APPENDIX O

Visual assessment

Cobbora Holding Company Pty Limited

EMM
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Visual assessment

Cobbora Coal Project

Prepared for Cobbora Holding Company Pty Limited | 17 September 2012

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Visual assessment

Final

Report J11030RP16 | Prepared for Cobbora Holding Company Pty Limited | 17 September 2012

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Executive Summary

EMGA Mitchell McLennan prepared a qualitative visual and lighting impact assessment for the Project. It assessed the likely visual impacts of the project on the surrounding private residences and public roads.

The visual and lighting impact assessment analysed likely visual impacts of the Project from 11 viewpoints in and around the PAA. These viewpoints were chosen as representative likely impacts of the Project on users of the areas surrounding the Project.

It was found that without mitigation, overburden emplacement areas, mine infrastructure, mine pits and lighting would be visible from different viewpoints to varying degrees at various stages of the mine life.

A range of measures will be incorporated into the Project during construction and operations to minimise visual impacts of the Project on surrounding viewers. These mitigation measures include planting vegetation to screen infrastructure and operational elements of the mine, accelerated rehabilitation of overburden emplacement areas, camouflage of mine infrastructure and operational/lighting management protocols to minimise light spill and sky glow associated with mining activities. CHC has already minimised potential impacts of the Project by acquiring properties where visual impacts will be significant, and is committed to entering into amenity agreements in other instances where this is the landholder's preference.

The Project is not predicted to significantly impact the visual amenity of the area.

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Acronyms

ABS	Australian Bureau of Statistics
AC – OOP	Mine Area A and C – Out of Pit emplacements
B – OOP E	Mine Area B – Out of Pit emplacement (east of Laheys Creek)
B – OOP W	Mine Area B – Out of Pit emplacement (west of Laheys Creek)
CHC	Cobbora Holding Company Pty Limited
CHPP	Coal Handling and Preparation Plant
DGRs	Director General's environmental assessment requirements
DoP	Department of Planning (now known as Department of Planning and Infrastructure NSW)
DP&I	Department of Planning and Infrastructure NSW
EA	Environmental assessment
EMM	EMGA Mitchell McLennan
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
ID No.s	Identification Numbers
km	kilometre
LEP	Local Environment Plan
LGA	Local Government Area
Mtpa	Million tonnes per annum
RL	Reduced Level
ROM	Run of mine
MIA	Mine Infrastructure Area
The Project	Cobbora Coal Project
VIA	Visual and Lighting Impact Assessment
VP	Viewpoint

1 Introduction

1.1 Cobbora Coal Project overview

The Cobbora Coal Project (the Project) is a new open cut coal mine proposed by the Cobbora Holding Company Pty Limited (CHC). The mine will supply thermal coal primarily to power stations in NSW. Some coal may be transported to the Port of Newcastle for export. The Project is located approximately 5 km south of Cobbora, 22 km south-west of Dunedoo, 64 km north-west of Mudgee and 60 km east of Dubbo in the central west of NSW. The regional and local context of the Project is shown in Figures 1.1 and 1.2.

The Project will include an open cut coal mine, a coal handling and preparation plant, mine infrastructure area, coal stockpiling and train loading facility. Associated infrastructure will include a rail spur line, water supply pipeline, pumping station, access roads, power lines and an electricity substation. Construction is planned to commence in mid-2013. Mine operations will start in the first half of 2015. A mine life of 21 years is proposed.

A Major Project application under Part 3A of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act) was submitted to the NSW Department of Planning on 5 January 2010 (application number MP 10_0001). The Director General's environmental assessment requirements (DGRs) for the Project were issued on 4 March 2010. Revised DGRs were issued for the Project on 23 December 2011 in response to changes in the proposed Project and government assessment requirements.

1.2 Purpose of the report

The purpose of this visual and lighting assessment is to determine the impact of the Project on the landscape in which it is to be sited. This report provides an assessment of the visual changes that will result from the Project, the impact of those changes and the ability of the landscape to absorb them, as well as measures to mitigate impacts. Where the impact of the proposal is assessed to be significant, the report provides measures to mitigate the impact on receptors.

The report addresses relevant DGRs for the Project as summarised in Table 1.1.

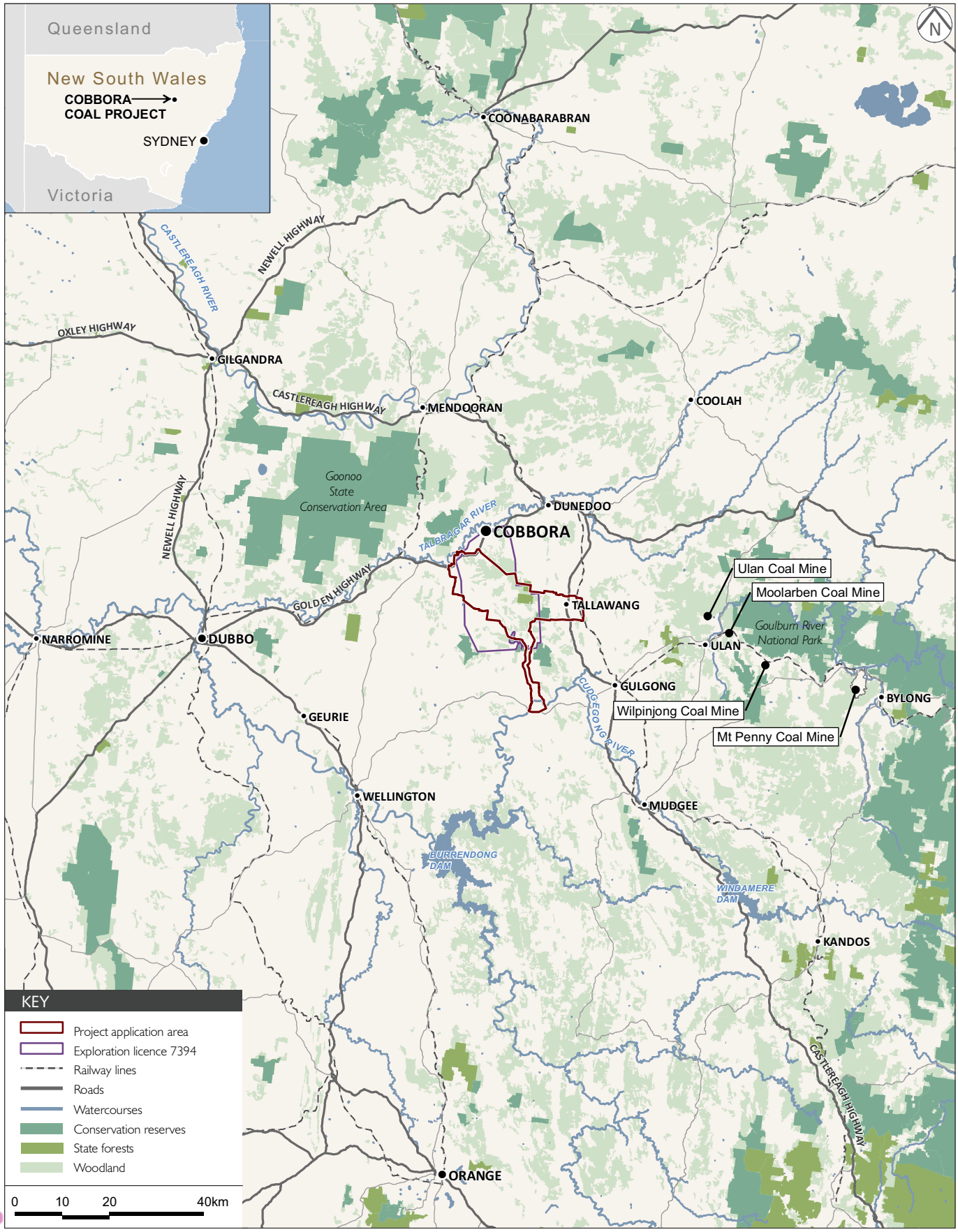
Table 1.1 DGRs for visual assessment

Requirement	Report section
"Visual – including:	
• *a detailed assessment of the:* *changing landforms on the site during the various stages of the Project;*	Section 4.2
• *potential visual impacts of the Project on the private landowners in the surrounding area as well as key vantage points in the public domain, including lighting impacts; and*	Section 5.1
• *a detailed description of the measures that would be implemented to minimise the visual impacts of the Project.*	Chapter 6

1.3 Structure of the report

This report is structured as follows:

- Chapter 2 provides an outline of the visual impact methodology used in the preparation of this report;
- Chapter 3 describes the existing landscape within which the Project will be sited;
- Chapter 4 describes the visual character of the components of the Project, the stages of the Project and the impact it has on the changing landforms;
- Chapter 5 describes the impacts of the Project from representative viewpoints in and around the Project area;
- Chapter 6 provides measures to mitigate visual impacts of the Project; and
- Chapter 7 provides conclusions.



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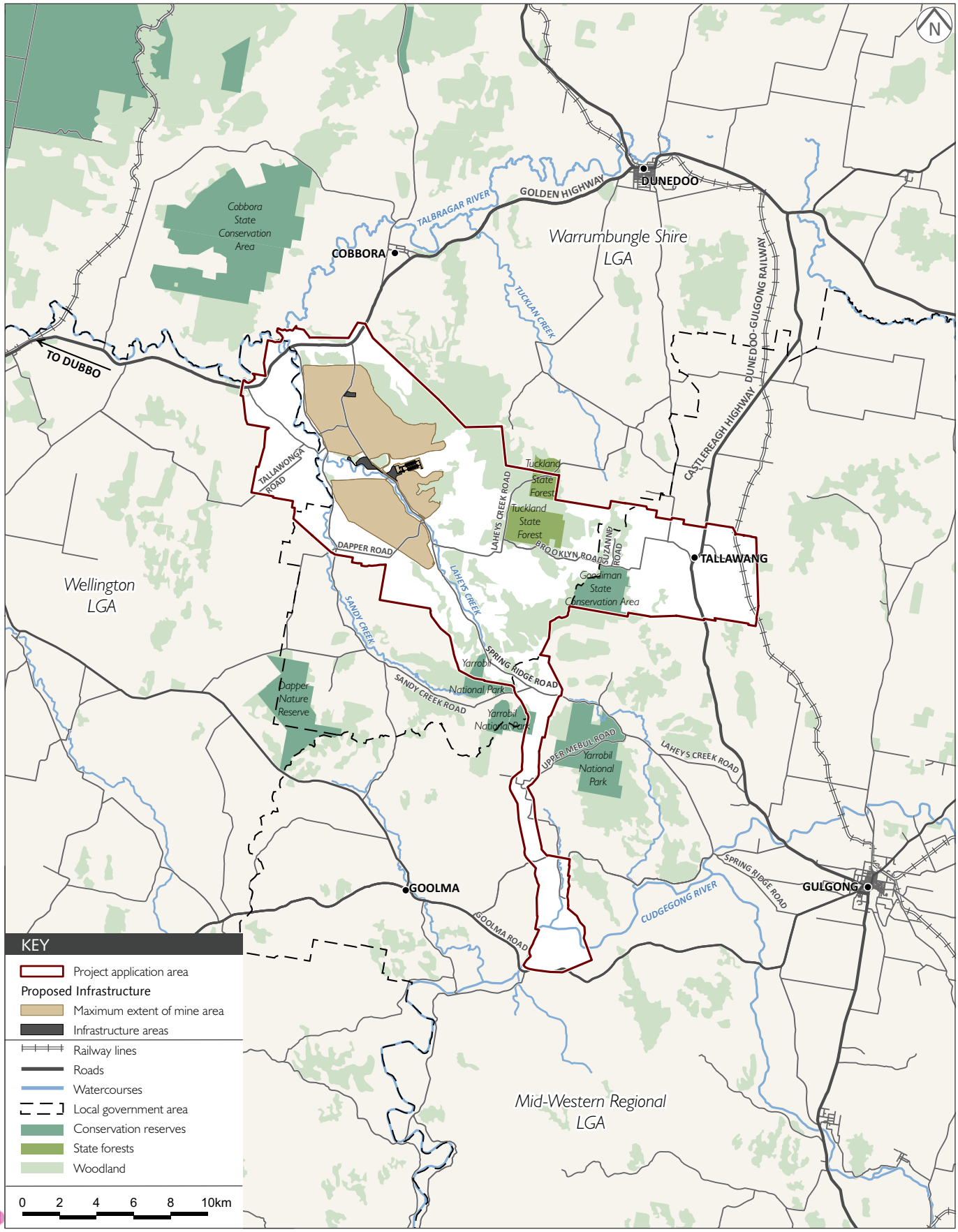
Regional Context

Cobbora Coal Project - Visual Assessment

Figure 1.1



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Local Context

Cobbora Coal Project - Visual Assessment

Figure 1.2

2 Visual impact method

2.1 Outline

The visual assessment for the Project is based on a qualitative analysis of private and public receptors, where views of the Project may result in visual impacts, or are considered to be representative of views of mining activities at the site.

The visual assessment process included:

- a desktop analysis to determine viewpoints that are representative of a range of landscape characters and are likely to be visually impacted;
- a site survey with a line of site analysis at each viewpoint to assess the view type and context, and to determine visual sensitivity;
- an assessment of the significance of the visual impact at each of the identified viewpoints; and
- identification of mitigation measures to minimise visual impacts of the Project.

2.1.1 Selection of representative viewpoints

A total of 16 representative viewpoints were selected based on an initial view-shed analysis. Viewpoints were selected to provide a representative sample of the likely impacts on the different users of the areas surrounding the site and their visual exposure to various mine elements. Viewpoints that were considered to have potential exposure to various mine elements or areas available to public access such as main roadways and other unsealed rural roads were selected for detailed assessment.

2.1.2 Site survey

Following the desktop analysis, a site survey was undertaken on Wednesday 26th and Thursday 27th October, 2011. From the site assessment undertaken, 11 viewpoints were selected as having direct visual impact of varying degrees from the Project based on a line of sight analysis.

2.1.3 Viewpoint photomontages

Following desktop analysis, site survey and viewpoint analysis, four receptors were chosen to have photomontages prepared. These four locations were chosen based on the assessment that they were considered to have the greatest potential visual impact due to exposure to active waste rock emplacements, open cut pits or other mine infrastructure. Additionally, these locations are representative of likely visual impact to surrounding private residential landowners or potential exposure to the Project for motorists travelling in the vicinity of the mine.

2.2 Viewpoint assessment methodology

2.2.1 View type and context

View type and context describes the existing landscape character, the built environment, topography and screening provided by vegetation or other elements. The context is a primary factor in the visual sensitivity of the view. Generally sites within higher contrasting landscapes have greater ability to absorb change, whereas sites within a uniform or highly ordered landscape have lower sensitivity.

2.2.2 Magnitude of change

The magnitude of change on the visual landscape is one factor in determining the significance of visual impacts of the Proposal. In accordance with The Landscape Institute of Environmental Management and Assessment: *Guidelines for Landscape and Visual Impact Assessment,* this visual assessment has considered the following criteria in determining the magnitude of change on a receptor:

- whether the impact is temporal or permanent – impacts that are for a limited duration are considered less significant than those which occur for an extended period or are permanent;
- scale of change – the loss or addition of features in the view and changes in the proportion of the view affected by the proposal;
- degree of contrast – level of integration of new features with existing or remaining landscape elements, having regard to form, scale, height, colour, and texture;
- distance of the viewer from the altered elements in the landscape – close proximity to an altered landscape will increase the significance for private residences. In the case of motorists, mid ground changes can be greater than foreground elements as they can result in longer viewing times;
- viewing direction – whether the change is to the primary view from the receptor;
- extent of view affected – impacts that are visible over a greater portion of a view are more significant than those where only a part of the view is impacted. Intervening topography and vegetation will also affect the magnitude of change; and
- length of viewing time – views from a residence are constant whereas some views from roadways as experienced by motorists may be brief dependent upon speed and viewing direction.

2.2.3 Visual sensitivity

Visual sensitivity is a measure of the landscape's ability to absorb development without a significant change in the character. It is a function of the view type and context. In this assessment, the major factor influencing visual sensitivity is the level of contrast between the mining activities and the rural landscape setting in which they sit.

Visual sensitivity is rated on a scale of high to low. The physical characteristics of the landscape, including existing development features, are integral components in determining the visual sensitivity. For example, a low visual sensitivity would enable a modification or addition to be made to the landscape which would only cause minimal contrast and result in a high level of integration with the surrounding landscape. Similarly, a high visual sensitivity would mean the same modification or addition to the surrounding landscape which would cause high contrast to the surrounding landscape.

In accordance with The Landscape Institute of Environmental Management and Assessment*: Guidelines for Landscape and Visual Impact Assessment*, the visual sensitivity of a receptor has been assessed based on the following criteria:

- importance of the view – changes to views from private residents or main tourist roads are considered more sensitive than from secondary roads;
- receptor viewer expectation – communities where development results in changes in the landscape setting or valued views; and
- location and context of the viewpoint – natural and modified elements that make up the visual landscape and contribute to the composition, and hence sensitivity of a viewscape.

2.2.4 Evaluation of significance

The significance of a change in the landscape is a function of the magnitude of that change when considered against the view type/context and the sensitivity of a receptor. Typically, a noticeable change in the landscape in an unmodified rural or natural landscape would be considered to be significant, whereas a change in an already heavily modified landscape be considered slight or moderate.

Table 2.1 illustrates how the magnitude of a change in the landscape is assessed, and its significance rated, against the sensitivity of a receptor.

Table 2.1 Evaluation of significance matrix

Magnitude of change	**Visual sensitivity**		
	High	Moderate	Low
High	Substantial	Moderate/ Substantial	Moderate
Medium	Moderate/ Substantial	Moderate	Slight/ Moderate
Low	Moderate	Slight/ Moderate	Slight
Negligible	Slight	Slight/ Moderate	Negligible
Key:	Significant		Not significant

2.3 Mitigation

The final step in the assessment process is to determine measures that can be incorporated into the design of the Project to ameliorate, or, where possible, eliminate the visual impact of the proposed activity.

Mitigation measures can be in several forms including:

- design of mine infrastructure to reduce the contrast with the surrounding environment;
- use of visual buffers and screening by planting vegetation; and
- designing waste emplacements to screen mining operations and lighting.

Proposed mitigation measures are given in Chapter 6 of this report.

3 Existing environment

3.1 Natural environment

3.1.1 Topography

The Project area ranges in elevation from the lowest points at approximately RL360 metres in the north around the Golden Highway and into the Sandy Creek Valley, and RL400 in the south along Spring Ridge Road in the vicinity of the Laheys Creek Road intersection. The highest parts of the Project area occur at Dapper Road (RL446) and Brooklyn Road near Goodiman State Conservation Area (RL526) and the Castlereagh Highway (RL508).

The Project area contains a ridgeline in the east, which extends to both the north and to the south of the proposed mine pits. The ridge areas contain rock outcropping of sandstone, conglomerates and siltstones, forming steep cliffs in some locations. The north-western part and the southern section associated with the pipeline corridor, are lower in elevation, with smaller rolling hills.

Water bodies in the greater Cobbora area include the Talbragar River, Macquarie River, Cudgegong River and the Castlereagh River. The Project area lies within the catchment of Sandy Creek, a tributary of the Talbragar River. Laheys Creek, a tributary of Sandy Creek, and a number of minor tributaries also occur within the study area.

3.1.2 Vegetation

The majority of the Project area has been highly modified by agricultural practices with most land cleared and replaced with pastures and to a lesser extent crops. Approximately half the site has been cleared and is covered by pasture grasses, shrubby regrowth, isolated paddock trees and the remainder is covered by remnant woodland communities (EMM 2012). The remnant woodland vegetation typically consists of the following communities: Box Gum Grassy Woodland, Ironbark/Stringybark woodlands, Red Gum Woodland and Cypress Pine Woodland. Endangered ecological communities include Box Gum Grassy Woodland, Fuzzy Box Woodland, and Inland Grey Box Woodland.

