impossible to completely reduce the sky glow impacts. On a cloudy

night the sky above the infrastructure area and working areas of the OCA will glow with a soft reflected light.

An analysis of the visual impact of the Infrastructure areas, open cuts and both the in the pit and out of pit emplacement areas is shown below in **Figure 5.7** .

Figure 5.7
Night Lighting Impact



5.8 Mitigation Measures (Night Lighting)

The measures that could be taken by Moolarben Coal Mines Pty Ltd to mitigate adverse night lighting impacts are as follows:

- Within the infrastructure areas use approximately 15 metre high light columns and low brightness floodlights with the floodlight body horizontal and the floodlight reflector designed to provide sharp cut-off and restrict stray light.;
- Use wall mounted lights with horizontal bodies and low brightness design to light areas around the workshop and CHPP to 50 lux and adjacent portions of the hard stand area to 10 lux;
- Shield all floodlights in the open cut area to the maximum extent practicable;
- Face workshop doors east to reduce light spill;
- Where safe to do so, trucks on access roads would make use of portable visual edge markers to increase drivers' visibility of road edges when driving with dipped headlamps;
- Lighting should be screened to viewers were possible but lighting must always be selectedto meet safe working practices.

5.9 Summary

A review of the visual impacts of the project reveals that viewpoints around the main infrastructure area are significantly impacted throughout the life of the mine. These viewpoints will be affected by the works in OCA 1 and the main infrastructure area. A large proportion of the impact identified in

this report and related to the location of the main infrastructure was assessed and previously approved as part of Underground No. 4 in 1985. Our report provides some recommendations to ameliorate these impacts. These impacts are however not viewed in isolation as they are adjacent to the existing Ulan Coal Mine and viewed within that context.

For viewing points located further south and into the rural residential areas impacts are significantly lower and of shorter duration. These impacts are primarily ameliorated by distance.

A key point of difference to other proposed coal mining operations assessed by our company in the Hunter Valley area is the shorter proposed mine working period of the open cuts of approximately 10 -11 years. This of course depends on weather, market factors and extraction sequences but the shorter proposed mine life assists in limiting the duration of impacts of the open cut and emplacement areas. This should assist in reducing overall viewer sensitivity to the extraction works.

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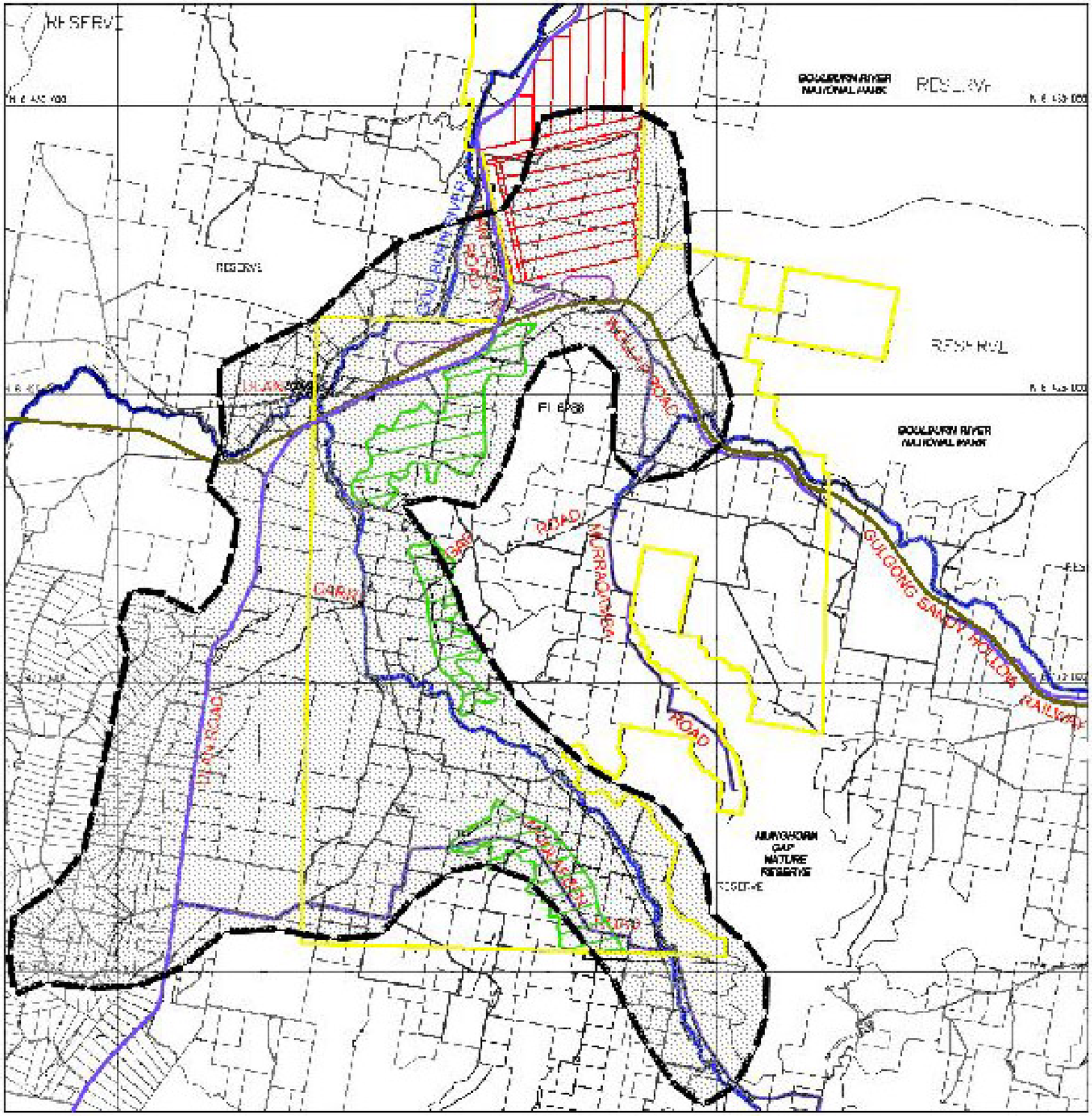