3.1.3 State forests and conservation areas

The rail spur is adjoined by the Tuckland State Forest to the east and north. The Goodiman State Conservation Area is to the east of the proposed mining area and immediately to the south of the rail spur. Cobbora State Conservation Area is to the north of the Project area, with Yarrobil National Park to the south and Dapper Nature Reserve to the south-west.

3.2 Local context

3.2.1 Gulgong, Dunedoo and other townships

Gulgong is located approximately 30 km south-east of the Project area and 30 km north of Mudgee. It has a population of 2,916 (ABS 2006). Gulgong's association with the goldfields in 1866 is evident with historic buildings throughout the town, including the Pioneers Museum and the Henry Lawson Centre. Adequate modern services are also available in the town with a library, two primary schools, a high school, an environment education centre and a multi-purpose health service centre which provides accident and emergency services.

Dunedoo is situated at the junction of the Golden and Castlereagh Highways about 22 km north-east of the Project area. It has a population of 1,653 (ABS 2006). Dunedoo contains educational facilities including a TAFE, multi-purpose health service centre and a library and is serviced by police, fire and ambulance stations.

Cobbora is a small village about 5 km north of the Project area. It has low density, scattered dwellings. Estimated population is below 200 people (ABS 2006).

3.2.2 Farmland

Rural farmland has been classified according to the '*Systems Used to Classify Rural Land in NSW*' (Cunningham et al., 1988). The dominant Rural Land Capability class across the Project area is Class IV Land and is used mainly for cattle and sheep grazing. The remainder of the farmland is made up of relatively similar proportion of Class III, V and VI land. The Class III land is largely used for the production of crops for feedstock (eg wheat and oats) as well as for the production of rotational crops such as canola and wheat. The Class V and VI land is used for cattle grazing with some merino wool and prime lamb production or has been left timbered.

The Project disturbance footprint is mainly on good grazing land (Class IV) or land that can be used for grazing if structural erosion control measures are in place (Class V). However, a small area of Class III land will also be disturbed temporarily. Progressive rehabilitation will occur throughout the operation of the mine and a greater proportion of Class III land will be reinstated compared to the area of Class III land that will be disturbed.

3.2.3 Traffic routes

The road network in and around the Project area consists a range of roadways from State Highways through to minor unsealed rural property access roads. The Golden Highway to the north is the major roadway in the area carrying significant traffic volumes (1050 vehicles/day) and provides a link from Dubbo to the west and Dunedoo to the north-east of the Project area. The Castlereagh Highway is located to the east of the Project area and although not as heavily used as the Golden Highway, traffic volumes are still significant (670 vehicles/ day).

Spring Ridge and Laheys Creek Roads provide the major traffic route through the Project area from the south to the Golden Highway in the north. Brooklyn Road provides an east-west link from the proposed mining area through to the Castlereagh Highway to the east.

Minor rural roads in the vicinity of the Project are Sweeney Lane, Sandy Creek Road and Dapper Road. These roadways primarily service the existing rural landholdings and carry low traffic volumes of less than 50 vehicles/ day.

3.2.4 Night lighting

Existing sources of night lighting character in the vicinity of the Project area are minimal due to its rural setting. The only sources are farmhouses, farm machinery and vehicles on roads.

The majority of the Project area is in Warrumbungle Local Government Area which also contains the Siding Spring Observatory, an important optical astronomical observatory. In November 2004, the Shire Council adopted a lighting policy known as Development Control Plan No.1 – Shire Lighting Code to Protect Siding Spring Observatory (DCP No.1). The code seeks to protect the dark skies for the benefit of the observatory and it applies to the entire Shire. The Project is therefore subject to its requirements, despite being approximately 100 km away.

DCP No.1 operates by classifying areas around the observatory in concentric rings. The Project is located approximately 100 km from the observatory and therefore falls within Area C, land within the LGA that is greater than 18 km from the observatory. Within this area, lighting which exceeds 15,000 lumens requires consent from the Shire Council.

DCP No.1 then creates zones for each of the Areas and the Project falls within Zone E1c. The controls within these zones are designed not only to protect the observatory but also to regulate lighting from activities which may disturb residents. The requirements for lighting within Zone E1c are set out as follows:

- all light sources brighter than 420 lumens must be fully shielded to ensure no light is emitted above the horizontal;
- all lighting between 420 and 1,200 lumens must be activated by motion sensors and have an activation time of five minutes;
- any source exceeding 1,200 lumens must be fully shielded from any exposed viewer;
- all floodlights and similar area lights must have full cut-off light spill characteristics and be aimed only at the area being illuminated;
- lights on building facades that exceed 1,800 lumens must be fully shielded, aimed downwards and restricted to illuminating only the nominated vertical wall surface;
- all lighting to comply with the requirements of Australian Standard 4282 – Control of Obtrusive effects of outdoor lighting and 1158 Road Lighting series; and
- search and upward-facing lights – directing floodlights upward is prohibited.

Orana Regional Environmental Plan No.1 – Siding Spring is another planning instrument by which consent authorities can ensure that new developments do not detrimentally impact on the conditions for astronomical observation from the Siding Springs Observatory. This plan applies to nearby land within the Shires of Coonabarabran, Coonamble and Gilgandra and the City of Dubbo. The Project area falls outside these areas and does not apply to the Project.

4 Visual elements of the Project

4.1 Project components

The Project's key elements are:

- an open cut mine;
- a coal handling and preparation plant (CHPP);
- a train loading facility and rail spur;
- a mine infrastructure area; and
- supporting infrastructure including: access road, water supply and storage structures, and electricity transmission lines.

The locations of each of the above are shown in Figure 4.1. Their visual characteristics are described below.

4.1.1 Open cut mine

Multiple open cut mining pits will be developed within three mining areas:

- Mining Area A north of the infrastructure area;
- Mining Area B south of the infrastructure area; and
- Mining Area C north-east of the infrastructure area.

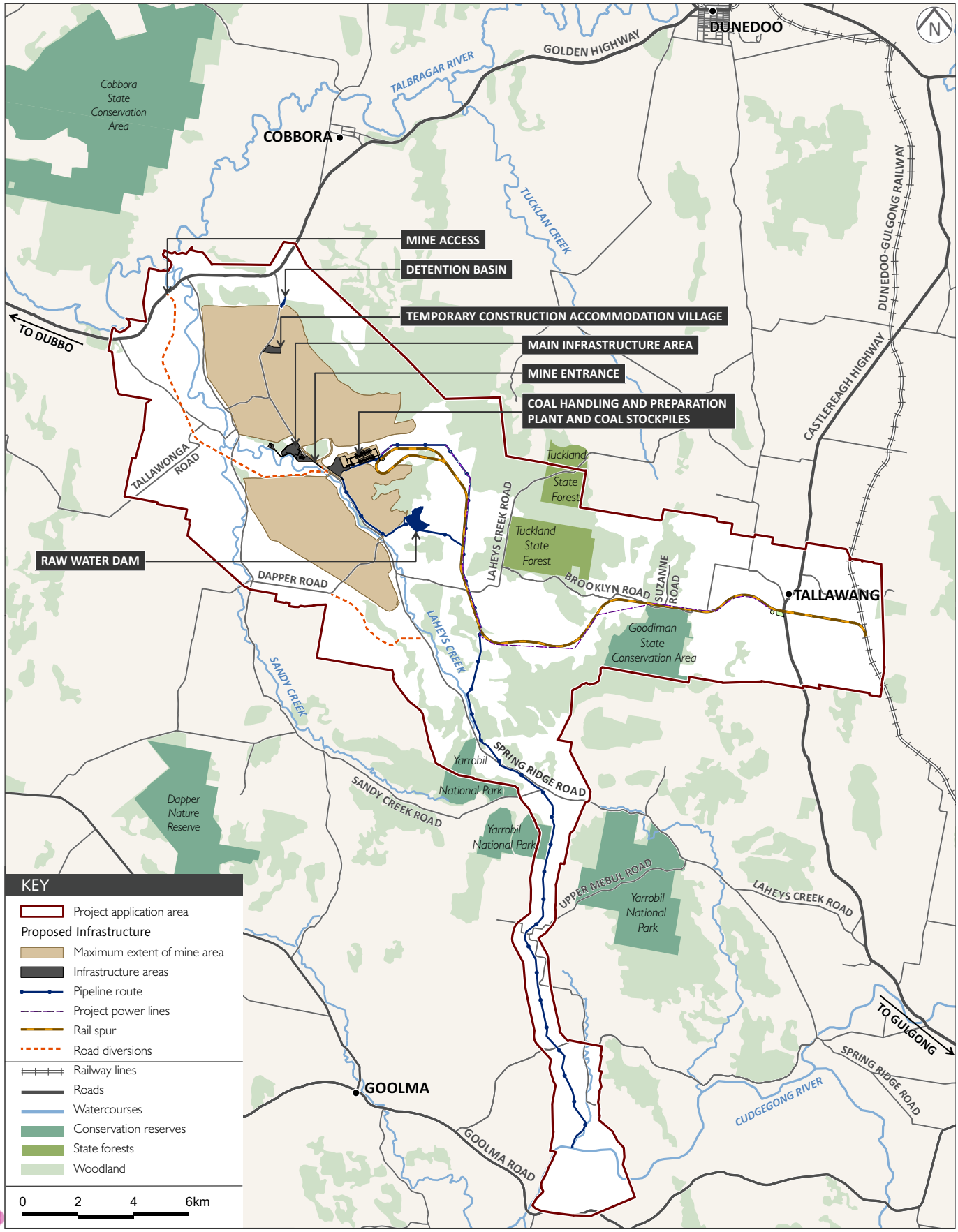
There will be three out-of-pit waste rock emplacements:

- AC-OOP between mining areas A and C;
- B-OOP E adjacent to Mining Area B on the east side of Laheys Creek; and
- B-OOP W adjacent to Mining Area B on the west side of Laheys Creek.

The Project area will encompass approximately 4,350 ha, including the associated infrastructure (eg haul roads), out-of-pit waste rock emplacements and rehabilitated areas. The pits and out-of-pit emplacements have been designed and located to maximise the efficient extraction of the coal resource, while avoiding or minimising impacts on creeks and ecologically significant vegetation.

A conventional load and haul operation is proposed using excavators, front-end loaders and trucks. Initially, trucks will haul waste rock to out-of-pit emplacements. Following this, the majority of the waste rock will be placed in the mined-out voids.

Trucks will haul excavated run-of-mine (ROM) coal to the CHPP where it will be tipped into dump hoppers above the primary crushers or onto secondary ROM stockpiles for later rehandling. Figure 4.2 illustrates the various elements of the mine operation and infrastructure areas.



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Project Components

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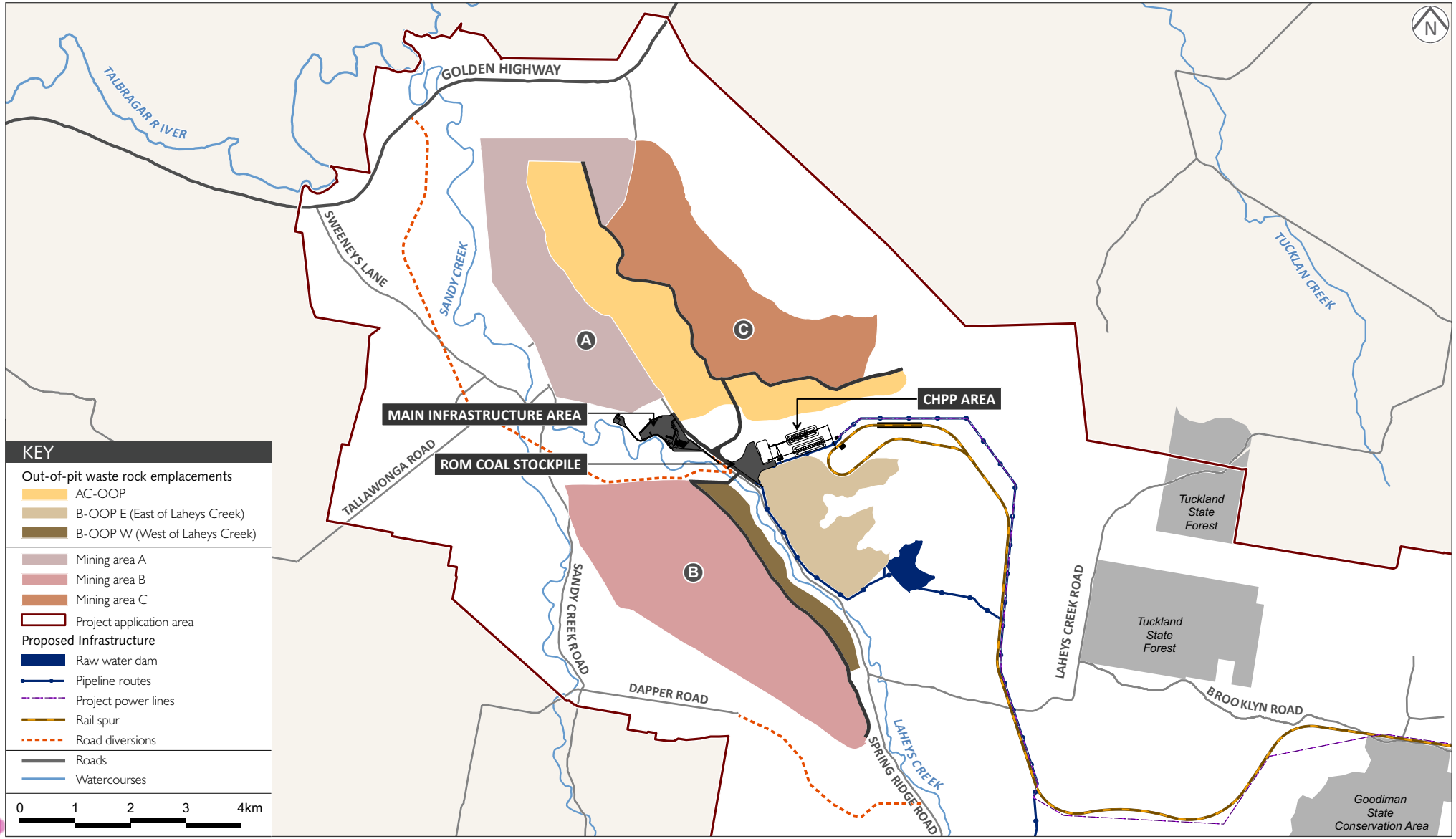
Figure 4.1



Mine Operations and Infrastructure Areas

Cobbora Coal Project - Visual Assessment

Figure 4.2

4.1.2 Coal handling and preparation plant

The CHPP will treat the ROM coal so that product coal meets the sizing and coal quality requirements of the customers. Subject to the level of impurities (rejects) in the coal and washability characteristics, the ROM will be either crushed and bypassed or treated (washed) in the preparation plant. The rejects will typically be waste rock, finer soil and clay dispersed within the coal.

The CHPP will be typical of those used by most coal mines in NSW and will be capable of treating up to 20 million tonnes per annum (Mtpa) of ROM coal. The washed product coal will be separated from rejects in a series of coal cleaning circuits (including heavy media separation) in the CHPP. The CHPP will also include a truck dump station, crushing plants, coal stockpiles, and infrastructure to move and stockpile the coal. Rejects from the CHPP will be disposed within the footprint of the mining area.

4.1.3 Train loading facility and rail spur

Product coal will be loaded onto trains from an overhead train loading bin located on the rail spur balloon loop. Approximately five trains will be loaded each day. The rail spur will be approximately 28 km long (including the loop) and will join the Dunedoo to Gulgong rail line near Tallawang. A locomotive provisioning facility and a siding for fuel delivery may be located adjacent to the balloon loop.

The natural topography along the rail spur alignment will necessitate construction of cuttings, waterway crossings and embankments. Road crossings at Lahey's Creek Road and Brooklyn Road will also be required, as will a rail underpass at Castlereagh Highway.

4.1.4 Mine infrastructure area

The mine infrastructure area will be located adjacent to the mining areas. It will include: workshops; hardstand and lay-down areas; bulk storage buildings; bulk fuel storage and a fuelling station; office buildings; an operations building and change-house; parking areas; an explosives magazine, and vehicle wash down bays.

4.1.5 Supporting infrastructure

i Access roads

The main access to the mine will be from the Golden Highway to the north via a road diversion that will replace an existing section of Spring Ridge Road. There will also be limited light vehicle access from the south via Spring Ridge Road.

Internal roads will connect the various operational facilities, the workshop, administration buildings, the mine infrastructure area, the mine pits and emplacement areas.

ii Water supply

Water will be sourced by intercepting surface water and by pumping groundwater that enters the mine pits in accordance with the relevant permits and licences. Water will also be sourced from the Cudgegong River and pumped approximately 26 km to the primary raw water dam south-east of the mining area. Pre-existing high security water access licences have been purchased for the Project to allow up to 3.31 gigalitres (GL) of water to be extracted from the river.

iii Electricity supply

The Project will require approximately 25 megawatts (MW) of electrical power. It will be connected to the grid at a small switching yard adjacent to the Castlereagh Highway. A power line, generally running parallel to the rail spur, will deliver the electricity to a substation in the mine infrastructure area.

In addition, an 11 kV transmission line will supply the Cudgegong River pump station from the existing grid approximately 2 km south of the pump station site.

4.1.6 Workforce and operating hours

The proposed mine construction workforce will commence with approximately 110 persons in late 2013 and build to a peak of approximately 550 persons during mid to late 2014. Mine construction is expected to occur up to 12 hours per day. However, construction may occur up to 24 hours per day at times (eg during major concrete pours).

Mine operations will commence during 2015. The initial workforce will be approximately 170 workers, increasing to 470 workers by 2020, then reaching a peak of approximately 590 workers between 2027 and 2030. Mine operation will occur up to 24 hours per day, 7 days per week, 52 weeks per year.

4.2 Visual elements of mine staging

The following section describes the changing landform associated with the various stages of the mine plan. This process helps understand the visual impacts of the various elements of the mine activities as they develop throughout the life of the Project. The mine staging plans to which the following description relates are shown in Figures 4.3 to 4.10.

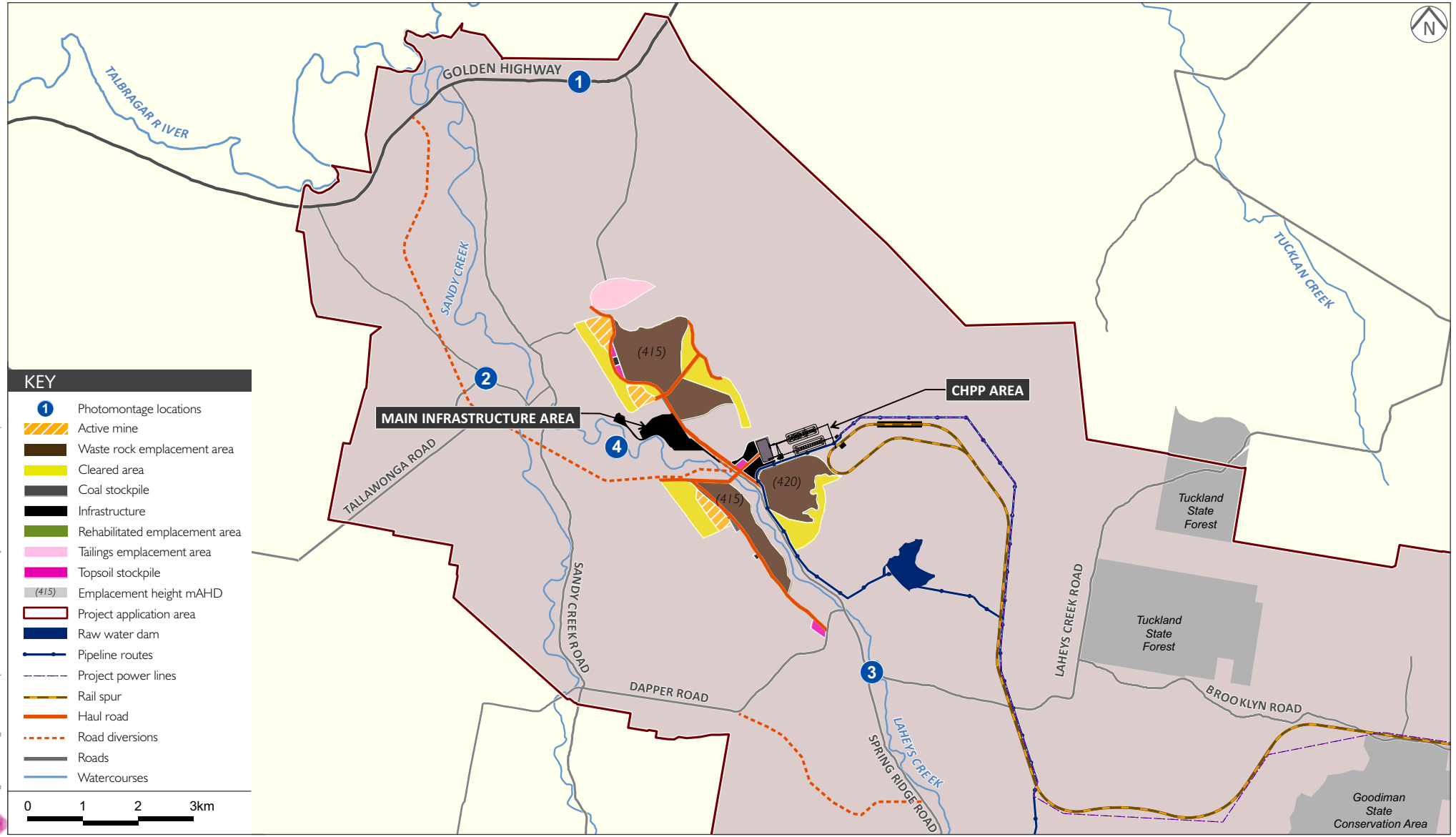
4.2.1 Year 1

Three mining areas will be developed in the north-east, north-west and south-west of the Project area as shown in Figure 4.3. Each pit commences with the removal of topsoil and some subsoil which is stockpiled for later reuse in rehabilitation.

Blasting and removal of overburden is then carried out. This is conducted by excavators and trucks, with material hauled to out-of-pit emplacements to expose coal seams. A north-south running box cut is then excavated into the upper coal seam which is then progressively mined in both a north-south and east-west direction. Progressive filling and rehabilitation of the mined areas will occur to minimise the time that the disturbed mine landscape is visible from surrounding areas.

Mining Area A - mining will commence in Mining Area A during Year 1 with the establishment of two open pits and associated waste rock emplacements. These emplacements, although relatively small at this stage, would be visible from some viewpoints to the west.

Mining Area B - mining will also commence with B-OOP W and B-OOP E being cleared and used for overburden emplacement. These waste rock emplacements will reach heights of RL415 and RL420, and will be visible to motorists along some sections of Spring Ridge Road and Dapper Road, as well as some private residences to the west of the mine area.



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Mine Plan - Year 1

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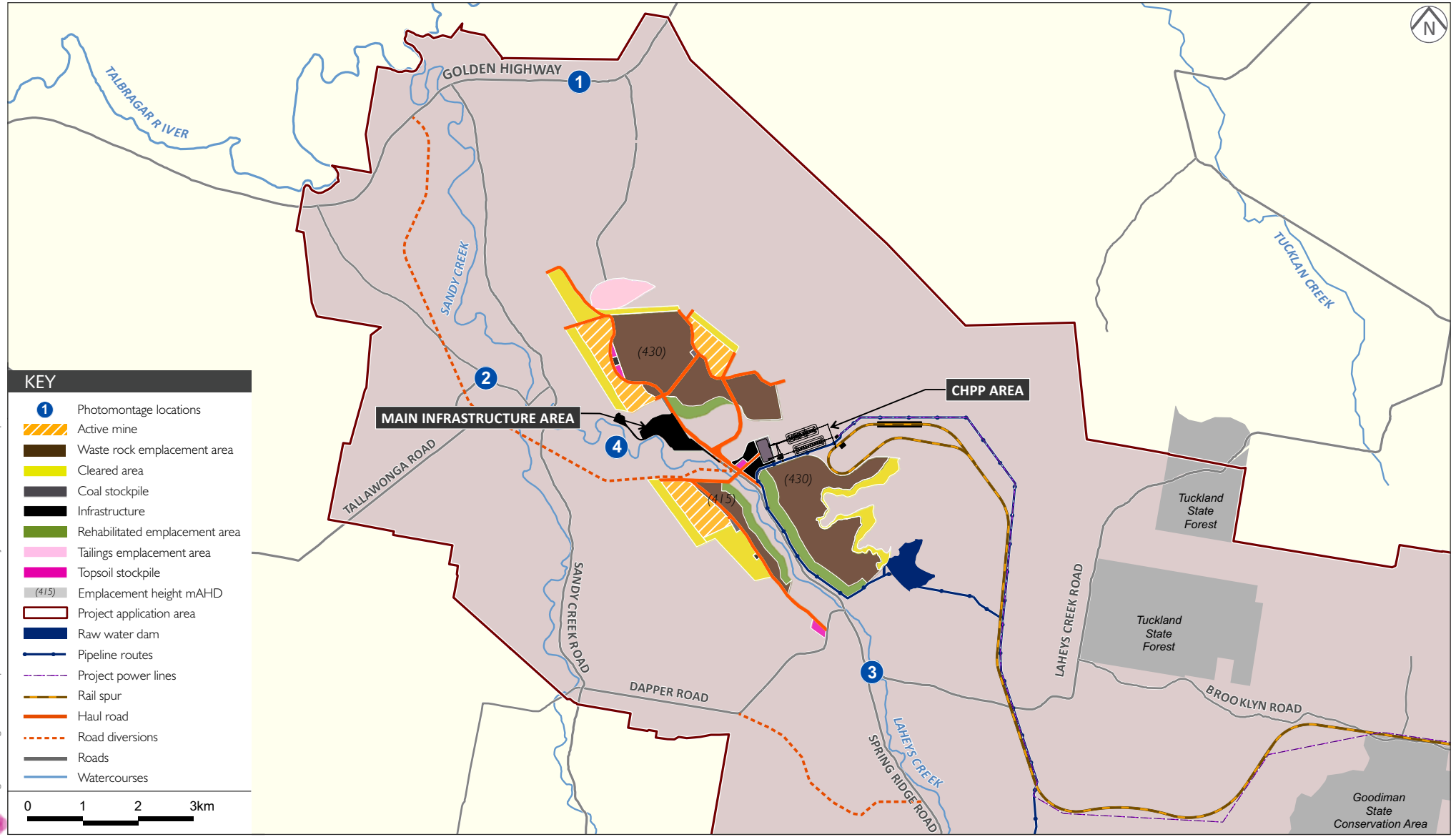
Figure 4.3



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Mine Plan - Year 2

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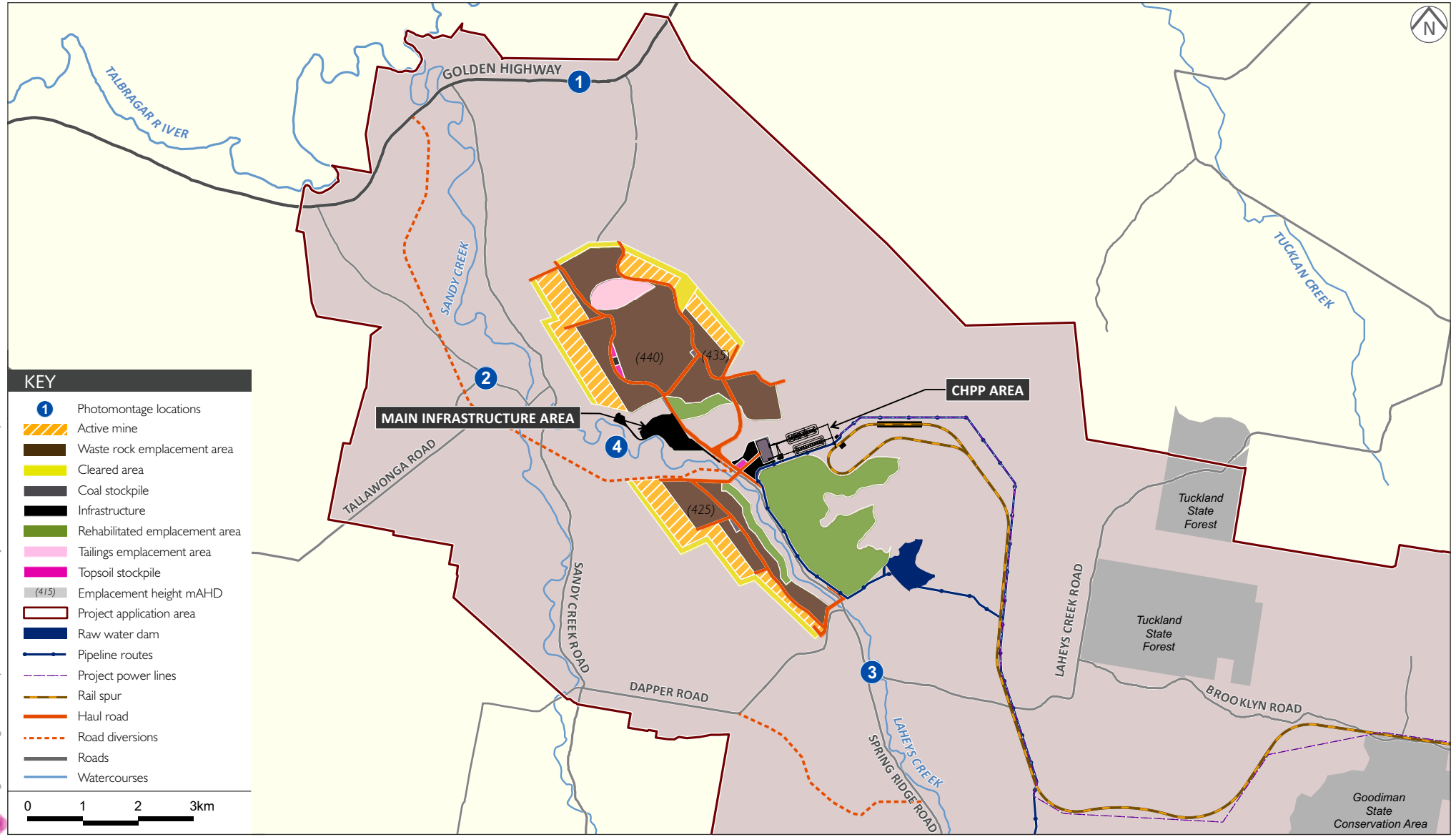
Figure 4.4



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Mine Plan - Year 4

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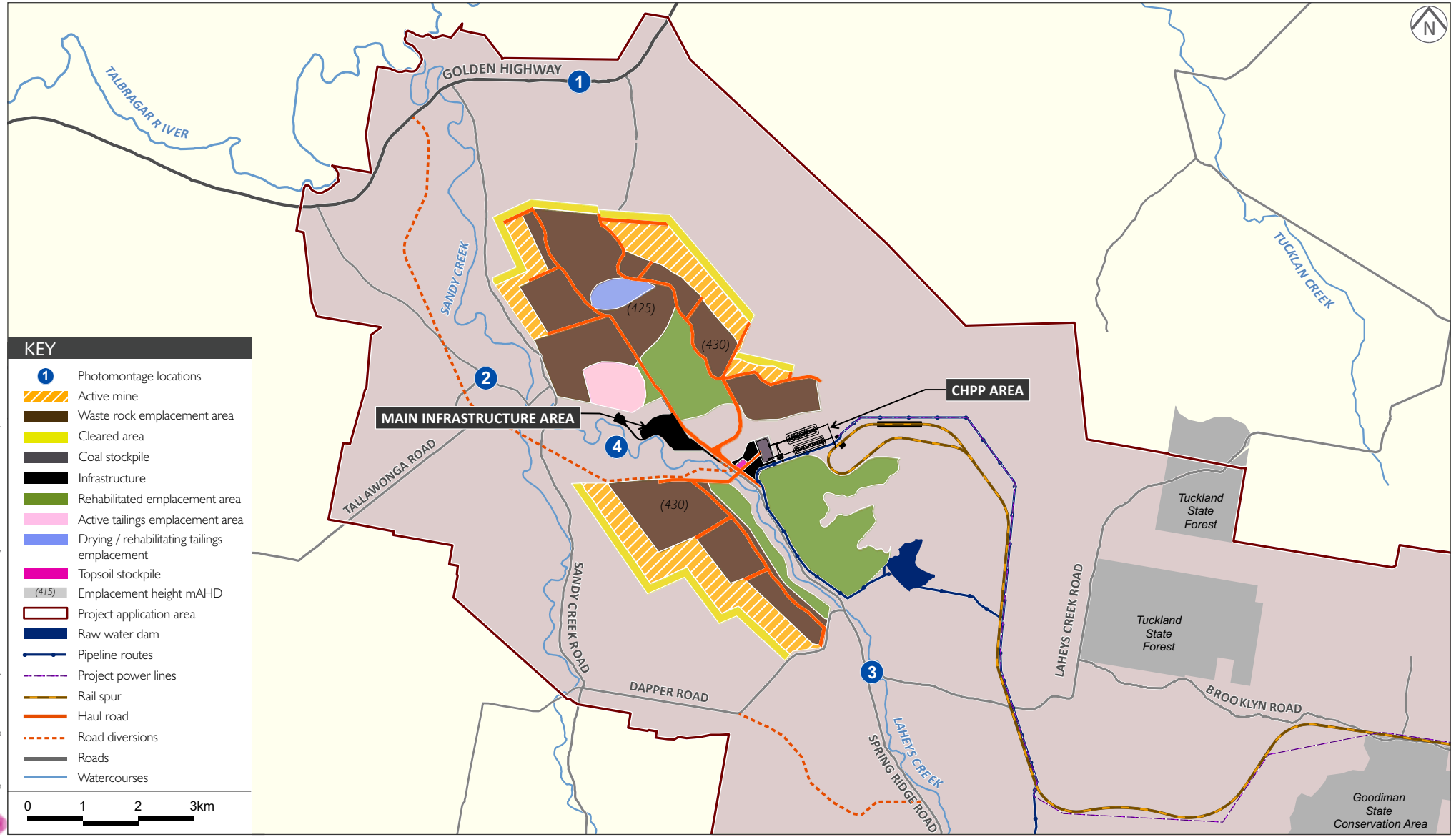
Figure 4.5



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Mine Plan - Year 8

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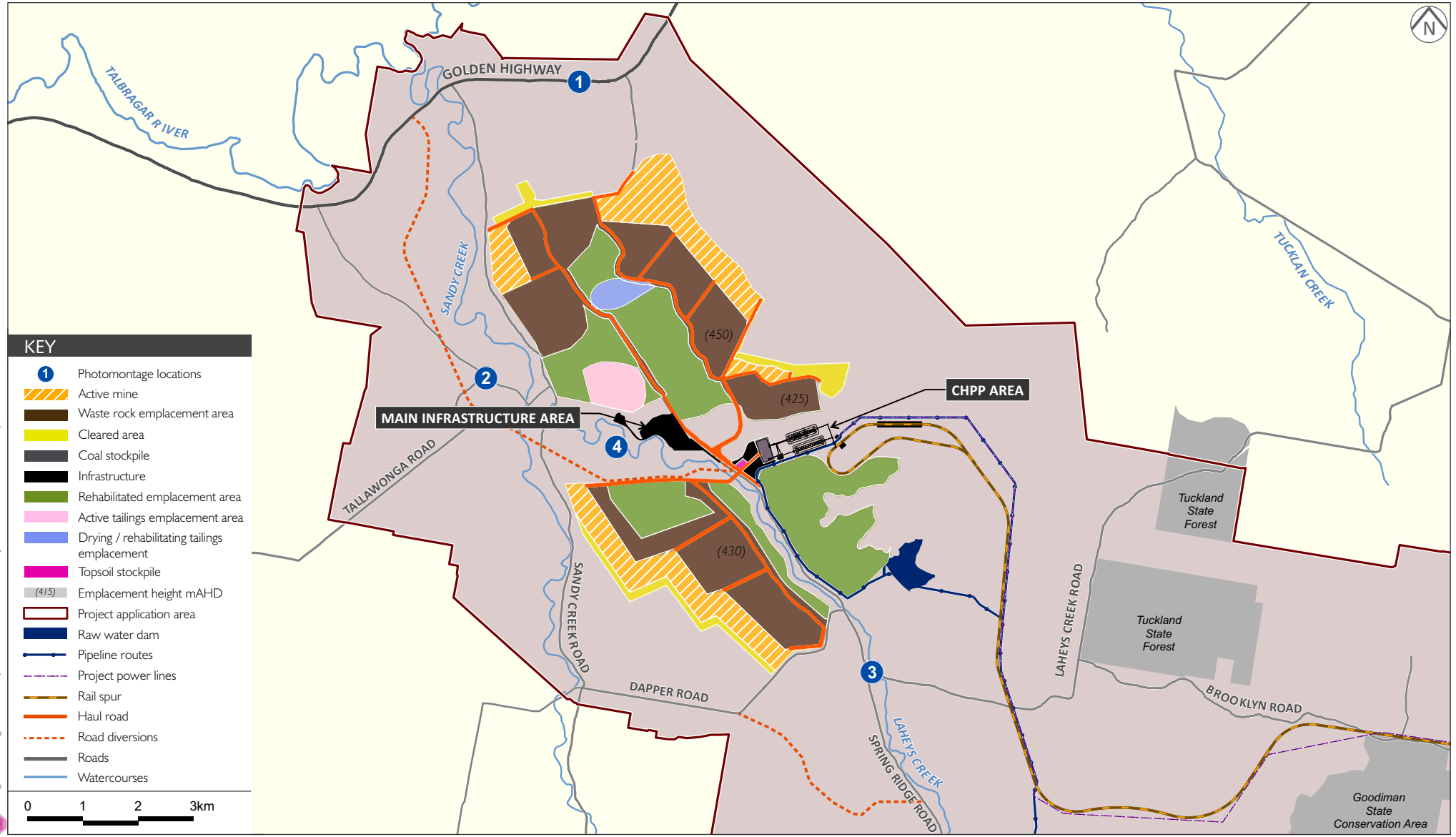
Figure 4.6