O'HANLON DESIGN
Pty Limited

LANDSCAPE ARCHITECTS

60 Gladesville Road Hunters Hill NSW 2110
Tel: 9816 5883 Fax: 9816 4179 email: qoh@qoh.net.au

Moolarben Coal Project

Visual Study

LEGEND

- Study Area
- Licence Area
- Existing Railway Line
- Proposed Rail Loop
- Proposed Open Cut - Affectation Area

DRAWING TITLE

Study Area

DRAWING NUMBER

DRAWING 01

DRAWING NUMBER

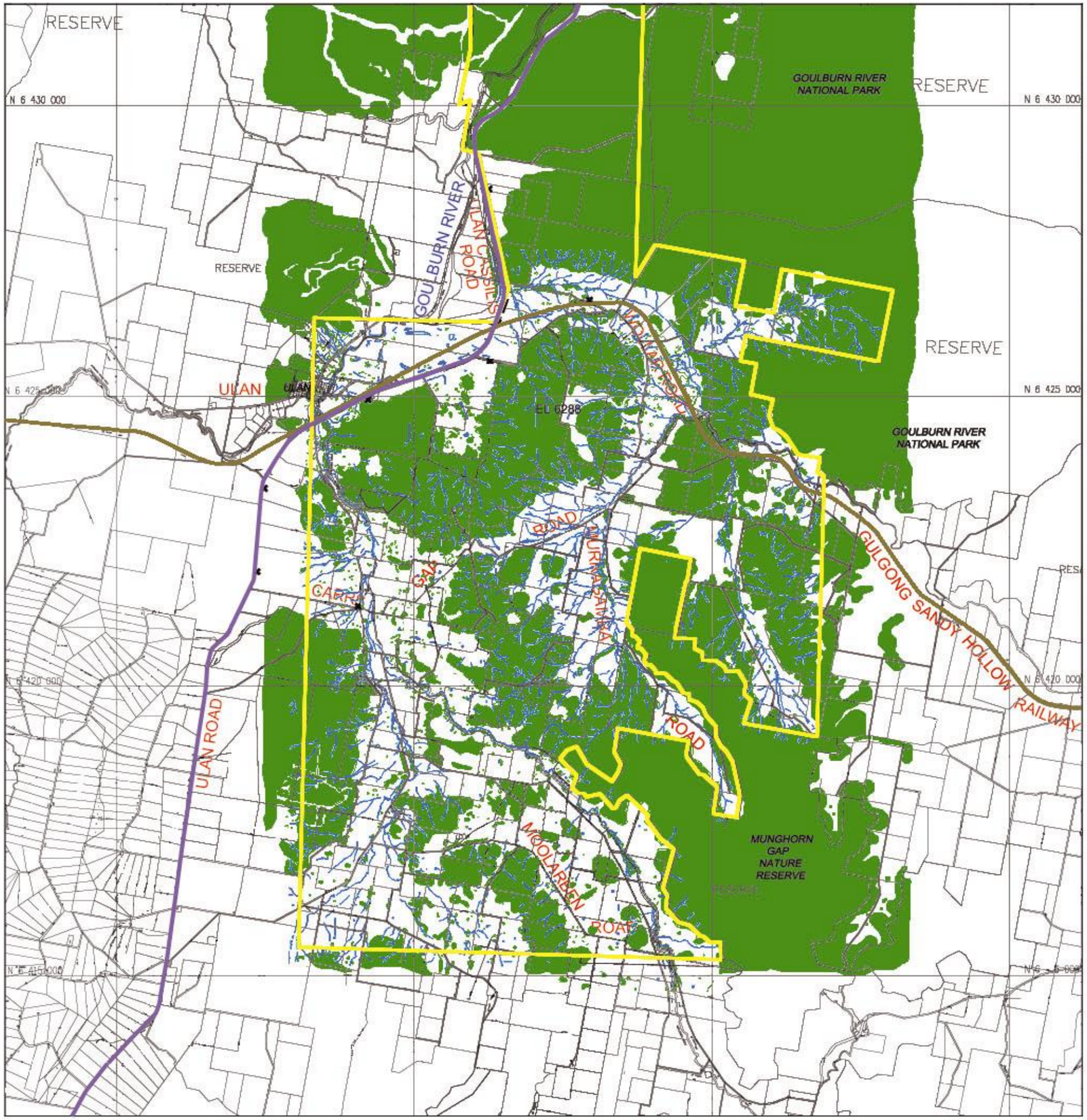
762 -01- B

DRAWN: DC/JPA

DATE: MAY 2006

NORTH

DATE	REVISION	ISSUE
03/05/2006	Final Issue	B
10/11/2005	Draft Issue	A



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Pty Limited
LANDSCAPE ARCHITECTS
60 Gladesville Road Hunters Hill NSW 2110
Tel: 9816 5883 Fax: 9816 4179 email: ohl@ohl.net.au