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Mine Plan - Year 12

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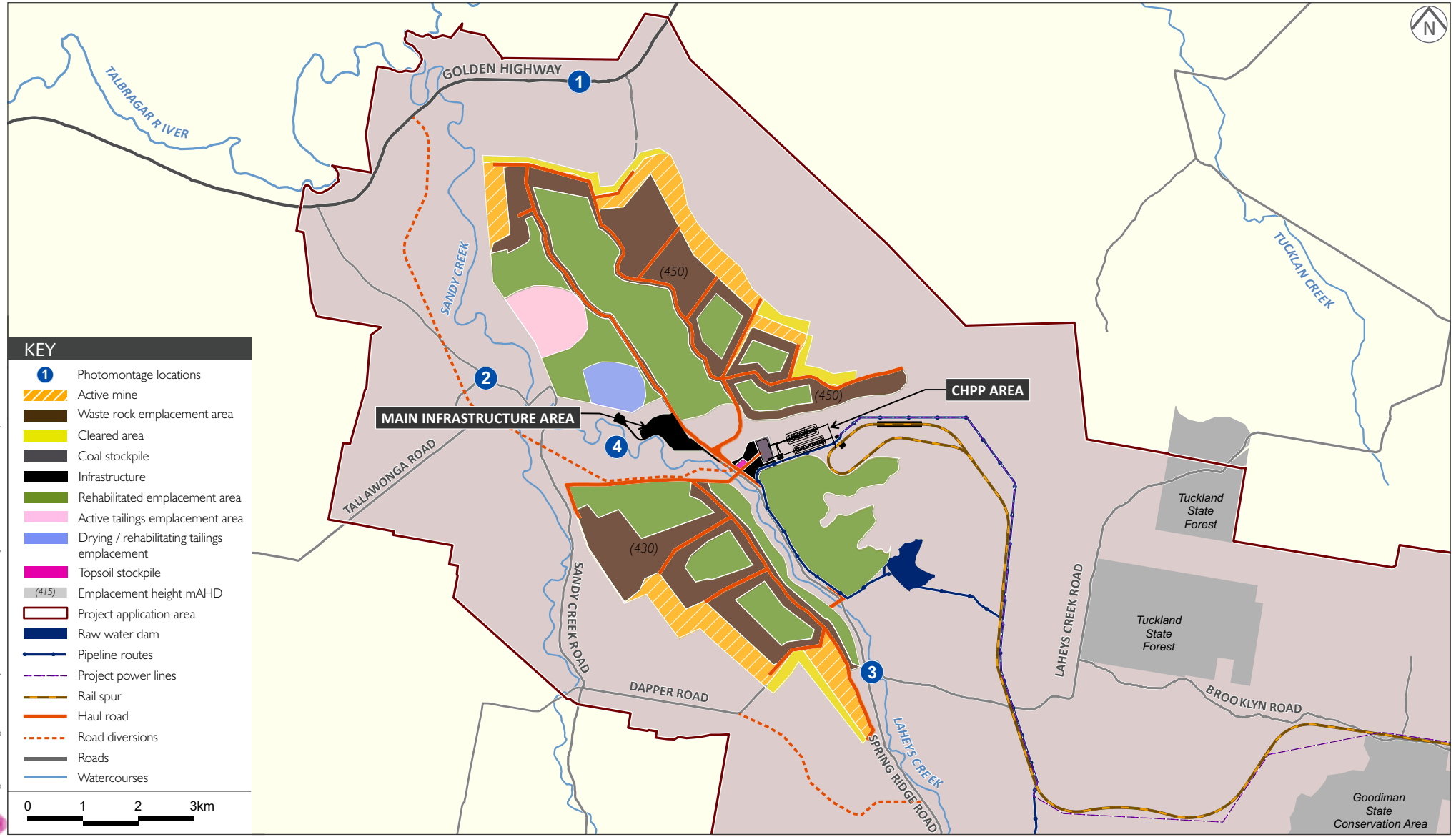
Figure 4.7



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Mine Plan - Year 16

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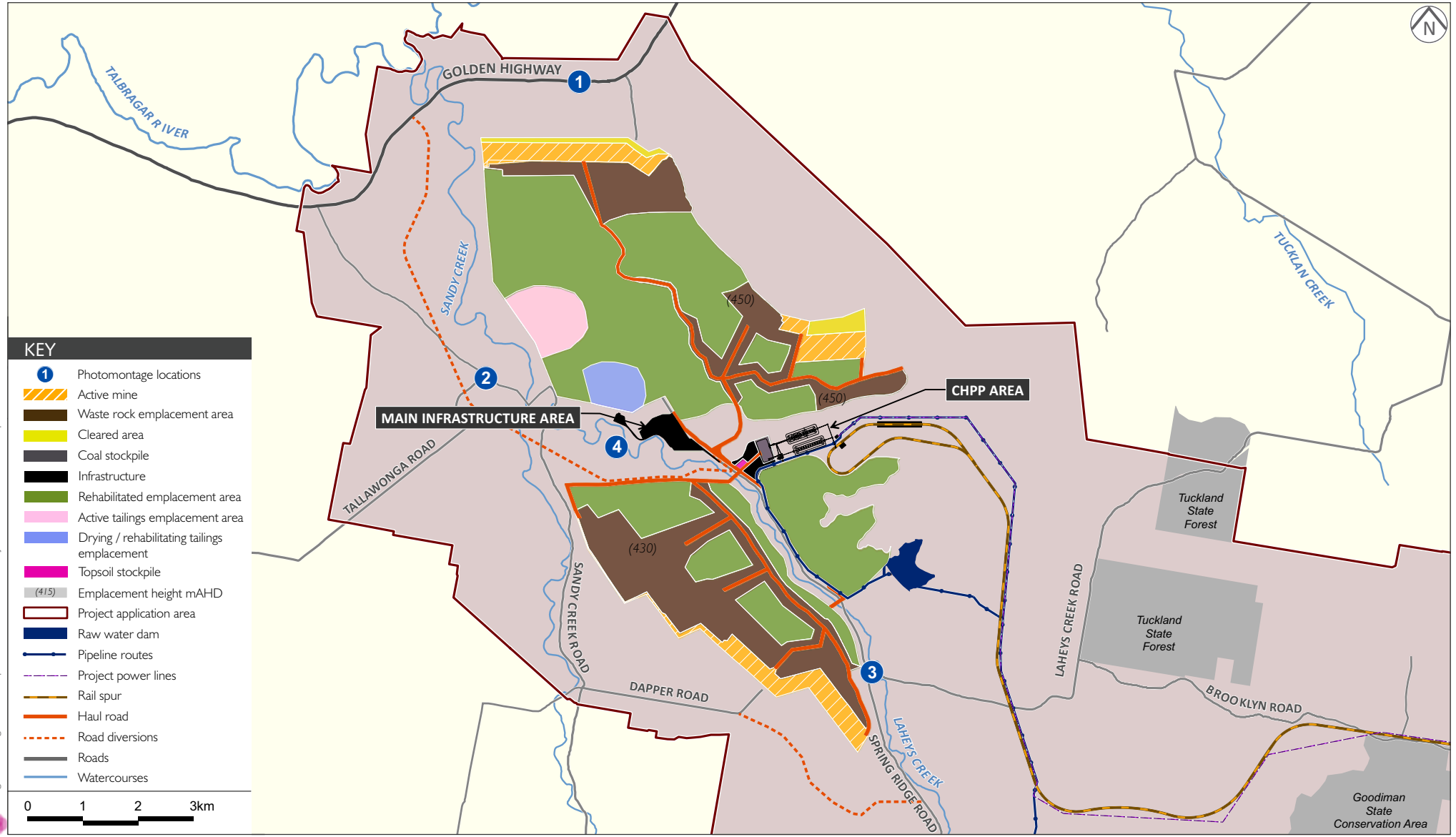
Figure 4.8



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Mine Plan - Year 20

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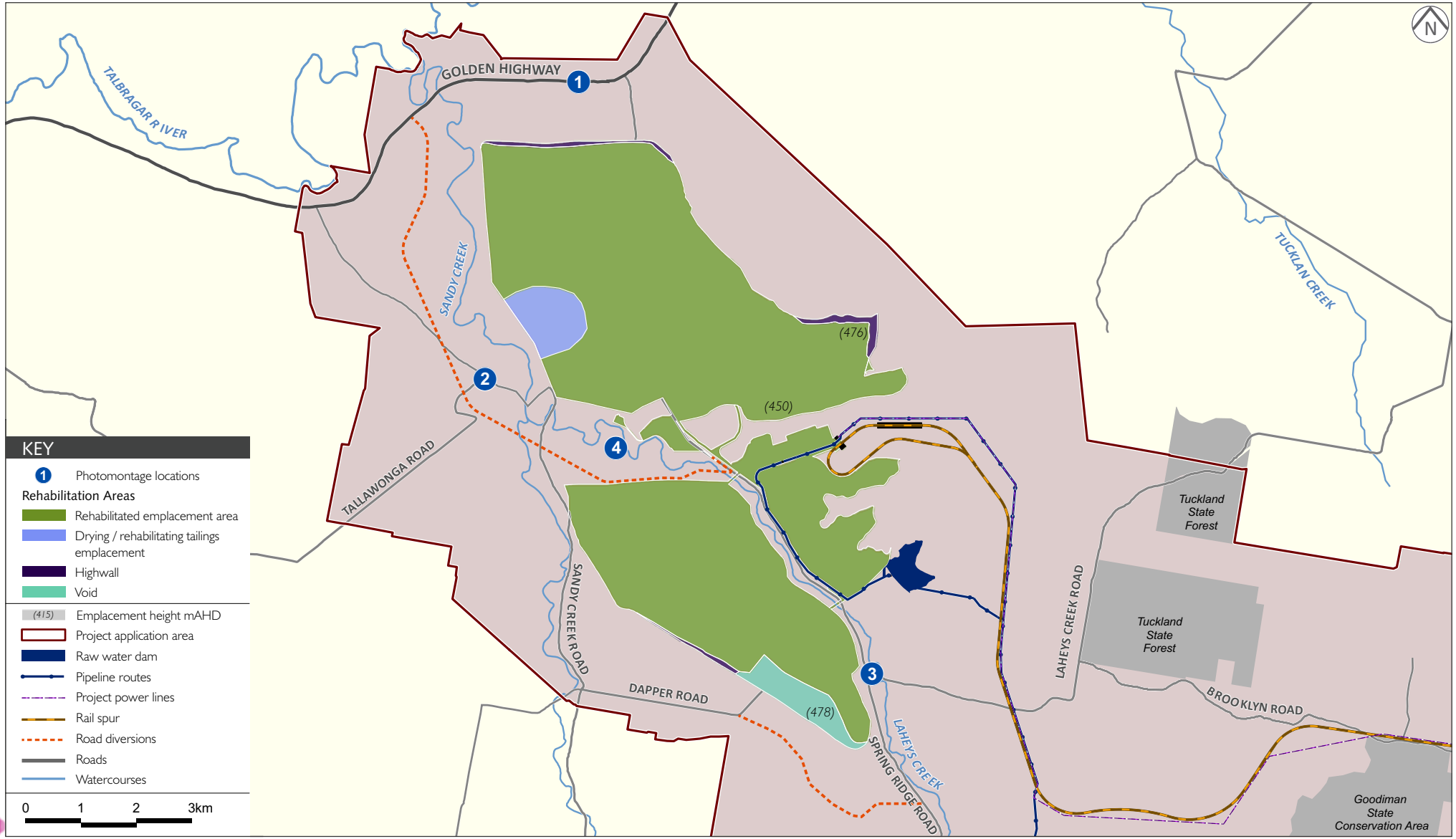
Figure 4.9



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Mine Plan - Year 21

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Figure 4.10

4.2.2 Year 2

Mining Area A - mining continues with the two open pits converging into one pit and progressing west. Stripping of additional land to the west and north will commence. The waste rock emplacement will increase its footprint and height to RL430. The emplacement will become more visible to receivers to the west and north-west, particularly motorists travelling along the Spring Ridge Road diversion and Sweeneys lane in the north-west. Rehabilitation of the emplacement will commence at the southern tip of Mine Area A.

Mining Area B - mining will progress to the north-west and south. Clearing of land to the south and west of the mine will continue. Rehabilitation will commence on the Spring Ridge Road side of both B-OOP E and B–OPP W which will begin to reduce the mine's exposure to motorists travelling along this roadway. The overall height of the emplacement will remain unchanged at RL415.

Mining Area C - mining will commence in Year 2 with a single open cut pit. The emplacements associated with this area will reach a height of RL430.

4.2.3 Year 4

Mining Area A - mining will progress to the west and north and the waste rock emplacement will grow by a further 10 m to RL440 and now be visible from the Golden Highway to the north. The emplacements will become more exposed to motorists and private residences to the west. Rehabilitation of the southern section of the emplacement will continue.

Mining Area B - the mining will expand substantially with open pits progressing to the west and south to Dapper Road. The waste rock emplacements will have a significantly larger footprint and increase in height by 10 m to RL425, making this element more prominent from Spring Ridge Road and Dapper Road. Rehabilitation of B-OOP E will be complete by Year 4.

Mining Area C - mining will continue with the creation of a second open cut pit to the north. The presence of the emplacements adjoining Mine Areas A and C will block views to the open cut faces of this new pit as it progresses into the hillside.

4.2.4 Year 8

Mining Area A – the footprint of mine area will reduce significantly although the pit will progress northwards. The waste rock emplacement will reach its maximum footprint and rehabilitation will commence from the south. This rehabilitated emplacement will reduce the visual impact to receivers to the west with the progressive creation of a more natural landscape. The overall height of the emplacement will reduce by 15 m to RL425 as a result of reforming to create the final landform.

Mining Area B - mining will continue with the pits extending south-west, toward Dapper Road. The footprint and height of the emplacement will increase by 5 m to RL430 making it more prominent to receivers to the west and motorists travelling along Spring Ridge Road. This is the maximum height of this emplacement and rehabilitation will continue during this stage.

Mining Area C - the two pits will join into one large open pit and a further pit will commence at the southern end of Mining Area C. Mining will progress in a north-easterly direction with progressive stripping of land in advance of the active mine. Overall emplacement height at this point is RL430.

4.2.5 Year 12

Mining Area A - mining will contract to a small 1 km long pit in the north-west and most of Mining Area A will now be rehabilitated. The maximum height of the emplacement will remain at to a level of RL425.

Mining Area B - mining will continue to the south-west but stop at Dapper Road. Rehabilitation of the associated emplacement will commence at the northern end, softening the impact of this area to motorists travelling south-east along Spring Ridge Road, but the height will remain at RL430.

Mining Area C - mining will progress north-east and into the hillside. The associated emplacement will increase in height to RL450 and may be visible over the top of the emplacement at Mining Area A from certain viewpoints to the west.

4.2.6 Year 16

Mining Area A - the active mining area will continue to contract, although it will extend further north during this period. A substantial amount of emplacement area will be rehabilitated and active emplacement areas will be obscured from many of the affected receivers to the west. The height of the active emplacement will increase to RL450.

Mining Area B - the mine will cross over Dapper Road and continue south, causing closure of the eastern end of Dapper Road with traffic being redirected onto the Dapper Road diversion which re-joins Spring Ridge Road further south. The height of the active emplacement remains unchanged at RL430.

Mining Area C - mining will continue to the north, north-east and south. Rehabilitation of the emplacement and C-OOP will commence and the active emplacement will remain at RL450.

4.2.7 Year 20

Mining Area A - in this final year of mine operations, mining will be confined to the north and will join up with Mining Area C. Rehabilitation of the emplacements will be almost complete and very limited active emplacement will be exposed to viewers from roadways and residences to the west. The small area of active emplacement has increased to RL450.

Mining Area B - mining will continue in the final year along the south-western edges of the Mine Area. Rehabilitation of B-OOP W will be completed and followed by rehabilitation of the adjoining active emplacements. The height of the emplacements remains unchanged at RL430.

Mining Area C - the final areas of mining are confined to the south-east and the northern tip where the pit joins up with Mining Area A. Rehabilitation of the emplacements will be largely completed but the maximum height of the remaining active area will remain at RL453.

4.2.8 Year 21

Mining in all areas will now be complete and final landform established and fully vegetated. Three final voids will remain: at the northern tip of Mining Areas A and C, the south-western edge of Mining Area B and the south-eastern corner of Mining Area C.

Following the completion of mining activities, removal of the infrastructure associated with the Mine Infrastructure Area and CHPP area will be undertaken.

4.3 Post-mining landform and rehabilitation

The design of the post mining landform is based on four main factors:

- landform stability;
- erosion minimisation;
- landform compatibility with the surrounding environment; and
- cost of earthworks.

The final landform will be designed to be stable and compatible with the surrounding landscape. This will involve the reshaping with large dozers of the majority of overburden emplacement to slopes of 10° or less and incorporation of contour-graded banks to reduce erosion risks. The spacing and ultimate dimensions of these structures will be a function of the final slope and catchment area and, consequently, these design details will be provided in the mine's rehabilitation plan. On the steeper slopes, the distance between contour banks will generally be between 50 and 80 m.

The rehabilitation strategy has three primary components. Firstly, during mining, the area of active emplacement will be minimised to reduce the potential for air borne dust generation and erosion of sediment by water. Secondly, land will be progressively rehabilitated to allow a mix of uses such as cropping, grazing and woodland. Finally, all upgraded and realigned roads will be retained at mine closure. With the exception of the rail line and raw water dam, all land covered by main and auxiliary infrastructure components will be returned to its pre-mining state and will be capable of its pre-mining land use. The three open-cut mining areas in the mining operations area will be backfilled and reshaped in accordance with the above landform design. The post-mining landform will differ from the pre-mining one in that:

- the local road network will be altered through some upgrading of roads and some road realignment;
- the raw water dam will be retained as an agricultural resource;
- the rail line including track, embankments and cuttings will be retained; and
- the land within Mine Areas A, B, and C will contain a similar mix of land capability classes but their actual contours will differ from the existing landform.

5 Visual impact assessment

5.1 Critical viewpoints

Following a desktop analysis and site inspection, the locations of critical viewpoints and key receptors was determined. Eleven receptor locations were chosen to represent the key visual viewpoints to various elements of the Project which will be experienced by residents or visitors within the view-shed. The visual impacts of a particular mine element at any given receptor will change depending on the particular point in the mine life. As an example, the view from one receptor may be to an open cut face at a particular point in time and therefore the visual impact on that receptor may be high while a few years later, this open face may obscured by rehabilitation and the view may be of natural vegetation and resemble something more like the pre-mine landform.

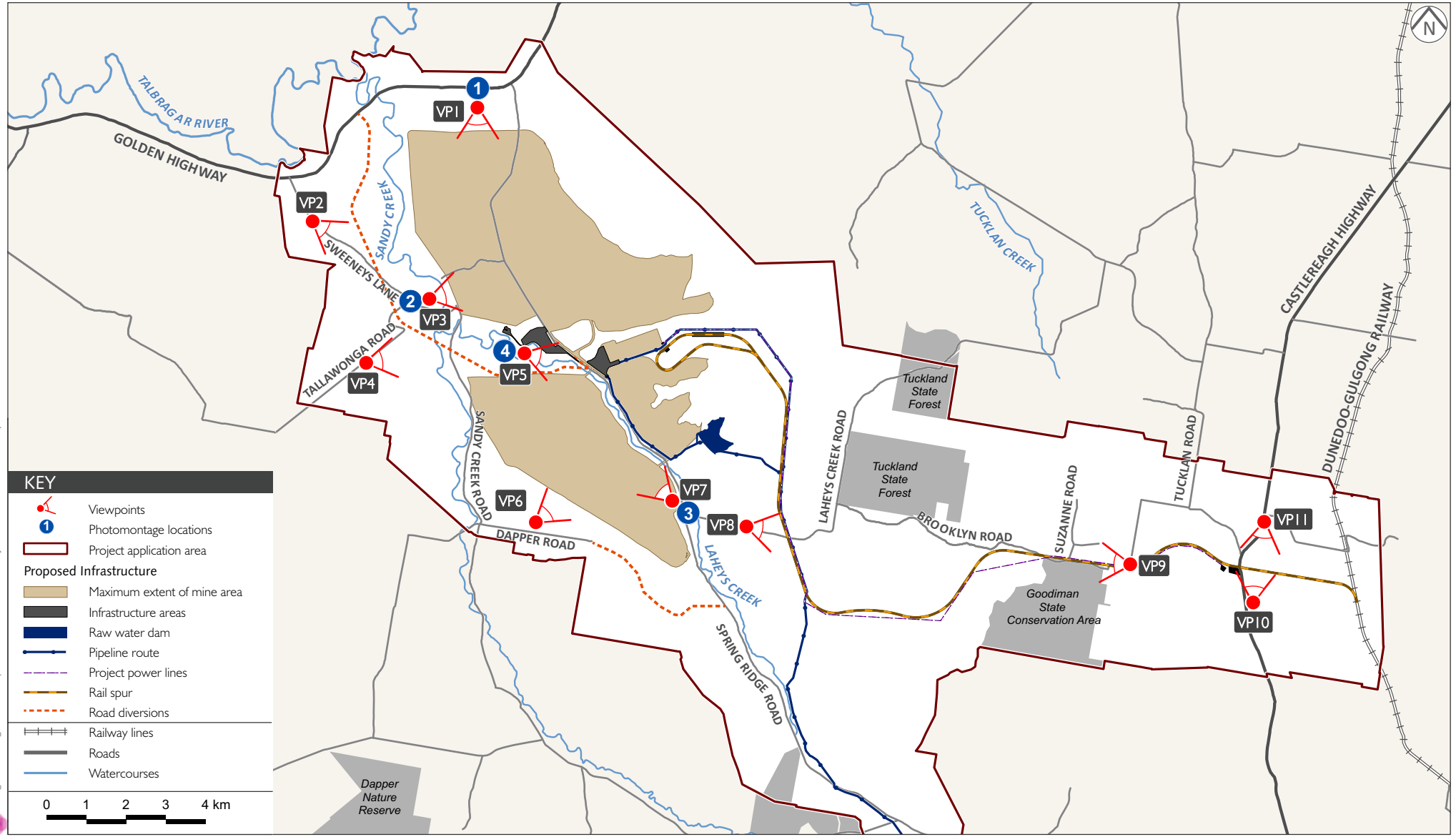
Each of the 11 viewpoints (VP) and four photomontage locations are illustrated in Figure 5.1 and described in detail below.