Moolarben Coal Project

Visual Study

LEGEND

- Licence Area
- Natural Vegetation
- Water Bodies

DRAWING TITLE

Water/Vegetation

DRAWING NUMBER

DRAWING 02

DRAWING NUMBER

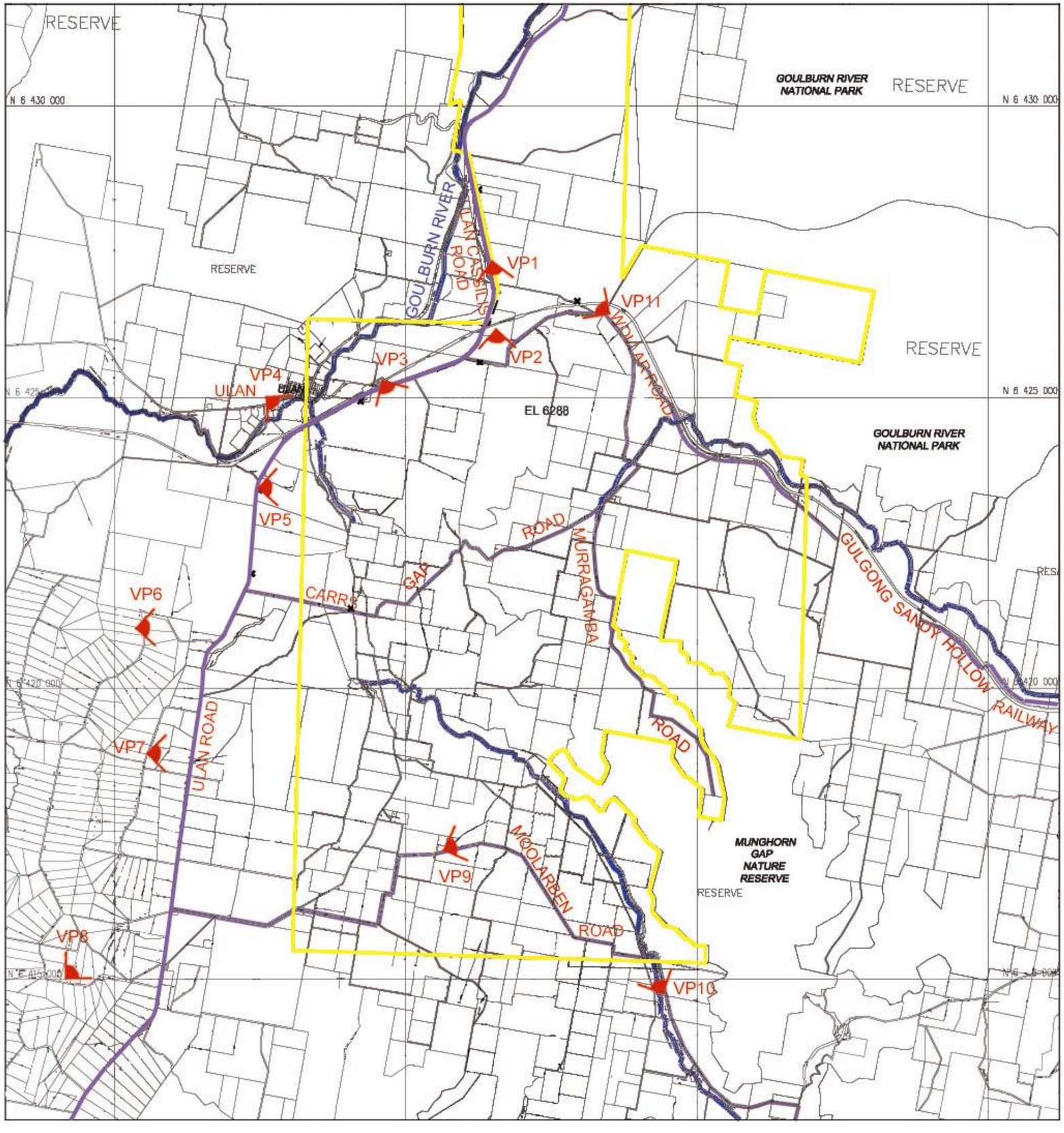
762 -02- B

DRAWN: DC/JPA

DATE: MAY 2006

NORTH

DATE	REVISION	ISSUE
03/05/2006	Final issue	B
11/11/2005	Draft issue	A



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LANDSCAPE ARCHITECTS
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Moolarben Coal Project

Visual Study

LEGEND

- Licence Area
- View Point Locations
- Railway
- Roads
- Rivers & Creeks

DRAWING TITLE

View Points

DRAWING NUMBER

DRAWING 03

DRAWING NUMBER

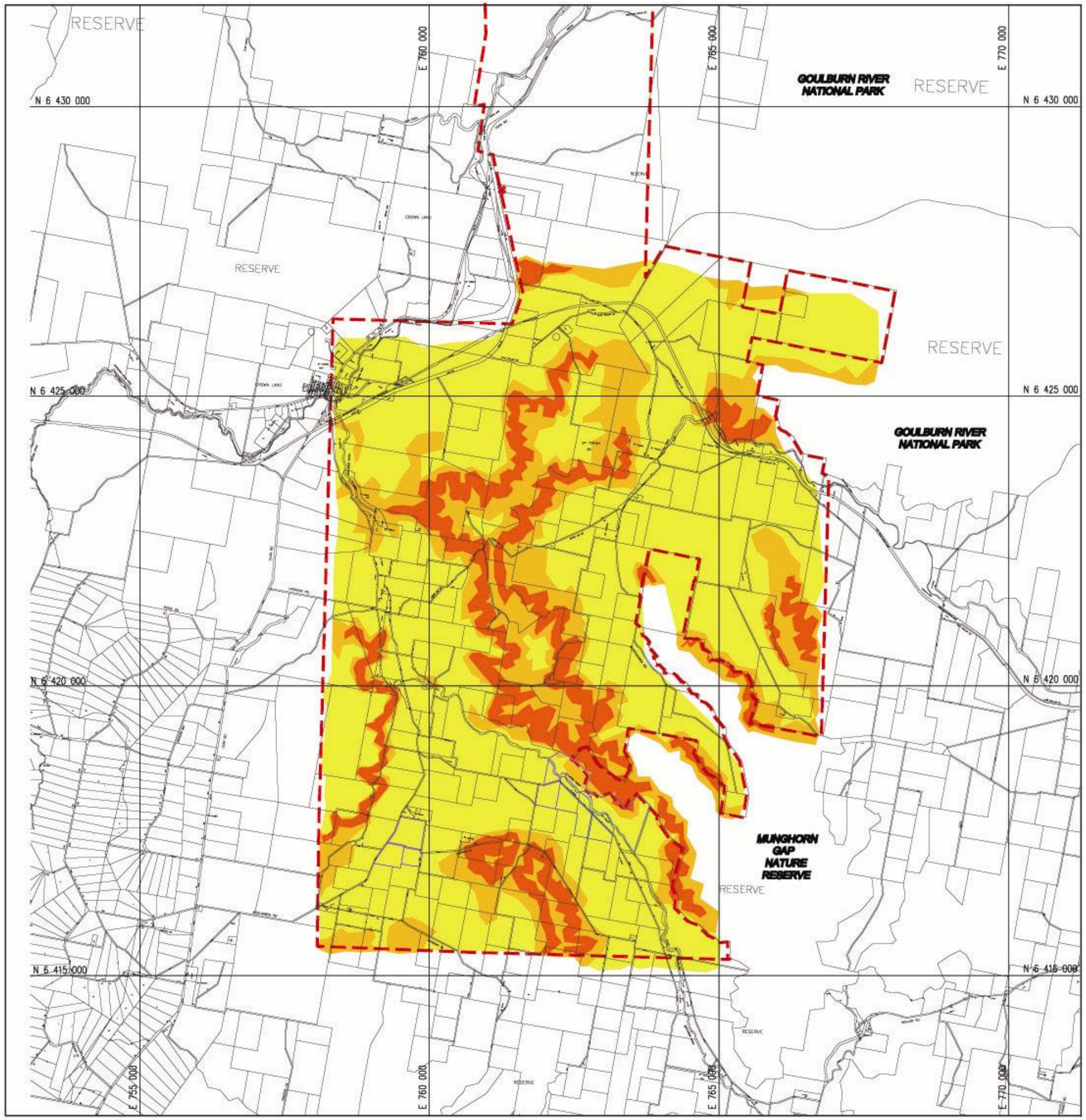
762 -03- B

DRAWN: DCJ/PA

DATE: MAY 2006

NORTH

DATE	REVISION	ISSUE
03/05/2006	Final Issue	B
11/11/2005	Draft Issue	A



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Moolarben Coal Project

Visual Study

LEGEND

- Licence Area
- 0% - 10% Slope
- 10% - 30% Slope
- 30% >50% Slope

DRAWING TITLE

Slope Analysis

DRAWING NUMBER

DRAWING 04

DRAWING NUMBER

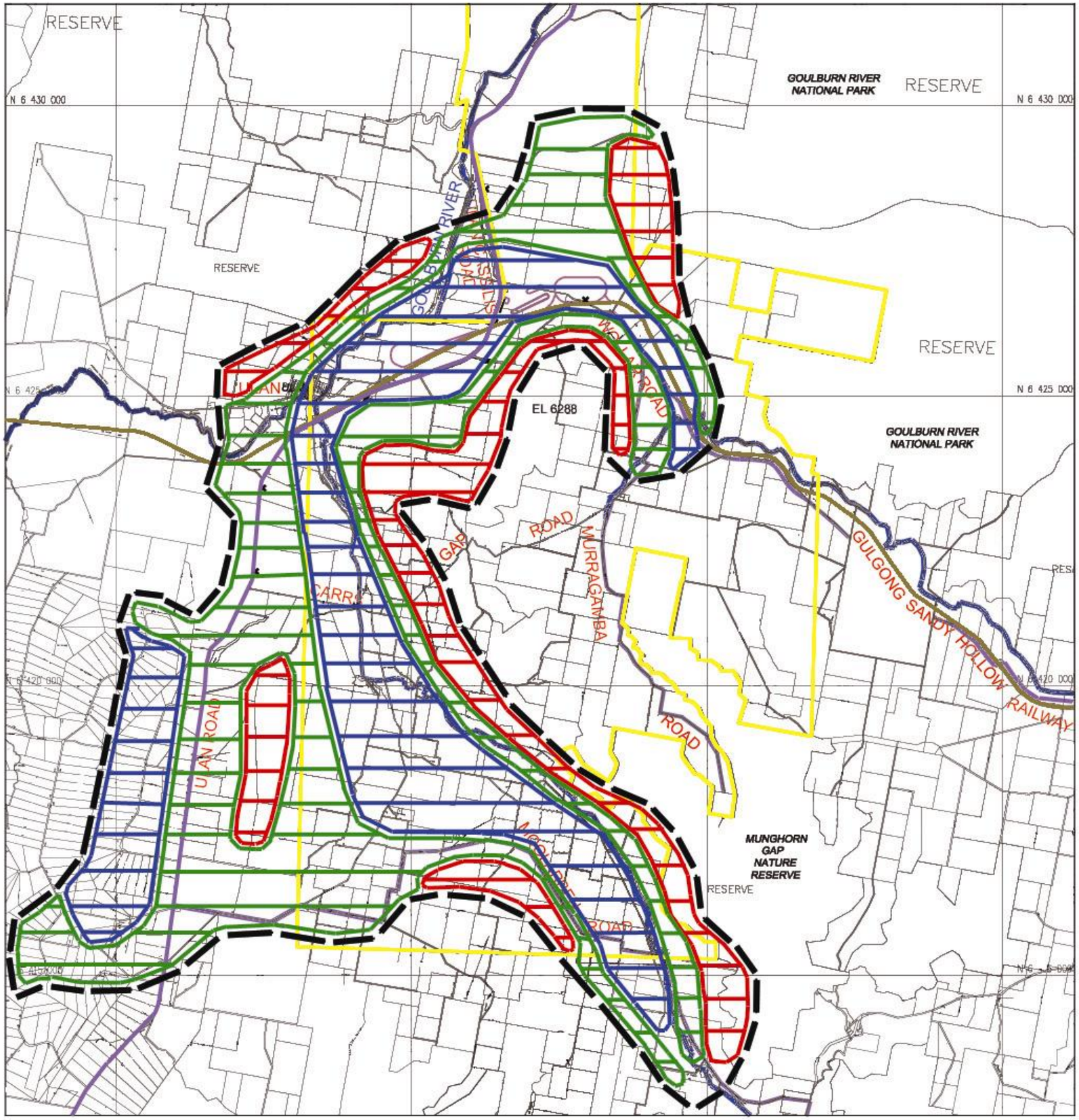
762 -04- B

DRAWN: DC/JPA

DATE: MAY 2006

NORTH

DATE	REVISION	ISSUE
09/05/2006	Final Issue	B
10/11/2005	Draft Issue	A



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Pty Limited