5.1.1 VP1 and photomontage location No.1 – Golden Highway looking south: RL345

i Viewpoint type and context

This viewpoint is located on the Golden Highway taken from the bridge across Sandy Creek. The relevant viewing direction is facing south and the pre-mining view is shown in Figure 5.2. The view from this receptor is typical of not only the view to the Project for traffic travelling along the Golden Highway but also from rural-residential properties located on the northern side of the roadway.

Views from this location represent a typical rural setting although the landscape exhibits a number of modifications. The Golden Highway is a dominant feature in the foreground including the Sandy Creek bridge crossing. Other modifications include power lines, fences, rural structures and residences. The middle ground is dominated by a large expanse of flat landscape and cleared farm land. A vegetated ridgeline dominates the western middle ground and more distant ridgelines can be seen in the background and they define the horizon.



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Viewpoints and Photomontage Locations

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Figure 5.1

Photomontage 1 - Existing (Golden Highway near Sandy Creek Bridge)

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Figure 5.2

Photomontage 1 - Year 20 (Golden Highway near Sandy Creek Bridge)

Cobbora Coal Project - Visual Assessment

Figure 5.3

Photomontage 1 - Final Landform (Golden Highway near Sandy Creek Bridge)

Cobbora Coal Project - Visual Assessment

Figure 5.4

Figure 5.5 View from VP1 Looking South Toward Northern Pit

ii Impacts of mine infrastructure

Due to distance and intervening topography there will be no views of mine infrastructure. Figure 5.5 shows the typical vista.

iii Impacts of mine activities

Views will be across flat agricultural land to the northern end of the Mining Area A. The proximity of the mine will decrease over time as mining and waste rock emplacement progresses to the north and closer to the Golden Highway. Without any visual mitigation, the active emplacement associated with Area A would become visible from Year 4 at a distance of approximately 4 km and would continue to increase in prominence up until the end of mining activities in Year 20 when operations would be approximately 1.5 km from the viewpoint. Figure 5.3 illustrates the view at Year 20. Progressive expansion of the emplacement into the landscape will have a heightened visual effect in the short-term. However, this will extend the existing ridgeline and following rehabilitation, the final landform will be compatible with the pre-mining landscape as Figure 5.4 illustrates. During mining operations, motorists travelling at speed along the Golden Highway could be distracted by attempting to view mine operations.

To reduce the associated risks and visual impacts, intervening planting in both the foreground and mid ground will occur. The species will be consistent with the Blue–leaved Ironbark Woodland found in the vicinity. This planting will be undertaken prior to mining to allow establishment and screening to occur before operations become visible in Year 4.

iv Impacts of night lighting

Viewers at this location will be exposed to lighting from activities on top of the active emplacements within Mining Area A. Unmitigated, temporary lighting structures and lighting from mobile mine equipment working on batters and the edge of emplacements will be visible to motorists. Sky glow from mining and various elements of the Mine Infrastructure Area are similarly likely to produce sky glow.

The impact of sky glow on viewers from this location is not likely to be significant. However, lighting from works on top of the emplacements has the potential to be a significant distraction to motorists travelling east along the Golden Highway. These impacts will be reduced by ensuring the design and operation of all lighting sources associated with works on emplacement areas are directed below the horizontal to minimise light spill to the north. These measures will be designed in detail and incorporated into a lighting management plan which will be a part of the Operations Environmental Management Plan. Requirements for this lighting plan and regulatory requirements are discussed in Section 6.1.2.

v Duration and significance of impacts

Views of the emplacements in Mining Area A will commence in around Year 4 and progressively increase over the life of the mine to Year 20. With implementation of the mitigation measures outlined above ie foreground and mid-ground vegetative screening and design and operational protocols concerning the lighting sources on the overburden emplacement areas, the visual impacts will be acceptable. This will improve further with the maturing of tree cover.

Following completion of mining and rehabilitation of the emplacement, this element will create a permanent change to the existing landform. However, the altered landform will appear as an extension of the existing ridgeline as can be seen in Figure 5.4. The extended landform will be lower than the existing ridgeline and will therefore not be a dominant feature. In addition, its intrusiveness will be diminished by the intervening vegetative screening.

5.1.2 VP2 –Sweeneys Lane looking east (road): RL381

i Viewpoint type and context

The relevant viewing direction from VP2 is to the east and south-east shown in Figure 5.1. The pre-mining landscape is shown in Figure 5.6 and most viewers would be motorists travelling south along Sweeneys Lane. This view would also be representative of the view from the Spring Ridge Road diversion which will be located to the east of this viewpoint, albeit that the Spring Ridge Road viewpoint would be at an inferior viewing elevation but closer to mining activities.

This viewpoint is located atop a small ridge along Sweeneys Lane which offers views of cleared rural land. The mid-ground exhibits undulating hills with scattered vegetation, while ridgelines and wooded slopes are visible in the background and on the horizon. The landscape is typically rural with some modifications including power lines, fences and rural-residential properties. The viewpoint is considered to have a low to moderate visual sensitivity due to its rural-residential character.

Figure 5.6 Views to the South-East from Sweeneys Lane

ii Impacts of mine infrastructure

From this location, all of the mine infrastructure will be obscured from view by intervening topography and vegetation.

iii Impacts of mine activities

Due to its relative height, mining activity will be clearly visible from this viewpoint. Mining Area A will be particularly dominant, commencing as a mid-ground element at a distance of approximately 4 km. As mining progresses to the north and west, the impact on this viewpoint will increase and the emplacement associated with this operation will become more dominant within the foreground.

Due to its higher elevation and the open intervening topography, it will be difficult to provide visual screening of mine operations along Sweeneys Lane. To be effective, planting should occur as early as possible during the construction phase.

iv Impacts of night lighting

Viewers at this location will be exposed to lighting associated with activities in Mining Area A. Mobile lighting structures and equipment lighting are likely to be visible due to the elevated viewing location. Sky glow is likely from in-pit activities and various elements of the Mine Infrastructure Area are also likely to produce sky glow.

Whilst the impact of sky glow on viewers from this location is not likely to be significant, lighting impacts from operations on top of the active emplacements have the potential to be a significant distraction to motorists travelling south along Sweeneys Lane and other roadways to the west of the Project area. To reduce the visual impact of night lights, workings on out-of-pit emplacements benches will be staged, wherever possible, so that outer embankments will be created first around the perimeter, providing a visual screen while work is undertaken in the central part of the emplacement.

v Duration and significance of impacts

The elevated nature of VP2 and the open topography between this viewpoint and Mining Areas A and B will result in mining activities and night light impacts being evident for the entire mine life. Impacts at this viewpoint will increase from Year 1 to Year 8 as mining activities progress to the west and north. From Year 8, rehabilitation of Mining Area A will commence and from then until Year 21 the visual impact will progressively decrease.

The final landform in the vicinity of Mining Areas A and B will appear as a new ridgeline in the mid-ground. Due to the position of the mine from VP2, this altered landform will appear below the horizon which is the vegetated ridgelines. To ensure compatibility, the design of the final landform should replicate the contours of the background ridges.

Unmitigated visual impacts from this viewpoint would be substantial albeit to a very small number of motorists that use Sweeneys Lane. The proposed mitigation to be implemented, in particular the proposed early planting, bunding and implementation of a Lighting Management Plan, would reduce it to a slight visual impact.

5.1.3 VP3, VP4 and photomontage Location No.2–Sweeneys Lane/ Tallawanga Road looking north-east (road/housing): RL369

i Viewpoint type and context

The relevant viewing directions from VP3 and 4 is facing north-east, east and south-east as shown in Figure 5.1. Typical current views are shown in Figures 5.7, 5.8 and 5.9 and the view to the north-east is shown in Figure 5.10 (photomontage). Views from this location would be typical of those experienced by five private rural-residential properties located to the north-west and south-west of this viewpoint. Similarly, this view would be experienced by motorists travelling along Sweeneys Lane and Tallawanga Road.

The landscape which is visible from this viewpoint is dominated by cropping and grazing land with some wooded ridges. The topography of the land in this area is varied with flat grazing land in the foreground to the north-east, low undulating agricultural land in the mid-ground exhibiting scattered vegetation, and wooded ridgelines in the distant background. To the east and south-east, the topography is more varied with flat land in the foreground and vegetated slopes in the mid-ground.

There have been a number of modifications within this landscape, especially to the east and south-east where a number of rural farm buildings have been erected. Power lines, fences, rural roads and farmland are all apparent the foreground and mid-ground from this viewpoint. This landscape has a low to moderate visual sensitivity depending on the particular viewing direction.

Figure 5.7 Views to North–East from VP3

Figure 5.8 Views to East from VP3

Figure 5.9 View to North-East from VP4

ii Impacts of mine infrastructure

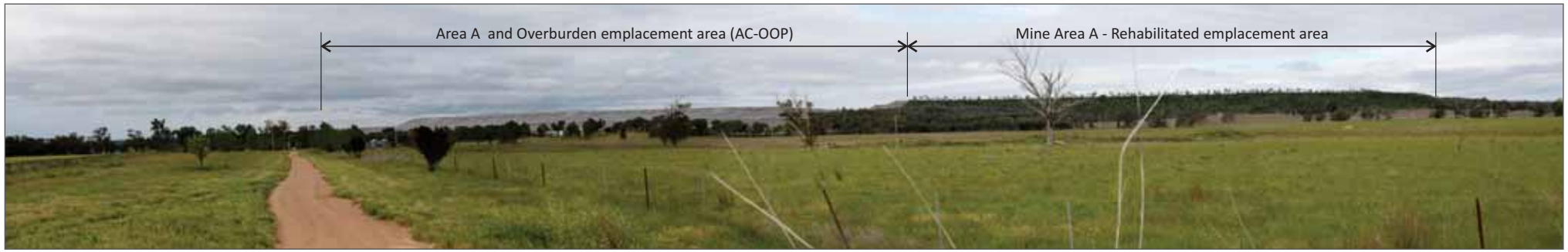
Infrastructure is located approximately 3 to 4 km from this viewpoint. With this distance and the intervening topography and vegetation, no views of the infrastructure area will be possible.

iii Impacts of mine activities

From this viewpoint, Mining Area A will be a dominant visual element. The impact of the emplacement on viewers at this location will increase from the commencement of mining until Year 8 (see Figure 5.10). After this, rehabilitation will commence at the south-western tip. The result will be an extended ridgeline as shown in Figure 5.10.

The visual impact shown in Figure 5.10 is representative of views experienced by five privately-owned residences located to the north-west and south-west of VP3 and VP4. Computer modelling of the visual impacts has indicated that these properties will experience visual impacts from different elements of the Project to varying degrees. These properties are identified by the following ID numbers and their exposure to visual impacts from the mine is described in Table 5.1.

EXISTING



YEAR 8

FINAL LANDFORM

Photomontage 2 - Tallawonga Road / Sweeneys Lane Intersection

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Figure 5.10

Table 5.1 Unmitigated impacts of the Project on private properties to the west of the Project area

Residence ID	Mine element visible from residence	Duration of impact	Significance of impacts
1222	Mining Area A – active emplacement	Mining Area A – Progressive increase in impact until Year 8 when rehabilitation commences. Impact then reduces with progressive rehabilitation until Year 21	Moderate
1223	Mine not visible from residence although possible views to Mining Area A from other parts of the property	Unknown – would require further investigation should the residence remain privately owned	Negligible/ slight
3224	Mining Areas A and B - emplacements Mine Infrastructure Area B –OOP E	Mining Area A – Progressive increase in impact until Year 8 when rehabilitation commences. Impact then reduces with progressive rehabilitation Mining Area B – Progressive increase in impact over course of mine life. Some rehabilitation of the emplacement will commence in Year 12, however, majority of rehabilitation doesn't happen until Year 21 The various elements of the Mine Infrastructure Area would be constructed at the commencement of the Project and will remain static for the entire life of the mine. All elements of the infrastructure as seen from this residence would be removed in Year 21 Visible between Years 1 and 4. This OOP emplacement will be rehabilitated by Year 4	Substantial
3218	Mining Areas A and B - emplacements	Mining Area A – Progressive increase in impact until Year 8 when rehabilitation commences. Impact then reduces with progressive rehabilitation Mining Area B – Progressive increase in impact over course of mine life. Some rehabilitation of emplacement will commence in Year 12, however, the majority of rehabilitation doesn't happen until Year 21	Moderate to substantial
1213	Mining Areas A and B - emplacements	Mining Area A – Progressive increase in impact until Year 8 when rehabilitation commences. Impact then reduces with progressive rehabilitation. Mining Area B – Progressive increase in impact over course of mine life. Some rehabilitation of emplacement will commence in Year 12, however, majority of rehabilitation doesn't happen until Year 21	Moderate to substantial

The five rural properties identified above are currently in private ownership. However, CHC is currently discussing the impacts with the landholders and will acquire the properties if the owners desire this. Should these properties be acquired, then the impacts as described above would no longer be relevant.

If any of the above properties do remain in private ownership, individual visual assessments should be undertaken for each to identify the specific visual impacts and determine the most appropriate mitigation measures. Measures such as early targeted planting around residences to provide foreground and mid-ground buffers would need to be implemented.

Also, along exposed sections of Sweeneys Lane, targeted planting of Box Gum Woodland species would be desirable.

iv Impacts of night lighting

Viewers from this viewpoint and the private residences identified above, would be subject to moderate visual impacts from mobile mine equipment working on active emplacement areas of Mining Areas A and B. Light spill from these areas has the potential to be of distraction to motorists and provide disturbance to private residences to the west.

To minimise the amount of light spill along the outer edge of the emplacements at Mining Areas A and C, workings on out-of-pit emplacements benches will be staged, wherever possible, so that outer embankments will be created first around the perimeter, providing a visual screen while work is undertaken in the central part of the emplacement. The height of this bund would need to be adequate to minimise light spill from all types of mobile mine equipment that will be operating on top of the emplacements.

v Duration and significance of impacts

The final landform in the vicinity of Mining Areas A and B will appear as an extended ridgeline in the mid-ground when viewed from VP3 and VP4. Due to the lower elevation of these viewpoints, this altered landform will appear as a new element on the horizon. To maximise compatibility, the detailed design of these waste rock emplacements will need to mimic the adjoining ridge contours to the extent that stability and drainage will allow.

Unmitigated visual impacts from this viewpoint would be moderate to substantial to the very small number of motorists who use Sweeneys Lane. Assuming the proposed mitigation measures are implemented, in particular early planting and screening, impact would be reduced to a moderate level. CHC is committed to acquiring the remaining private residences to the west of the Project area should the landholders desire this. Discussions are currently underway.

5.1.4 VP5 and photomontage No.4–Spring Ridge Road Diversion (views to mine pits and mine infrastructure)

i Viewpoint type and context

The relevant viewing directions from VP5 to the Project are to the north, east and south as shown in Figure 5.1. The existing view is shown in Figure 5.11. Viewers from this location would typically be motorists travelling east along the Spring Ridge Road diversion and they would see grazing land in the foreground and mid-ground, and a background of vegetated foothills and ridgelines which define the horizon.

The landscape is typical of a rural setting with little in the way of cultural modifications, although cleared land and fences are visible. The viewpoint is considered to have a moderate to high visual sensitivity due to its low level of modification.

Figure 5.11 Views from VP5 Toward Location of Mine Infrastructure Area

ii Impacts of mine infrastructure

Viewers from this location will have views of both the Mine Infrastructure Area and the CHPP. The Mine Infrastructure Area will be visible from its construction in Year 1 until its removal in Year 21.

Various infrastructure elements have the potential to dominate the landscape during the mine life. Elements such as the CHPP, ROM pad and workshops will all be visible to passing motorists as they travel through this viewpoint. To reduce impacts these structures will need to be coloured in tones that are compatible with the surrounding landscape. The sensitivity of viewers to the mine and its various elements will vary from person to person. Whilst some viewers may consider the impacts of the mine infrastructure and mining operations to be significant and negative, others may be curious about the Project to which they would not normally have exposure to. This could lead to motorists/viewers travelling along Spring Ridge Road to want to slow down or stop to view the Project from this viewpoint where exposure to mine operations and infrastructure is possible from a public roadway. In the interest of motorist's safety and to meet public interest in the Project, it may be beneficial to construct a viewing area off Spring Ridge Road in this vicinity.