LANDSCAPE ARCHITECTS

60 Gladesville Road Hunters Hill NSW 2110
Tel: 9816 5883 Fax: 9816 4179 email: qoh@qoh.net.au

Moolarben Coal Project

Visual Study

LEGEND

- Study Area
- Licence Area
- Existing Rail Loop
- Proposed Rail Loop
- High Scenic Quality
- Moderate Scenic Quality
- Low/Moderate Scenic Quality

DRAWING TITLE
Scenic Quality Assessment

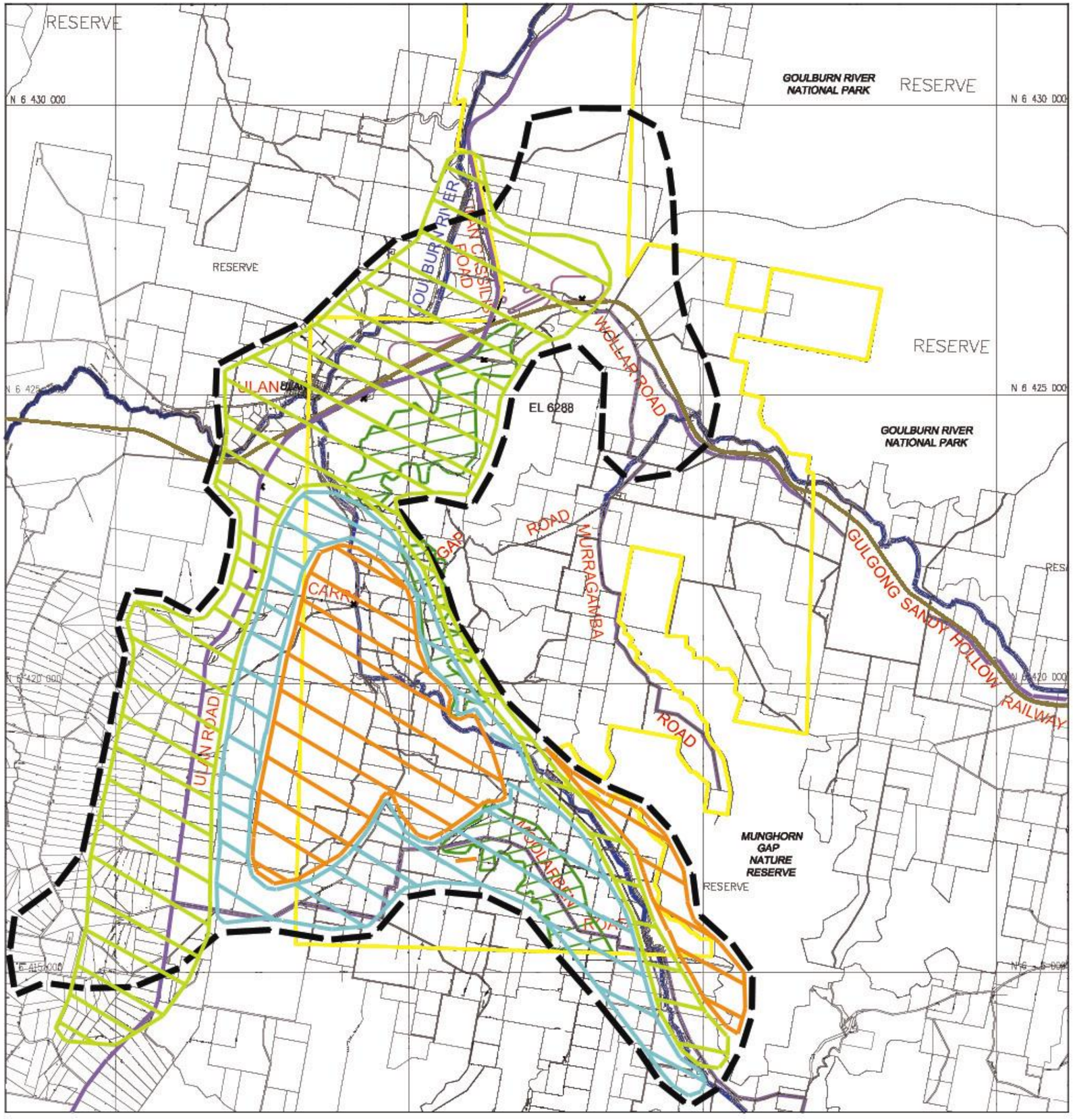
DRAWING NUMBER
DRAWING 05

DRAWING NUMBER
762 -05- B

DRAWN: *DG/JPA*
DATE: *MAY 2006*

NORTH

DATE	REVISION	ISSUE
09/05/2006	Final Issue	B
11/11/2005	Draft Issue	A



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Pty Limited
LANDSCAPE ARCHITECTS
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Tel: 9816 5883 Fax: 9816 4179 email: oph@ozemail.com.au