Photomontage 4 - Existing (Spring Ridge Road Diversion)

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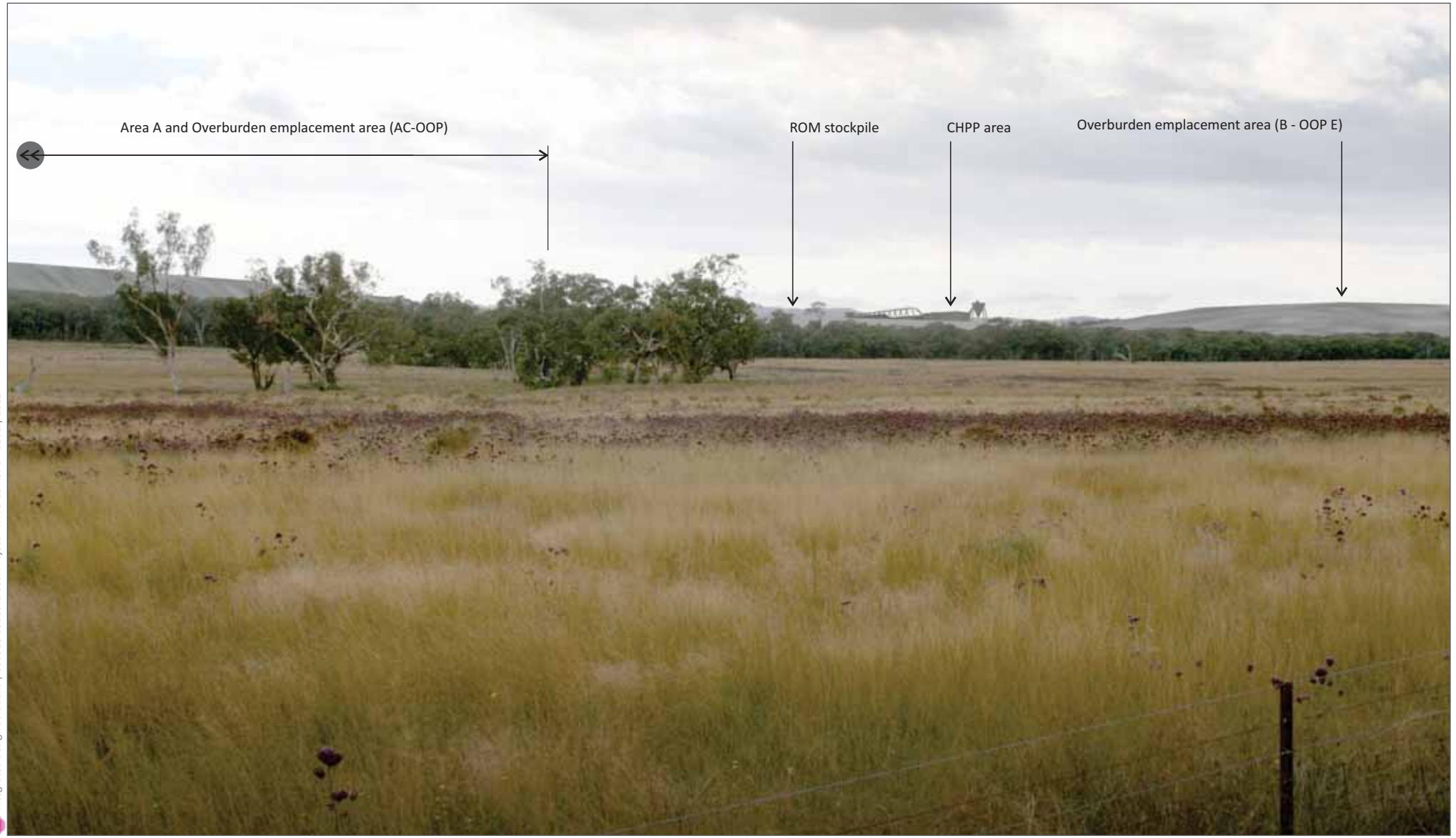
Figure 5.12



Photomontage 4 - Year 8 (Spring Ridge Road Diversion)

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Figure 5.13

Photomontage 4 - Final Landform (Spring Ridge Road Diversion)

Cobbora Coal Project - Visual Assessment

Figure 5.14

iii Impacts of mine activities

The proximity of the viewing point to Mine Areas A, B and C and their associated emplacements means they will be visually significant to motorists at this viewpoint. Some screen planting will occur on either side of the roadway which will soften the impact over time, although, total screening of the emplacements will not be possible. Early rehabilitation of these areas will be the most effective way of reducing the visual impacts. Rehabilitation of the southern tip of Mining Area A commences in Year 4 and by Year 8 the emplacement will appear in its final landform. Rehabilitation of the emplacement to Mining Area B will commence in Year 12 and whilst the majority of the emplacement's northern end will appear in its final landform by Year 16, total rehabilitation of this area will not be completed until Year 21.

iv Impacts of night lighting

Viewers at this location will be exposed to lighting associated with activities within Mining Areas A and B AC-OOP and B-OOP E, the CHPP and Mine Infrastructure Area. Temporary lighting structures and mobile mine equipment lighting will be visible and lighting from in-pit activities will produce sky glow.

Whilst the impact of sky glow on viewers from this location is not likely to be significant, lighting impacts from works on top of the active emplacements and OOP emplacements could be a significant distraction to motorists travelling south along Spring Ridge Road. To reduce such impacts, workings on out-of-pit emplacements benches will be staged so that outer embankments will be created first around the perimeter, providing a visual screen while work is undertaken in the central part of the emplacement. Control of lighting spill from this viewpoint will also need special attention in the proposed Lighting Management Plan.

v Duration and significance of impacts

Visual impacts, including night lighting, associated with the infrastructure elements visible from this viewpoint will remain for the duration of the mine life. These elements will be constructed prior to the operational phase of the mine and will not be removed until the completion of mining in Year 21.

Visual impacts from Mining Areas A and B will commence in Year 1 and increase in significance until Year 8 when rehabilitation of the southern end of Mining Area A commences. Rehabilitation of Mining Area B commences in Year 12 and views to the northern end of Mining Area B will appear fully rehabilitated by Year 16 (see Figure 5.14).

Unmitigated visual impacts from this viewpoint would be high. The proposed mitigation, in particular early screen planting, bunding and light spill control, will reduce the visual impact to a moderate level. The creation of a viewing area over the mine would be positive for those interested in the mine's operations.

5.1.5 VP6–Dapper Road: RL446

i Viewpoint type and context

The relevant viewing directions from VP6 are to the north, east and south as shown in Figure 5.1. Viewers of the Project from this location would typically be motorists travelling east along Dapper Road toward Spring Ridge Road.

The landscape is dominated by grazing land in the foreground, with vegetated hills and ridges in the mid to background. The topography is varied with flat land in the foreground, vegetation lining Spring Ridge Road in the mid-ground and hills and ridges in the background.

There have been a number of modifications to this landscape: rural residences, power lines, fences, rural roads and cleared farmland are all apparent in the fore and mid-ground. This landscape has a moderate visual sensitivity.

Figure 5.15 Views Toward Mining Area B

ii Impacts of mine infrastructure

Some elements of mine infrastructure, such as the CHPP, will be visible in the mid-ground at a distance of approximately 3.5 km. These elements will quickly become obscured by Mining Area B as the Project moves to an operational phase.

iii Impacts of mine activities

Viewers from VP6 will be exposed to Mining Area B for the full 21 years of mining. Due to the viewpoint's higher elevation, views to the mine pits and emplacements may be possible as mining progresses southwards.

In Year 12, Mining Area B will have progressed across Dapper Road and a new section of road will be constructed with traffic being redirected along this to join up with Spring Ridge Road. The Dapper Road diversion will run parallel to Mine Area B and within close proximity to the open cut pit and emplacement which could provide a distraction to motorists, albeit a very small number. The indicative road diversion alignment passes alongside a heavily vegetated band of Blue-leaved Ironbark woodland which commences immediately to the south of Mining Area B. It is recommended that a band of this woodland be extended north along the remainder of the eastern side of the road diversion to help screen the mining area and active emplacements which would otherwise be dominant visual elements.

iv Impacts of night lighting

Due to its higher elevation, views from VP6 to the open pits and emplacements will be possible for the duration of operations within Mining Area B, being Year 1 to Year 21. As with other viewpoints that are exposed to work on active emplacements, staging of work, wherever possible, to create the outer embankments of the out-of-pit emplacement benches and appropriate light control will be required measures to protect viewers at VP6. The elevation of this viewpoint means that mitigation such as screening and lighting measures are likely to have limited effect. The recommended planting of Blue-leaved Ironbark woodland species such as *Eucalyptus nubila* will be the most effective means to screen lighting impacts to the new section of Dapper Road.

v Duration and significance of impacts

Impacts to VP6 from Mining Area B will commence in Year 1 and continue to Year 12 when traffic will be closed to this section of Dapper Road. As a result of the higher viewing elevation, effort can be made to minimise visual impacts from this viewpoint through screening of emplacements and lighting measures, however, it is likely to have only limited effect.

From Year 12 onwards, this section of Dapper Road will be closed and motorists redirected along a new section of roadway. The roadway will be close to the open pits and emplacements of Mining Area B, but implementation of a vegetative screen to link up with the existing band of Blue-leaved Ironbark woodland would act as an effective visual barrier.

Unmitigated visual impacts from this viewpoint would be moderate to significant and viewed by a very small number of motorists who use Dapper Road. The proposed mitigation measures would reduce impacts to moderate by Year 12 and slight to moderate from Year 12 to Year 21.

5.1.6 VP7 and photomontage 3–Corner Spring Ridge Road and Laheys Creek Road: RL405

i Viewpoint type and context

The relevant viewing direction from VP7 is to the north-west around to the south-east as shown in Figure 5.1. As Figure 5.16 shows, the existing outlook is rural and scenic with the foreground dominated by open paddocks and trees along Spring Ridge Road, while the mid- and background exhibit heavily vegetated ridgelines which define the horizon. Viewers from this location would typically be motorists travelling north or south along the Spring Ridge Road or west along Laheys Creek Road.

The landscape has little in the way of modifications, although cleared land and fences are visible. The viewpoint is considered to have a moderate visual sensitivity.

Figure 5.16 VP7 Views to West of Spring Ridge Road

ii Impacts of mine infrastructure

At a distance of approximately 3 km and given the intervening topography and vegetation, there will be no impacts from any of the mine infrastructure from this viewpoint.

iii Impacts of mine activities

Views of mining operations from VP7 will be to Mining Area B and B-OOP W. Visual impacts of the associated emplacements will commence in Year 8 as mining operations cross Dapper Road and progress southwards. The visual impact of the emplacements will progressively increase as the footprint of both continues to expand to the south and west.

Viewers at VP7 would be exposed to mobile mine equipment working on active emplacements from Year 12 to Year 20 in the case of Mining Area B and Year 8 to Year 16 in the case of B-OOP W. Existing vegetation along Spring Ridge Road offers a substantial screening of the mine activities. Motorists travelling along Spring Ridge Road will, however, have sporadic exposure to mine activities where vegetation it sparse, as shown in Figure 5.17. This is indicative of the maximum predicted visual impact. To reduce impacts, targeted infill planting will be necessary along sections of this roadway and species common to the existing Grey Box (*Eucalyptus microcarpa*) and Fuzzy Box (*Eucalyptus conica*) woodland communities are recommended.

EXISTING

YEAR 20

FINAL LANDFORM

EMM

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Photomontage 3 - Spring Ridge Road

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Figure 5.17

iv Impacts of night lighting

Viewers at this location will be exposed to lighting from Mining Area B and B–OOP W. Temporary lighting structures and mobile mine equipment lighting are likely to be visible and in-pit mining activities will produce sky glow.

Whilst the impact of sky glow on viewers from this location is not likely to be significant, lighting impacts from work on top of the out-of-pit emplacement areas has the potential to distract motorists. Staging of work to create the outer embankments of the out-of-pit emplacement benches will minimise light spill from lighting sources in this area, reducing the visual impact of night lights. This is of particular importance between Years 16 and 20 when the majority of the rehabilitation works to Mining Area B will be undertaken.

v Duration and significance of impacts

Impacts from this viewpoint will commence in Year 12 as mining operations cross Dapper Road. The B–OOP W will progress southwards in close proximity to Spring Ridge Road until Year 16 by which time the OOP emplacement will flattened and rehabilitated.

The visual impact of Mine Area B will initially be only the open cut as it progresses south between Years 12 and 16. During this period, there would be little in the way of visual impact as it will not be possible to view the pits from this viewpoint. Some sky glow from mine operation may be possible. From Year 16 to Year 20 the emplacements will become progressively more visually significant.

It is considered that the implementation of targeted screen planting, combined with screening from creation of the outer embankments of the out-of-pit emplacement area, and development of appropriate night lighting measures will contain impacts to being minimal.

5.1.7 VP8 - Laheys Creek Road looking east to rail crossing overpass: RL425

i Viewpoint type and context

The relevant viewing direction from VP8 is to the east as shown in Figure 5.1. The current scenic rural view is shown in Figure 5.18. Viewers from this location would typically be motorists travelling east along Laheys Creek Road.

The landscape is typically rural with a moderate level of modification and has a moderate visual sensitivity.

This viewpoint is close to two residences which are likely to remain in private ownership for the duration of the Project. These two properties are identified as Residence ID No.s 3108 and ID 5001.

Figure 5.18 View to East from VP8

ii Impacts of mine infrastructure

This viewpoint is located some distance from the mine infrastructure area and will experience no visual impact from the CHPP or associated infrastructure.

The rail spur will cross Laheys Creek Road in the foreground of this viewpoint and consequently viewers will be exposed to the train movements during the day and night. To provide an appropriate grade for the railway at this location, construction of embankments on either side of the roadway to approximately 7.5 m above the roadway will be necessary. This will result in a new dominant element which will remain as a permanent feature within the landscape.

The two private residences (3108 and 5001), located to the south of this viewpoint, will be impacted by both the embankments associated with the crossing of Laheys Creek Road and the train movements. The rail line will pass between the two properties on land owned by CHC and will pass within approximately 200 m of each residence.

Should these two properties remain in private ownership, which appears to be both landholders' preference, careful consideration will need to be given to measures which will reduce visual impacts of the rail line on these landholdings. A combination of earth bunding and vegetative screening would be necessary to reduce visual impacts. The earth bund should be at least 3 m high to provide immediate screening while vegetation is being established. The length of the earth bund should extend at least 500 m either side of the residences and have regard for train lighting impacts to both residences.

With respect to Residence ID No.3108, bunding and screening design should also consider potential views from this receptor to the earth embankment associated with the Laheys Creek rail crossing. Bunding and vegetative screening should be sited as close as possible to the private residences to maximise its benefit.

iii Impacts of mine activities

This viewpoint is located approximately 1 km from Mine Area B and B-OOP W. Intervening topography and vegetation will screen any views to these areas.

iv Impacts of night lighting

Viewers at VP8 will be exposed to night light associated with train movements.

Motorists travelling along Laheys Creek Road will see trains approaching from either the north or south from a distance as the land is relatively open at this viewpoint. Trains will be climbing up an embankment approximately 6m above the roadway. Consequently, lighting from night time train movements is more likely to be directed upward at this viewpoint. This may result in additional sky glow to the surrounding area, however, it is not considered that the impacts of train lighting associated with night time rail movements will create a distraction to motorists that requires mitigation.

As mentioned above in (ii), design of bunding and vegetation buffers to reduce visual impacts to properties 5001 and 3108 should have careful regard to reducing the effects of night lighting at those properties.

v Duration and significance of impacts

Visual impacts, including night lighting impacts, associated with the train movements visible from this viewpoint will remain for the duration of the mine life. At the completion of the Project, the track and embankment would remain.

Unmitigated visual impacts from this viewpoint would be moderate to motorists along Laheys Creek Road but significant to the two private residences in the vicinity the proposed mitigation. In particular, the targeted vegetative screening and appropriate light control measures would reduce the visual impact to a moderate level which is assessed for both motorists and the two private land residents.

5.1.8 VP9–Brooklyn Road looking west: RL526

i Viewpoint type and context

The relevant viewing direction from VP9 is to the west as shown in Figure 5.1. As Figure 5.19 shows, views from this location are rural and scenic, with the foreground dominated by large areas of open grazing land, the mid-ground and background exhibiting undulating foothills and ridgelines which define the horizon. Modifications in this area are limited to an unsealed roadway, fences, a rural dwelling and clearing. Viewers from this location would typically be motorists travelling west along Brooklyn Road or would be at one of the approximately five private residences in the vicinity of this viewpoint. Due to the relatively unmodified landscape and attractive rural setting, the visual sensitivity of this viewpoint is considered to be moderate to high.

Figure 5.19 View to the West from VP9 Along Proposed Rail Spur

ii Impacts of mine infrastructure

This viewpoint is located some distance from the mine infrastructure area and will experience no visual impact from the CHPP or associated infrastructure.

The rail spur will travel alongside Brooklyn Road in the vicinity of this viewpoint and the prevailing topography dictates that the spur will require both cuttings and embankments. The movement of trains in such close proximity to the roadway and some nearby private residences will be a dominant occurrence with embankments of up to 9 m high in some areas. Figure 5.20 illustrates the location of cuttings, embankment and road crossing associated with the rail spur and their proximity to privately owned residences. Exposure to train movements at a close viewing distance could also be a distraction to motorists and a negative viewing experience to residents if left unmitigated.

This visual assessment has identified a number of properties in close proximity to the rail spur in the vicinity of this viewpoint that are likely to experience impact from the movement of trains. These residences are:

- 3062 – This private residence is located approximately 500 m from the rail spur, however, the residence is well screened due to surrounding vegetation and views to the spur are not possible. Some foreground views to the spur are possible from other sections of the property. The spur will be on a small embankment, typically less than 2 m in the vicinity of this property and screening should be implemented to reduce the visual impact of train movements through this area;

- 3052 – This private residence is located approximately 1.25 km from the rail spur and due to the elevated position of this property, some mid ground views of the rail spur will be possible. Embankments up to 9 m high may be visible from sections of the property, however, intervening vegetation will have a screening effect to some extent. Further plantings along the rail embankment would assist to further minimise views of train movements through this area;

- 3057 – This private residence is sited approximately 300 m from the rail spur and views to the north-east of train movements transitioning from cutting to embankments approximately 6 m high will be possible. Existing vegetation will screen views to the rail spur, however, additional targeted planting is considered appropriate to further screen train movements and embankments due to the close proximity of the receptor; and

- 3041 and 3043 – These private residences are located approximately 850 m and 450 m respectively from the rail spur and views looking south to the spur will be possible due to the relatively flat intervening terrain and lack of vegetative screening. Much of the spur will be located in cutting as viewed from these residences and, where not in a cutting, it will be situated on embankments of generally less than 2 m. Targeted vegetative screening to areas where train movements will occur would effectively screen off any views of rail movements for these receptors.

CHC is committed to acquiring these properties pending the agreement of the landholders. Where these properties remain in private ownership, it is recommended that vegetative screening be planted between the rail line and the residence. The appropriate length of screening, as well as length and design of bunding, would be determined via an onsite assessment having regard to intervening topography and existing vegetation. The bunding and vegetative screen should be sited as close as possible to the private residences to maximise their benefit.

A number of the properties identified above may also be exposed to the power lines that will be erected alongside the rail spur. The design of this power line should have consideration to the location of these properties and where possible ensure poles are not located in areas which will impact residences. Where this is not practical, vegetative screening should be considered to minimise exposure to power poles.

iii Impacts of mine activities

This viewpoint is located approximately 13 km from mine areas and, as such, intervening topography and vegetation will screen any views.

iv Impacts of night lighting

As the Project will operate 24 hours a day it is likely that some rail movements will occur at night and therefore viewers at VP8 may be exposed to night light from trains. The vegetative buffer recommended in (ii) above should minimise any impacts but detailed assessments of each property would be recommended.

v Duration and significance of impacts

Visual impacts, including night lighting, associated with the train movements visible from this viewpoint will remain for the duration of the mine life. The rail spur will be constructed prior to the operational phase of the mine and will not be removed. At the completion of operation mining, trains will cease to travel on this line.

Unmitigated visual impacts from this viewpoint would be moderate to significant to motorists travelling along Brooklyn Road. Once established, the proposed mitigation, will reduce impacts to slight and therefore acceptable.

5.1.9 VP10 and VP11 – Castlereagh Highway railway crossing: RL 503

i Viewpoint type and context

The relevant viewing description from VP10 and VP11 to the Project is to the west as shown in Figure 5.1. Viewers from this location would typically be motorists travelling north or south along the Castlereagh Highway.

Views from these locations are typically rural and scenic, with the foreground dominated by open grazing land. The mid-ground and background exhibit undulating hills and scattered vegetation which define the horizon. Existing views are shown in Figures 5.21 and 5.22.

This landscape has a moderate level of visible modifications. Cleared land, the highway, power lines, fences and other structures along the highway are all visible. The viewpoint is considered to have a moderate visual sensitivity.

ii Impacts of mine infrastructure

This viewpoint is located some distance from the Mine Infrastructure Area and will experience no visual impact from it. The rail spur will, however, cross the Castlereagh Highway near this location and consequently viewers will be exposed to train movements during the day and night, although trains will pass under the highway via a cutting, thereby reducing their exposure. Lighting associated with night train movements will have the potential to affect viewers travelling along the Castlereagh Highway and the potential impacts are discussed further at (iv).

iii Impacts of mine activities

Due to distance, topography and intervening vegetation, these viewpoints are far removed from the mining area and therefore no visual impacts will be experienced.