Moolarben Coal Project
Visual Study

LEGEND

- Study Area
- Licence Area
- Existing Rail Loop
- Proposed Rail Loop
- Zone of High Concern
- Zone of Moderate Concern
- Zone of Low Concern

DRAWING TITLE
Landscape Management Zones

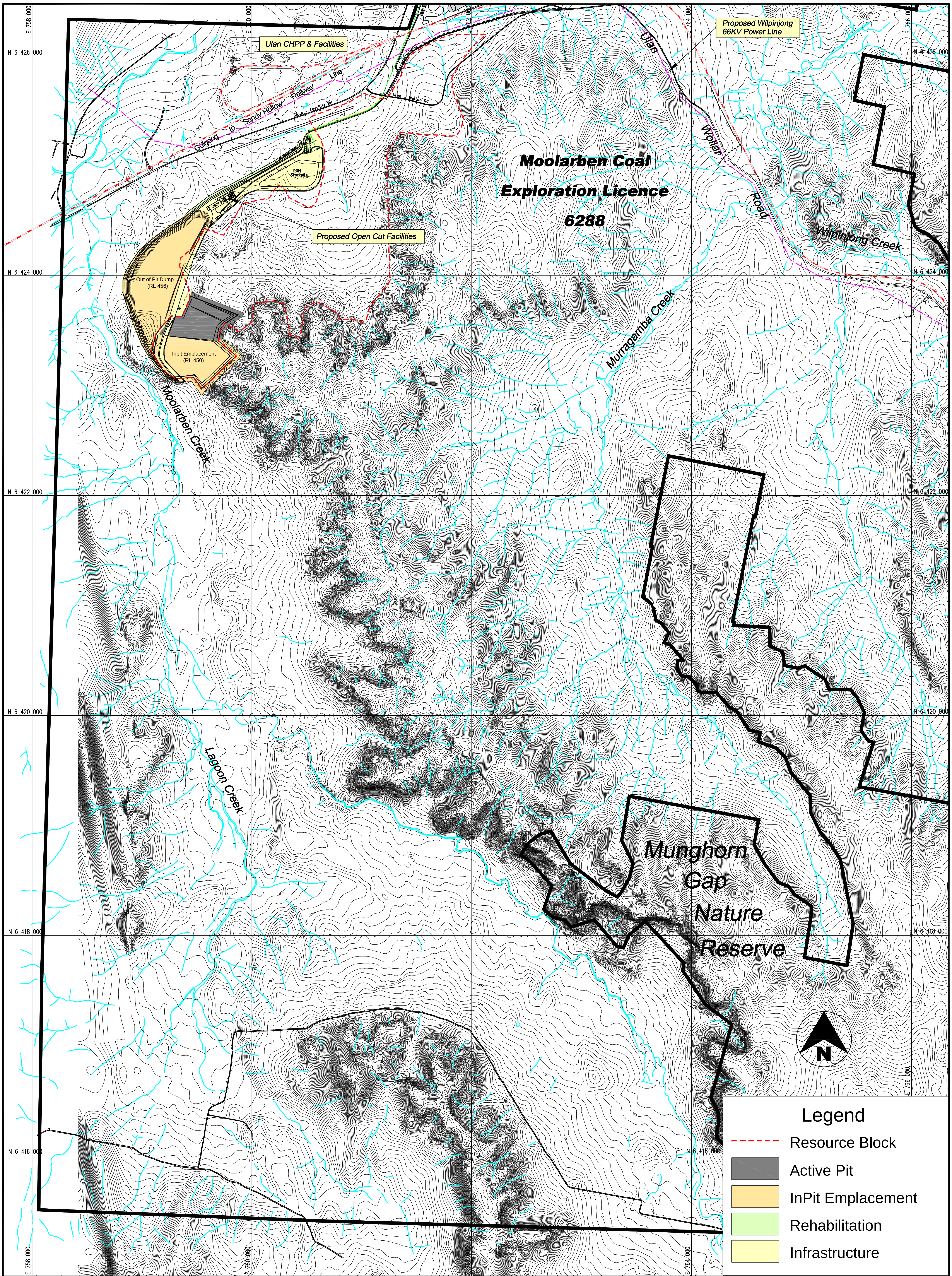
DRAWING NUMBER
DRAWING 06

DRAWING NUMBER
762 -06- B

DRAWN: DC/JPA
DATE: MAY 2006
NORTH

DATE	REVISION	ISSUE
03/05/2006	final issue	B
11/11/2005	draft issue	A

Appendix A



Revision			
Rev.	Drawn	Description	Approved

Moolarben Coal Mines Pty Limited
ABN 82 108 601 672
Level 14 213 Miller Street
North Sydney NSW 2060
Phone: 02 9922 3777
Fax: 02 9923 2427
Prepared by Co-Resources Pty Ltd Ph: 02 65 718888

Moolarben Coal Project
Proposed Mining Sequence Plan
6 Months

Drawing No.	Revision No.	Date	Scale:	Drawn	Checked	Approved	Sheet Size
01489	A	21.04.06	1:15000	CS	JF	Aw	A1

E 758 000
E 760 000
E 762 000
E 764 000
E 766 000
N 6 426 000
N 6 424 000
N 6 422 000
N 6 420 000
N 6 418 000
N 6 416 000

Ulan CHPP & Facilities

Proposed Wilpinjong 66KV Power Line

Ulan

Wollar

Road

Gulgong to Sandy Hollow Railway Line

Ulan Coggan Rd

Ulan Wollar Rd

ROM Stockpile

Moolarben Coal

Exploration Licence

6288

Proposed Open Cut Facilities

Inpit Emplacement (RL 460)

Rehabilitation

Wilpinjong Creek

Murragamba Creek

Moolarben Creek

Lagoon Creek

Munghorn Gap Nature Reserve

N

Legend

- Resource Block
- Active Pit
- InPit Emplacement
- Rehabilitation
- Infrastructure

Revision				
Rev.	Drawn	Description	Approved	

Moolarben Coal Mines Pty Limited
ABN 82 108 601 672
Level 14 213 Miller Street Phone: 02 9922 3777
North Sydney NSW 2060 Fax: 02 9923 2427
Prepared by Co-Resources Pty Ltd Ph: 02 65 718888

Moolarben Coal Project
Proposed Mining Sequence Plan
Year 2

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Revision No. A
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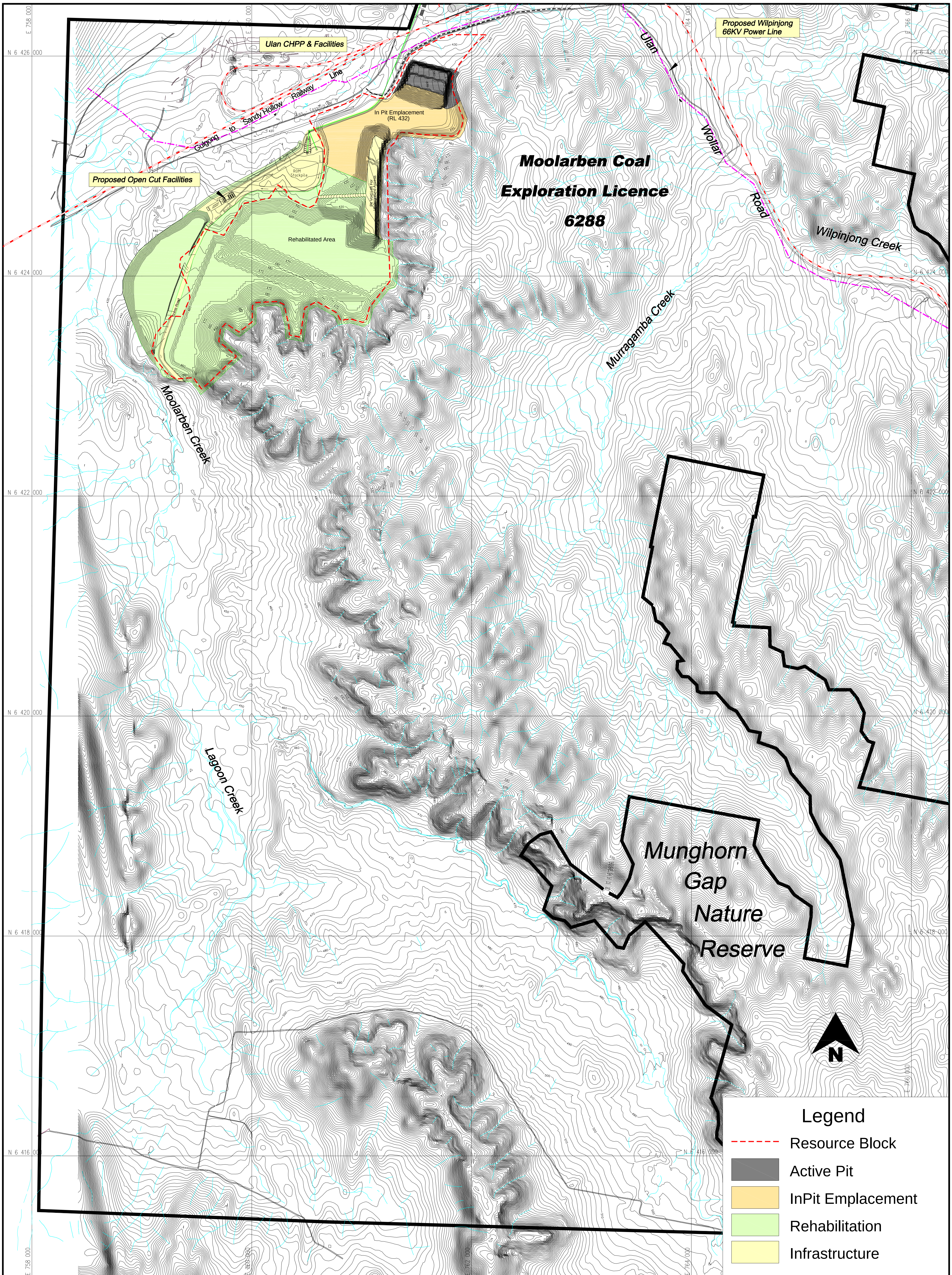

Rev.	Drawn	Description	Approved

Revision

Moolarben Coal Mines Pty Limited
ABN 82 108 601 672
Level 14 213 Miller Street
North Sydney NSW 2060
Phone: 02 9922 3777
Fax: 02 9923 2427
Prepared by Co-Resources Pty Ltd Ph: 02 65 718888