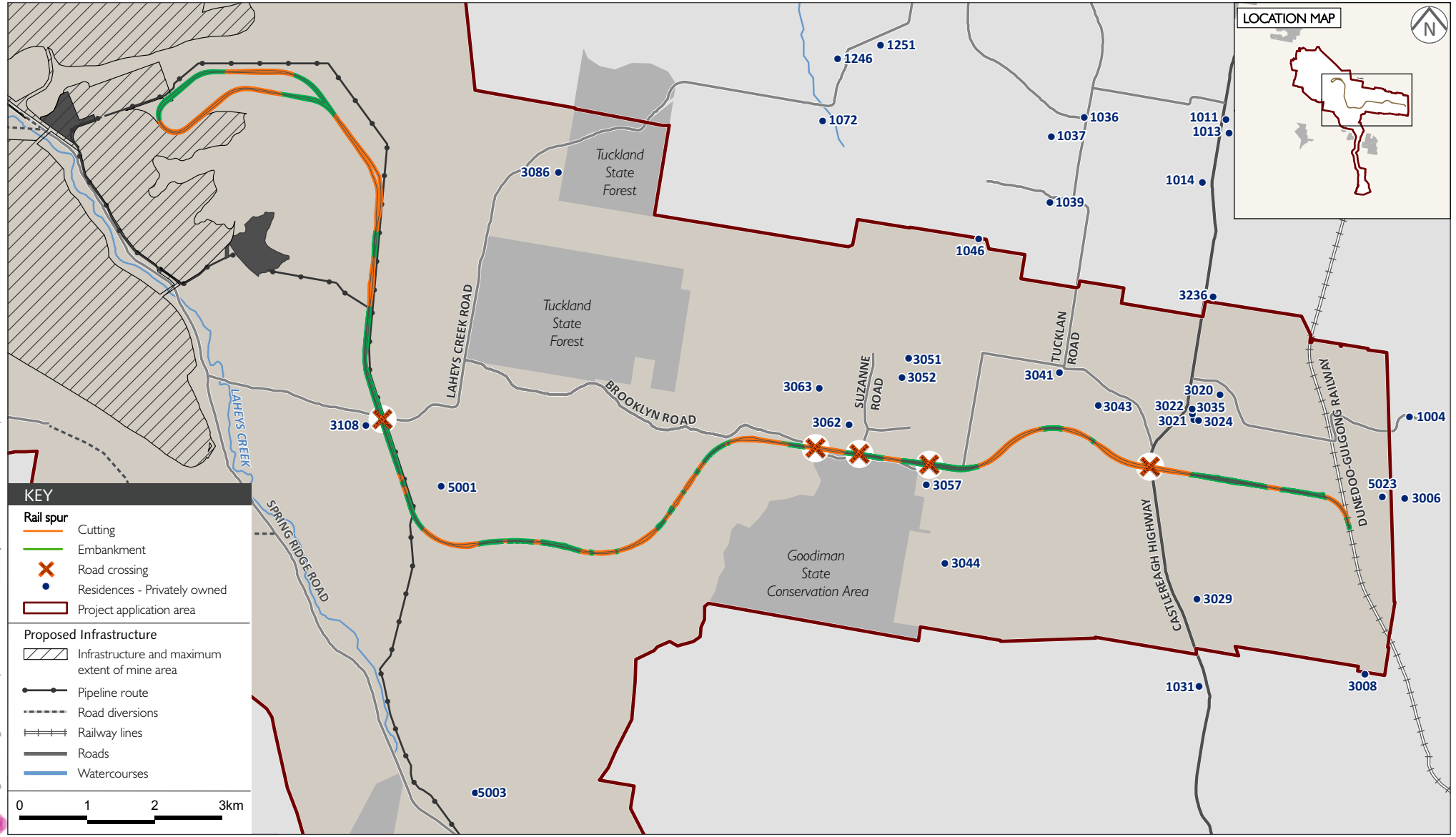
iv Impacts of night lighting

At peak operation, there will be a total of 10 train movements per day, five to the east and five returning. Some of these movements may be during the night period and thus there is potential for night lighting impacts. The rail spur runs perpendicular to the highway and will cross via a cutting and underpass. The cutting will screen direct views of the trains but there is still potential for light spill which could distract motorists. Actual impacts can only be estimated once rail design layouts showing relative levels are available. Once detailed designs of the rail spur are complete, a more comprehensive lighting assessment should be undertaken and if there is a real risk of driver distraction, additional safeguards should be devised. These would probably be vegetated screening or framing along the cuttings.

v Duration and significance of impacts

This viewpoint's visual impacts are associated with train movements and night lighting and will remain for the duration of the mine life.

Unmitigated visual impacts from this viewpoint would be moderate to motorists along Castlereagh Highway. However, with the proposed mitigation, impacts would be reduced to slight and therefore acceptable. This conclusion assumes that the detailed design retains cuttings and an underpass, and that any necessary screening identified will be provided at that stage.



Location of Cuttings, Embankments and Road Crossings along Rail Spur

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Figure 5.20

Figure 5.21 View to North Along Castlereagh Highway from VP10

Figure 5.22 View from VP11 to South Along Castlereagh Highway

6 Mitigation measures

6.1 Mitigation of visual impacts

The Project's design has evolved considerably since the original concept was lodged with DP&I in 2010. Design developments include reducing the mine output and pit sizes so that sensitive areas can be avoided, as well as relocating the CHPP and MIA to an area which is less exposed to viewers to the west. All of these amendments have reduced the overall visual impacts. This detailed assessment has led to further refinement of the Project to reduce visual impacts. However, changes in the landscape and some visual impacts are unavoidable, especially in the early phases prior to the commencement of rehabilitation. Various mitigation measures have been developed to address impacts both generally and from specific viewpoints surrounding the Project as described in Chapter 5. These are summarised below in Table 6.1 and illustrated in Figure 6.1. The exact form of each measure will be determined following individual assessments of each area and these design details will be incorporated into a Landscape Management Plan.

Activities will be scheduled to give priority to the establishment of the most exposed faces of overburden emplacements, so that they can be stabilised and then rehabilitated as soon as possible.

6.1.1 Progressive rehabilitation

Early and progressive rehabilitation of disturbed areas is generally the most effective way of minimising visual impacts. CHC is committed to undertaking this as an integral component of mining operations. The most exposed elements of the Project are the emplacements around Mining Area A which will be visually prominent from roadways and other receptors to the west. Rehabilitation will commence in Year 8 and continue progressively over the remainder of the mine life. Continual rehabilitation in this manner will ensure that exposure to active emplacements is minimised.

Elsewhere, rehabilitation will occur in accordance with Mine Rehabilitation Strategy which forms part of the Environmental Assessment (Appendix F) and as illustrated in Figures 4.3 to 4.10 of this report.

6.1.2 Visual screening

Screening in the form of foreground and mid-ground tree and shrub planting is a very effective way of reducing exposure of a receptor to various aspects of the mine operation and/or infrastructure. Once established, such planting provides a permanent and natural screen to the various element of the mine from either roadways or private landholdings.

Vegetative screens will consist of species that are common to the ecological community into which they are to be planted. Most planting will be undertaken during construction activities such as road upgrading or realignment. This will maximise the time available for establishment of the trees and plants, thereby ensuring the effectiveness of the screening as early as possible.

The specific areas where screen planting will occur are as follows:

- Residence ID numbers 1222, 1223, 3224, 3218 and 1213 assuming any or all of these properties remain in private ownership. The exact nature of each screen planting will be determined after individual site assessments and incorporated into the Landscape Management Plan;
- along the southern edge of the Golden Highway, generally between Sandy Creek Bridge and Sandy Creek Road;
- along exposed sections of the new Spring Ridge Road diversion;
- along exposed sections of the Sweeneys Lane;
- along exposed sections of Spring Ridge Road, east of Mining Area B and west of B -OOP E;
- along exposed sections of the rail spur in the vicinity of Residence ID numbers 5001, 3108, 3065, 3062, 3052, 3057, 3041 and 3043 on the assumption that any or all of these properties remain in private ownership and with details to be determined for incorporation into the Landscape Management Plan; and
- along exposed sections of the Dapper Road diversion.

6.1.3 Camouflage

Integration of otherwise dominant structures with the surrounding backdrops will minimise impacts. These elements are typically the large structures such as the CHPP and rail embankments which are all present for the entire life of the mine.

All such elements will be nominated in the Landscape Management Plan which will also specify the external colouring or treatment that is compatible with each element's surrounds. All relevant items will then be constructed in accordance with these specifications.

6.1.4 Night lighting

Various measures will be adopted to reduce light spill generally and provide shielding from exposed work areas, such as the outer faces or crests of overburden emplacements. These measures and other detailed design features for particular buildings or operating equipment will be incorporated into a Lighting Management Plan. The plan will meet the requirements of Warrumbungle DCP No. 1, AS 4282 and AS/NZS 1158, unless such compliance is practically impossible. In the unlikely event that any requirement cannot be met, special measures will be implemented in consultation with affected parties.

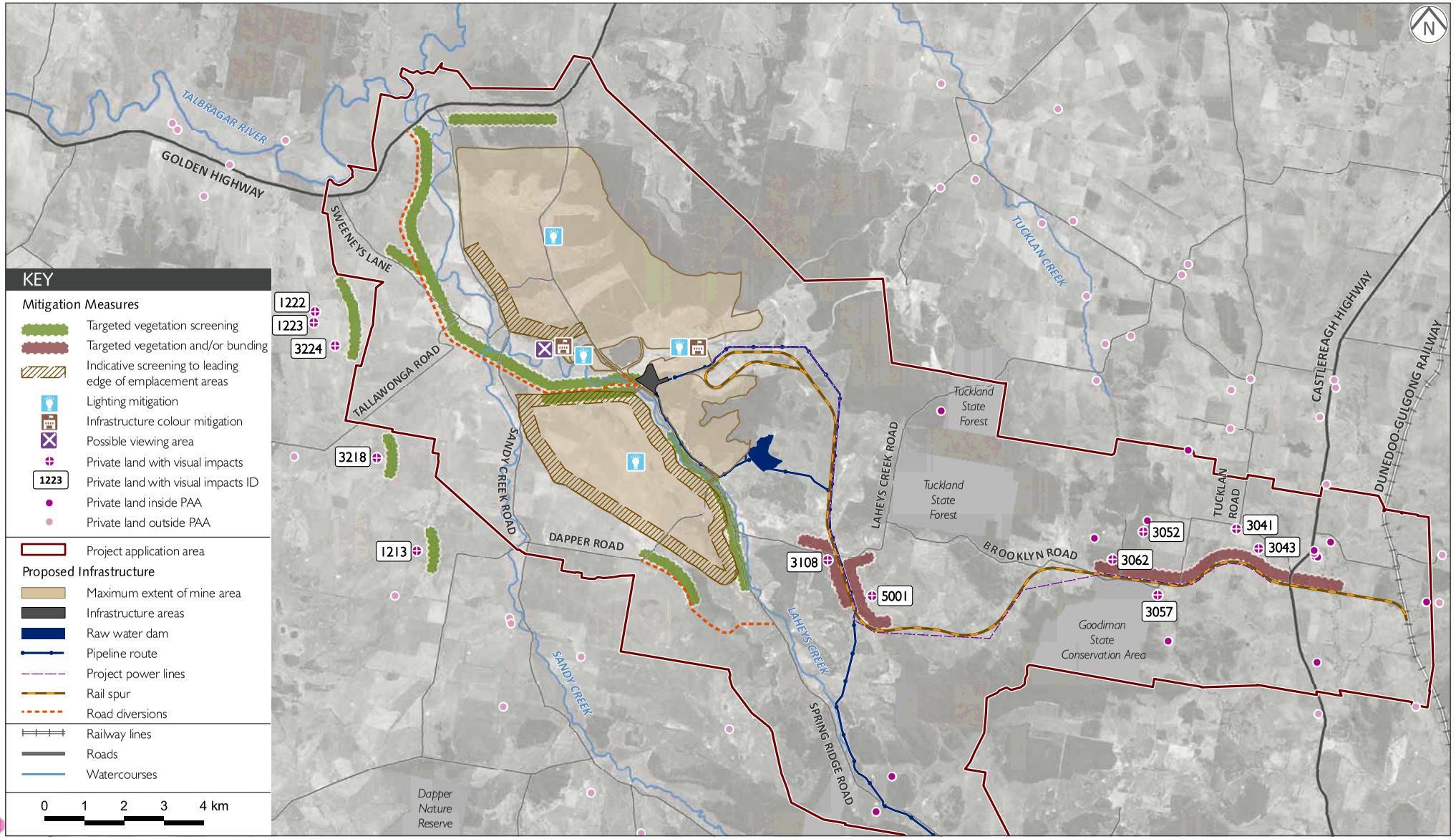
This VIA includes a qualitative assessment of lighting impacts as there is insufficient engineering information to undertake a quantitative assessment at this stage. The Project will be approximately the same distance from Siding Springs Observatory as Dubbo but will have far less lighting, so any impacts will be small compared with existing impacts. CHC have consulted with a representative of Siding Springs Observatory to gain an appreciation of potential impacts of lighting on night skies and Observatory operations. A more detailed assessment of potential light spill from the Project will be undertaken as part of detailed design by a suitably qualified lighting consultant who is familiar with the Observatory and its operational requirements. In general, basic principles will be applied which include:

- design light systems that minimise wastage;

- design light systems such that they do not rise above the horizontal;
- avoid lighting of light coloured surfaces which have greater reflectivity;
- avoid use of LED lighting which scatters light into the atmosphere; and
- wherever practical use High Pressure Sodium lights.

6.2 List of visual mitigation commitments

Table 6.1 itemises specific mitigation measures that will be implemented in and around the Project area.



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Mitigation Measures

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Figure 6.1

Table 6.1 Visual impacts and mitigation commitments

Area impacted	Impact Type	Detail of Impact	Mitigation commitment
• VP1 – Golden Highway	• visual – mine operations	• visual impact of Mining Area A active emplacement from Years 4 to 20	• early foreground and mid-ground screen planting of *Eucalyptus nubila* species. Details of planting to be determined from site specific analysis
	• visual – mine operations	• visual impact of mobile mine equipment working on active emplacements and batters	• as above
	• visual – mine operations	• visual impact of active mining operations at the northern tip of Mining Area A between Years 16 and 20	• as above
	• lighting – mine operations	• distraction to motorists from light spill from mobile mine machinery and mobile lighting towers	• preparation of Lighting Management Plan to control light spill and sky glow generally through design and operational protocols
• VP2 – Sweeneys Lane	• visual – mine operations	• visual impact of Mining Areas A and C active emplacements from Years 1 to 20	• early targeted foreground planting of *Eucalyptus blakelyi and Eucalyptus mellioobra* species along selected sections of Sweeneys Lane to screen views to Mining Area A. Details of planting to be determined from site analysis
	• visual – mine operations	• visual impact of mobile mine machinery working on active emplacements and batters to Mining Areas A and C	• as above
	• visual – mine operations	• visual impacts to active mine operation associated with Mining Area A	• as above
	• lighting – mine operations	• distraction to motorists from light spill from mobile mine machinery and mobile lighting towers	• workings on out-of-pit emplacements benches will be staged, wherever possible, so that outer embankments will be created first around the perimeter, providing a visual screen while work is undertaken in the central part of the emplacement. • preparation of Lighting Management Plan

Table 6.1 Visual impacts and mitigation commitments *(Cont'd)*

Area impacted	Impact Type	Detail of Impact	Mitigation commitment
• VP3/ VP4 – Sweeneys Lane at Willow Park	• visual – mine operations	• visual impact of Mining Area A and C active emplacements from Years 1 to 20	• early targeted foreground planting with *Eucalyptus blakelyi and Eucalyptus mellioobra* species along selected sections of Sweeneys Lane to screen impacts and views to Mining Area A. Details of planting to be determined from site analysis
	• lighting – mine operations	• Distraction to motorists from light spill from mobile mine machinery and mobile lighting towers	• workings on out-of-pit emplacements benches will be staged, wherever possible, so that outer embankments will be created first around the perimeter, providing a visual screen while work is undertaken in the central part of the emplacement. The emplacements will be designed to minimise light spill. • preparation of Lighting Management Plan
• Residence ID 1222	• visual & lighting – mine operations	• visual impacts associated with active emplacements and night lighting to Mining Area A from Year 1 to 20. Impact reduces from Year 8 with progressive rehabilitation of active emplacements	• site specific visual impact assessment to determine level of impact to any remaining private properties and to develop specific mitigation measures • potential for property to be purchased by CHC. If so, the above would no longer be required
• Residence ID 1223	• visual & lighting – mine operations	• potential visual impacts associated with active emplacements and night lighting to Mining Area A from Years 1 to 20. Impact would reduce from Year 8 with progressive rehabilitation of active emplacements	• site specific visual impact assessment to determine level of impact to any remaining private properties and to develop specific mitigation measures • potential for property to be purchased by CHC. If so, the above would no longer be required

Table 6.1 Visual impacts and mitigation commitments *(Cont'd)*

Area impacted	Impact Type	Detail of Impact	Mitigation commitment
• Residence ID 3224	• visual & lighting – mine operations and infrastructure	• visual impact of Mining Areas A and B active emplacements from Years 1 to 20. Impact from Mining Area A reduces from Year 8 with progressive rehabilitation of active emplacements. Some rehabilitation of emplacements will commence in Year 12, however, majority of rehabilitation doesn't occur until Year 21. • impacts of views to B – OOP E until Year 4 when rehabilitation is complete • impacts of views to CHPP area which will remain for life of the Project • night light impacts from above operations	• site specific visual impact assessment to determine level of impact to any remaining private properties and to develop specific mitigation measures • potential for property to be purchased by CHC. If so, the above would no longer be required
• Residence ID 3218	• visual & lighting – mine operations	• visual impact of Mining Areas A and B active emplacements from Years 1 to 20. Impact from Mining Area A reduces from Year 8 with progressive rehabilitation of active emplacements. Some rehabilitation of emplacements will commence in Year 12, however, majority of rehabilitation doesn't occur until Year 21	• site specific visual impact assessment to determine level of impact to any remaining private properties and to develop specific mitigation measures • potential for property to be purchased by CHC. If so, the above would no longer be required
• Residence ID 1213	• visual & lighting – mine operations	• visual impact of Mining Areas A and B active emplacements from Years 1 to 20. Impact from Mining Area A reduces from Year 8 with progressive rehabilitation of active emplacements. Some rehabilitation of emplacements will commence in Year 12, however, majority of rehabilitation doesn't occur until Year 21	• site specific visual impact assessment to determine level of impact to any remaining private properties and to develop specific mitigation measures • potential for property to be purchased by CHC. If so, the above would no longer be required

Table 6.1 Visual impacts and mitigation commitments *(Cont'd)*

Area impacted	Impact Type	Detail of Impact	Mitigation commitment
• VP5 – Sandy Creek Road Diversion	• visual – mine operations	• visual impacts from Mining Areas A & B active emplacements, AC – OOP and B - OOP	• early targeted foreground planting with *Eucalyptus blakelyi and Eucalyptus mellioobra* species along selected sections of Sandy Creek Road to screen impacts and views to Mining Area A. Details of planting to be determined from site analysis
	• Visual – mine infrastructure	• potential distraction to motorists from views to CHPP area and ROM coal stockpile	• construction of a dedicated viewing area along the side of Spring Ridge Road diversion to allow for safe viewing of mine operations and infrastructure
	• Lighting – mine operations and infrastructure	• light spill and sky glow impacts from mine operations and infrastructure	• preparation of Lighting Management Plan which is to include measures to minimise light spill and sky glow. Plan to meet requirements of Warrumbungle's DCP No.1, AS 4282 & AS/ NZS 1158 • design of structures within the main infrastructure area to have consideration for potential light spill to Spring Ridge Road
	• visual – colour of structures	• visual impacts and potential distraction to motorists of dominant mine infrastructure elements such as the CHPP and mine workshops	• structures within the CHPP area and Mine Infrastructure Area to be constructed in colours which are tonal variation of the surrounding landscape
• VP6 – Dapper Road	• visual – mine operations	• visual impact of Mining Area B active emplacements from Years 1 to 20	• early targeted foreground planting along Dapper Road diversion of *Eucalyptus nubila* species. Details of planting to be determined from site analysis
	• visual – mine operations	• visual impacts to active mine operation associated with Mining Area B from Years 1 to 20	• as above
	• lighting – mine operations	• Light spill and sky glow associated with active mine and active emplacement operations in Mine Area B and B-OOP W.	• preparation of Lighting Management Plan