Moolarben Coal Project
Proposed Mining Sequence Plan
Year 5

Date	Scale:	Drawn	Checked	Approved	Sheet Size
21.04.06	1:15000	CS	JF	Aw	A1

Drawing No. 01491
Revision No. A

Ulan CHPP & Facilities

Proposed Wilpinjong 66KV Power Line

Proposed Open Cut Facilities

Moolarben Coal

Exploration Licence

6288

Rehabilitated Area

Rehabilitated Area

Rehabilitated Area

Inpit Emplacement (RL 466)

Out of Pit Emplacement

Proposed Open Cut 3 Facilities

Preferred Moolarben Rd Diversion

Munghorn Gap Nature Reserve

Ulan Road

Wollar Road

Wilpinjong Creek

Murragamba Creek

Moolarben Creek

Lagoon Creek

Gulgong to Sandy Hollow Railway Line

ROM Stockpile

E 758 000

E 760 000

E 762 000

E 764 000

E 766 000

N 6 426 000

N 6 424 000

N 6 422 000

N 6 420 000

N 6 418 000

N 6 416 000

N

Legend

- Resource Block
- Active Pit
- InPit Emplacement
- Rehabilitation
- Infrastructure

Revision				
Rev.	Drawn	Description		Approved

Moolarben Coal Mines Pty Limited
ABN 82 108 601 672
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Moolarben Coal Project
Proposed Mining Sequence Plan
Year 8

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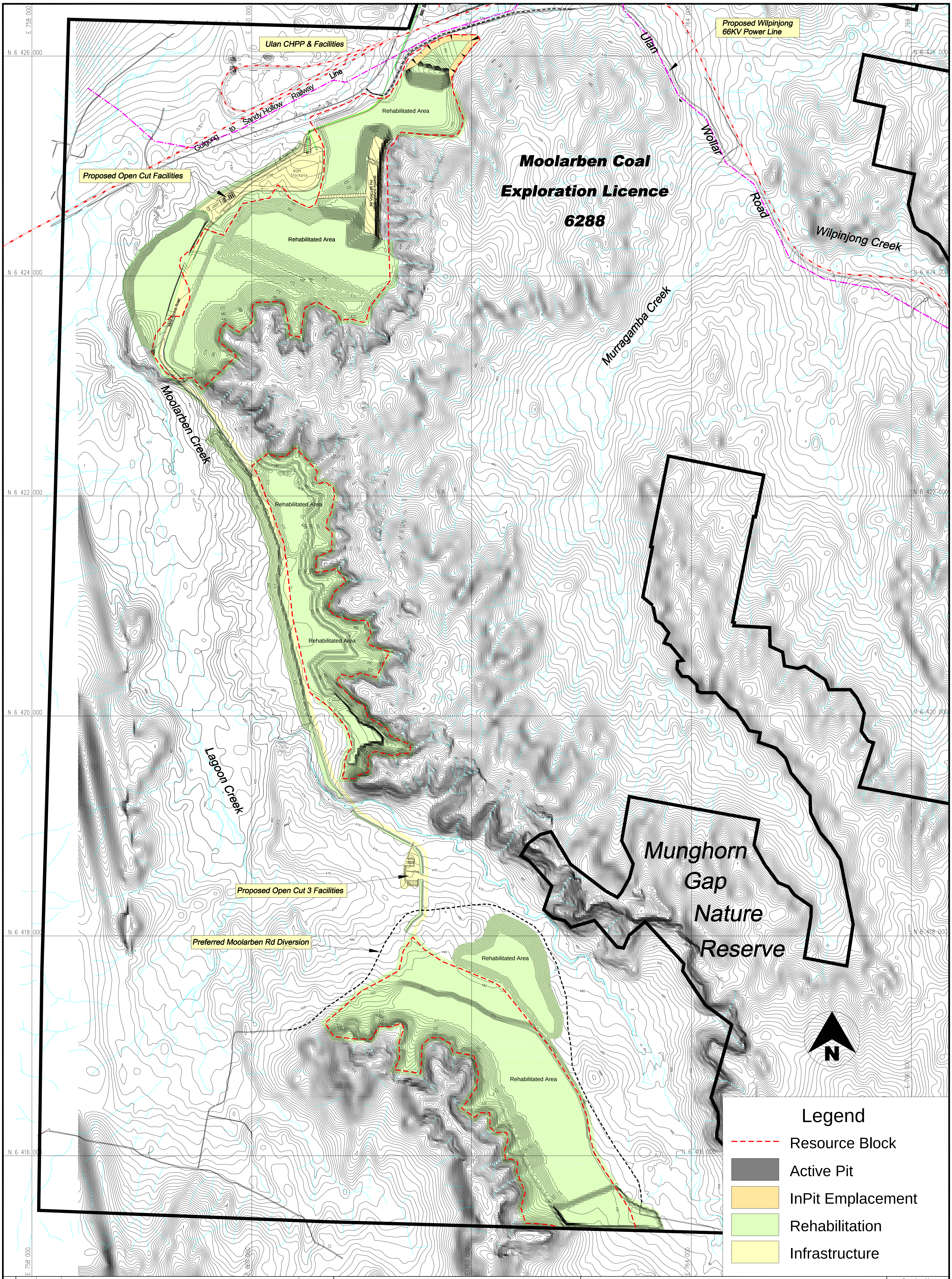

Rev.	Drawn	Description	Approved

Revision

Moolarben Coal Mines Pty Limited
ABN 82 108 601 672

Level 14 213 Miller Street Phone: 02 9922 3777
North Sydney NSW 2060 Fax: 02 9923 2427

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Moolarben Coal Project
Proposed Mining Sequence Plan
Year 10

Date	Scale:	Drawn	Checked	Approved	Sheet Size
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Revision No. A