Table 6.1 Visual impacts and mitigation commitments *(Cont'd)*

Area impacted	Impact Type	Detail of Impact	Mitigation commitment
• VP7 – Spring Ridge Road/ Laheys Creek Road intersection	• visual – mine operations • lighting – mine operations	• visual impact of Mining Area B active emplacements from Years 12 to Year 20 and B-OOP W from Years 8 to Year 16 • light spill and sky glow associated with active mine and active emplacement operations in Mine Area B and B-OOP W	• early targeted foreground planting along Spring Ridge Road diversion of *Eucalyptus conica* and *Eucalyptus macrocarpa.* Details of planting to be determined from site analysis • preparation of Lighting Management Plan
• VP8 – Laheys Creek Road (Rail Crossing)	• visual – mine infrastructure	• the rail crossing embankment will create a new dominant/permanent visual element in the landscape	• screen railway embankment by foreground planting for affected receptors
• Residence ID 3108	• visual & lighting – mine infrastructure	• visual and lighting impact of train movements in close proximity to receptor	• offer of site specific visual impact assessment to determine specific impacts to property and develop any mitigation measures necessary • construction of earth bunding along targeted section of rail spur to mitigate impacts of train movements. Height of bund to be a min. of 3 m • early targeted foreground planting *Eucalyptus blakelyi and Eucalyptus mellioobra* species along selected sections of rail spur to visually mitigate impacts of train movements. Details of planting to be determined from site analysis • preparation of Lighting Management Plan
• Residence ID 5001	• visual & lighting – mine infrastructure	• visual and lighting impact of train movements in close proximity to receptor	• offer of site specific visual impact assessment to determine level of impact to property and to develop specific mitigation measures • construction of earth bunding along targeted section of rail spur to mitigate impacts of train movements. Height of bund to be a min. of 3 m) • early targeted foreground planting with *Eucalyptus blakelyi and Eucalyptus mellioobra* species along selected sections of rail spur to visual mitigate impacts of train movements. Details of planting to be determined from site analysis • preparation of Lighting Management Plan

Table 6.1 Visual impacts and mitigation commitments *(Cont'd)*

Area impacted	Impact Type	Detail of Impact	Mitigation commitment
• VP9 – Brooklyn Road	• visual & Lighting – mine infrastructure	• visual and lighting impact of train movements in close proximity to roadway	• early targeted foreground planting with *Eucalyptus blakelyi and Eucalyptus mellioobra* species along selected sections of rail spur to mitigate visual impacts of train movements. Details of planting to be determined from site analysis
• Residence ID No.s – 3062, 3052, 3057, 3041, 3043	• visual & Lighting – mine infrastructure	• visual and lighting impact of train movements in close proximity to receptor • visual impact of railway embankments creating a dominant visual element in the landscape	• one or a number of these properties are likely to be purchased. If not, the following would apply: – site specific visual impact assessment to determine level of impact to property and to develop specific mitigation measures – construction of earth bunding along targeted sections of rail spur to mitigate impacts of train movements. Height of bund to be subject to future assessment/ design having regard for intervening topography, vegetation and final rail spur design – early targeted foreground planting of *Eucalyptus blakelyi* and *Eucalyptus mellioobra* species along selected sections of rail spur to visual mitigate impacts of train movements. Location of planting to be determined from site analysis – location of power poles to minimise visual impacts to private residences wherever practical
• VP10 and VP11 – Castlereagh Highway	• lighting – mine infrastructure	• potential lighting impacts of train movements approaching highway	• preparation of Lighting Management Plan

7 Conclusion

The Project design has progressively evolved to reduce its scale and attendant impacts, including visual impacts. Nonetheless, the development of the Project will change the landscape especially in the early stages prior to rehabilitation of exposed overburden faces and maturation of screen landscaping. Such changes will be noticeable to viewers and generally perceived as intruding into an attractive rural landscape. The magnitude of such impacts will, however, be localised because the Project area is distant from townships and major transport routes, and many affected neighbouring properties have already been acquired by CHC. Traffic volumes on roads in and around the Project are such that the number of affected motorists will be very low.

CHC has undertaken a comprehensive acquisition programme which has resulted in the purchase of the majority of residential properties where visual and lighting impacts may be significant. CHC is committed to purchasing any remaining residential properties where impacts exist where the landowner is amenable to sale of the property. Where purchase is not possible, CHC is committed to entering visual amenity agreements to identify and implement site specific screening measures to mitigate the impacts of the Project.

Where amenity agreements are reached with private landowners, impacts will be of a short to medium term in nature, until vegetative screening is established. Once an effective visual screen is established, the significance of impacts in these instances will reduce to be negligible.

This report has assessed visual impacts from all representative locations around the Project area. In some instances, distance combined with intervening topography and vegetation means that impacts will be minimised. Elsewhere, measures have been proposed to reduce exposure to mine elements at viewer locations, and/or minimise the contrast between the element concerned and the surrounding landscape. Some of these measures, particularly vegetation screening, will take time to become established and fully effective but, once established, the measures will mitigate visual impacts such that they will be generally acceptable to residents in the locality and to motorists. The above measures have been described conceptually in this report. They will be fully assessed and specified during the Project's detailed design phase and incorporated into Landscape and Lighting Management Plans.

The Landscape Management Plan will detail a range of planting and earth mounding measures, to reduce exposure of various viewpoints to the mine operation and infrastructure. Vegetative screens will be based on species common to the immediate area. Most planting will be undertaken during the construction phase of the Project to maximise the time for establishment of screening prior to the operation phase.

The Lighting Management Plan will describe design features for particular buildings, permanent lighting structures or operating equipment. It will be prepared to ensure the Project's compliance with *AS 4282 – Control of Obtrusive Effects of Outdoor Lighting* and *AS/NZS 1158 – Lighting for Roads and Public Spaces*. The lighting management plan will contain protocols to ensure compliance with *Warrumbungle Development Control Plan No.1 – Shire Lighting Control* to Protect Siding Spring Observatory.

This report has detailed a range of specific measures for each of the affected viewpoints to mitigate the impacts of the Projects from each of these locations. These measures are detailed in Section 6.2 of this report. Figure 6.1 provides an illustration of the mitigation measures proposed overall. Provided the recommended mitigation measures are implemented, the Project is not predicted to significantly impact the visual amenity of the area.

References

Standards Australia, 1997 *Control of the Obtrusive Effects of Outdoor Lighting* (AS 4282 – 1997).

The Landscape Institute of Environmental Management and Assessment 2002*: Guidelines for Landscape and Visual Impact Assessment (Second Edition).*

Warrumbungle Development Control Plan No.1 2004, *Development Control Plan No.1 – Shire Lighting Control to Protect Siding Spring Observatory.*

Appendix A

Warrumbungles DCP No.1 - Lighting code to protect Siding Spring Observatory

Development Control Plan

No. 1

Warrumbungle Shire Council

Lighting Code

to

Protect

Siding Spring Observatory

Development Control Plan No. 1 - Warrumbungle Shire Lighting Code to Protect Siding Spring Observatory

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Why dark night skies?

Warrumbungle Shire residents need to protect their dark night skies from light pollution because of the importance of Siding Spring Observatory, Australia's leading optical astronomical observatory.

The observatory is also an important contributor to the economy of the Shire, and its staff and their families are an important part of the Shire community. Warrumbungle Shire Council is committed to protecting our dark skies. Light pollution has a detrimental effect on professional and amateur astronomy, nocturnal animals and everyone's enjoyment of the night sky. Waste light is also wasted energy.

Good lighting

Siding Spring Observatory operates on the frontiers of astronomy, observing very faint objects at very great distances. Any light with a line-of-sight to the observatory affects observing conditions there – the brighter the light, the greater the impact. Any light shining up into the sky makes the sky less dark and observing less clear. Coonabarabran's town lights are the brightest light source the Observatory can see.

The answer to protecting observing conditions is not *no* lighting, it is *good* lighting. Good lighting does its job well, without causing a nuisance to others. It directs the right amount of light in the right place, does not shine upwards, does not annoy neighbours and does not cause glare, so it is safe, and saves energy. Good lighting benefits everyone.

The aims of this plan

This plan aims to help the observatory by preventing Warrumbungle Shire's dark skies deteriorating. It will do this by ensuring that all new lighting is good lighting and by encouraging existing lighting to be improved and better managed.

The plan also aims to guide residents and lighting consultants to install and manage good lighting with little or no disruption to people's normal life. Normal house lighting, as described in the Technical Annex, will not need council approval except within 18 kilometres of the observatory. This distance does not include Coonabarabran urban area. Unusually strong lighting such as tennis court or area floodlighting will need council consent throughout the shire.

This plan aims to be more effective and simpler than the plan it replaces.
It will help carry out the aims of Orana Regional Environmental Plan No.1 - Siding Spring and its replacement, the draft Siding Spring Observatory Dark Skies REP, as well as the Australian and United Kingdom Governments' joint agreement to site an optical telescope at Siding Spring Mountain. Warrumbungle Shire Council must observe these legal requirements and is committed to doing this.

In this plan, **Director** means the Director of the Australian National University research School of Astronomy and Astrophysics, or her delegate.

Name
This plan is called Warrumbungle Development Control Plan No.1 - Shire Lighting Code to Protect Siding Spring Observatory. It was approved by Warrumbungle Shire Council on 18-11-2004.

Where this plan applies

This plan covers the whole Shire of Warrumbungle, the same area covered by Coonabarabran Local Environmental Plan 1990 and Coolah Local Environmental Plan 2000.
It operates in rings at different distances from the observatory and with different degrees of control. These are called Area A, B, and C. The plan covers all outdoor lights and also indoor lights which can be seen from outside. It does not apply, except on a voluntary basis, to any lights existing when this plan was introduced, however replacements and upgrades must conform to this plan.

How this plan works with other plans

This plan provides more detail about lighting than Coonabarabran Local Environmental Plan 1990, Coolah Local Environmental Plan 2000, or Orana Regional Environmental Plan – Siding Spring. It is consistent with all these plans.

This plan replaces Coonabarabran Development Control Plan No. 2 – Coonabarabran Shire Lighting Code to Protect Siding Spring Observatory. That plan is repealed. Their content is similar, but the new plan adds a Dictionary and a Technical Annex.

International lighting zones for the night-time environment

The zones in this plan are based on international lighting zones developed by the CIE (International Commission on Illumination) which relate light to land uses. These in turn will be used in Australian Standards, although these may adopt a higher standard.
The table below explains the CIE zones.

Zone	*Description*	*Example*
E1	Intrinsically dark	Areas near observatories, national parks, forests, broadacre agriculture (roads unlit)
E2	Low district brightness	Rural residential
E3	Middle district brightness	Towns
E4	High district brightness	Major urban areas (high night-time activity)

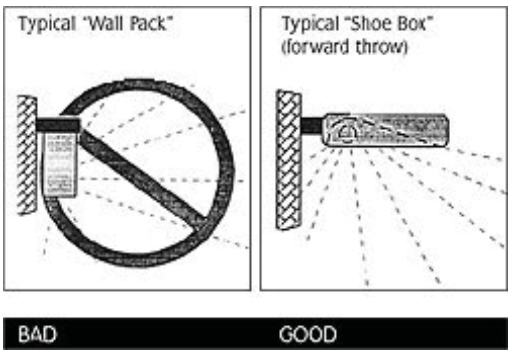
Only the E1 zone occurs in the shire. It is divided into three sub-zones based on distance from the observatory.

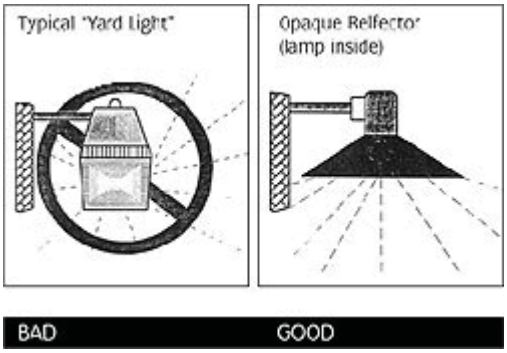
What makes good lighting?

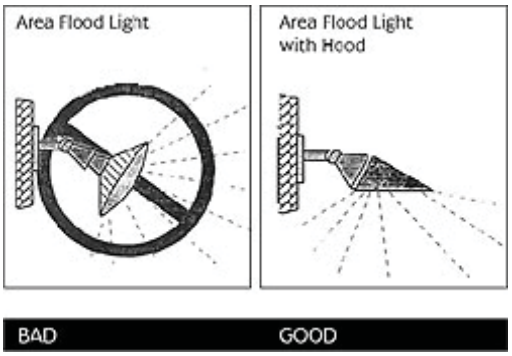
Good lighting –
- Uses the right amount of light for the job (only the amount necessary)
- Directs the light where it is needed (is shielded to avoid annoying neighbours and affecting Siding Spring Observatory)
- Does not create glare (so is safe and helps avoid crime)
- Does not waste energy (so saves money) or needlessly create greenhouse gases.

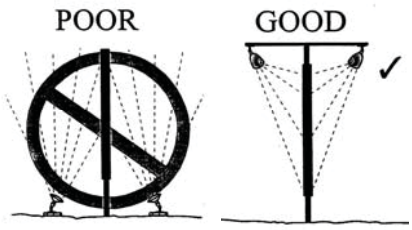
Fully shielded light fixtures, properly mounted, achieve good lighting. They stop light shining where it is not needed and stop it shining upwards. They prevent light trespass.

Examples of poor lighting and good lighting









Advice on lighting

Council staff can help you with advice on all types of lighting. Please ask them before you buy your light fittings.

Council consent and Director's concurrence

A few types of lights are not covered by this plan. See 'Lights that this plan does not cover' below. Normal residential and farm lights over 18 kilometres from Siding Spring Observatory do not need council consent if each is no more than 420 lumens or is a motion sensor light of not more than 1200 lumens, as described in the Technical Annex. The same applies to business, industrial and public lighting.
All other lights need council consent and some need the Director's concurrence. These are -
All lights in Areas A and B
Stronger residential lighting in Area C, including tennis court or area floodlights
All other business and industrial lights in Area C, including illuminated signs and all night businesses.
Lights totalling 15 000 lumens or more per development need the Director's concurrence.

Restricted and prohibited lighting

The number and brightness of lights is restricted in Zones E1a and E1b and some lights are prohibited in all zones. For details please see the Technical Annex at the end of this plan.

Types of Lighting

Street lighting and park and gardens lighting

All new streetlights will have high-pressure sodium lamps, except where it is important for safety to see colours clearly. In this case, metal halide lamps may be used with the concurrence of the Director.
All lights must have fully shielded fittings in Areas A, B, and C.
Park and garden lighting should follow Australian Standard AS/NZS 1158.3.1:1999.
The Australian Standards website is www.standards.com.au.

Sports fields and tennis courts

No sports field or tennis court lighting will be approved in Areas A and B.
In Area C, all sports field and tennis court lighting must have fully shielded fittings, installed so that no light shines above horizontal, to minimise sky glow. There must also be no light trespass to adjacent properties. (See Australian Standard AS 4282 Control of the obtrusive effects of exterior lighting, which deals with this). Indoor sports centres with skylights must prevent light escaping, by using curtains, blinds or shutters.

Security lighting

Good security lighting helps prevent crime, feels safer and is safer. But it needs to be well-aimed and low intensity, to avoid glare and harsh shadows that can hide people and make visibility more difficult. In Areas A and B, security lighting of unattended premises must use a motion detector sensor switch. This is also encouraged in Area C. Fittings must be fully shielded so that no light shines above the horizontal.

Shops, commercial and industrial buildings

Lighting of these buildings must cater for public safety, security and work needs. Under awning lighting must be recessed or integral with the awning. Building facade lighting should be aimed downwards and should be no brighter than necessary, taking account of the surrounding light conditions. When illuminating light coloured surfaces, care should be taken not to over-light them. Unnecessary brightness produces glare which makes it harder for people, especially older people, to see objects and people. This makes areas less safe not more safe. All lights must be fully shielded and only operate during normal business hours. Display lighting in shop windows, and advertising signs, should be switched off at the end of business hours or no later than 11pm.
Subdued internal security lighting may operate all night. Special exceptions can be approved for essential all night businesses.

In work areas where recognising colour is important, sodium lights cannot be used. Heritage buildings should use small light sources to accentuate their architectural details without causing unwanted light spill. Two Australian standards are useful for commercial and industrial buildings: AS/NZS 1158 3.1 Pedestrian area (Category P) lighting; and AS 4282 Control of the obtrusive effects of outdoor lighting.

Advertising signs

Illuminated signs add to the liveliness of towns but flashing signs are annoying to neighbours and are unsafe for pedestrians and motorists. They will not be allowed. All signs should be switched off either at the end of business hours or at 11pm, whichever is earlier. Essential businesses which operate all night must have specially approved low output lighting for signs. Bare lamps (eg festoon lighting) must be avoided unless they are completely screened, for instance by an awning.

The best illuminated signs have white or light-coloured lettering on a dark background without reflecting surfaces nearby. These signs are clearer to read and cause less glare, nuisance and stray light. They get their message across better.

Recreational, decorative, promotional and special effects lighting.

These lights are prohibited in Areas A and B. Lasers, searchlights and similar high intensity lights are prohibited everywhere except in emergencies by police or fire personnel, or to gather meteorological data. These lights are ineffective because they can only be seen from a distance but people usually cannot identify where the light is coming from.

Other lights should be fully shielded and well aimed to produce no upward light spill or nuisance to neighbours. They should be turned off at 11pm or before then.

Major developments in rural areas

All development, especially animal feedlots, animal saleyards, grain elevators, mines and gas flares on natural gas fields must take special care with lights to avoid upward light spill and nuisance to neighbours, including motorists. Most of these developments will need to be assessed by the Director.

Short term exemptions for temporary lighting

Temporary lighting is lighting operated for 28 days or less in one calendar year, whether or not the 28 days are consecutive. It includes lighting for televised sporting or other events, or single community events. Anyone may make a written request to the council for a short-term exemption from the requirements of this plan for temporary outdoor lighting. The request for the exemption must contain, as a minimum, the following information -

- Specific exemption requested
- Reason for the requested exemption
- Time period for use of proposed temporary lighting
- Proposed location of outdoor lighting
- Type and use of outdoor fixtures and lights proposed
- Details of screening and aiming of lights
- Total wattage, light output and type of lamps.

In addition to this information, the council may ask for any other information it needs to consider your request. This consideration will be done with the Director. The council will usually accept or reject your request in writing within twenty-one days of receiving it. Reasons for rejection may include special astronomical observations taking place at the time.

To speed up decisions on short-term exemptions the council will delegate its powers to approve them to nominated council staff. All requests not accepted by staff will be referred to the council for a decision. These may take longer than twenty-one days because council meetings are monthly.

Lighting that this plan does not cover

This plan does not cover -

- Lighting that existed prior to this plan, unless 25 percent or more of the lamps and/or fittings in an existing installation will be replaced, or any additional light fittings installed. However, voluntary compliance with this plan for all existing lighting is encouraged and this will help Siding Spring Observatory, neighbours and the community
- All lights on moving vehicles
- Lights on Commonwealth or State Government properties. However, these governments have agreed to comply with this plan
- Fires or fuel lamps, but it does cover lamps with an incandescent mantle, and gas flares on natural gas fields
- Fireworks and Christmas decorations, subject to an 11pm curfew.

Managing lights

Even when lights comply with this plan, you can help achieve dark night skies by managing lights well. This means –

- Shielding or screening outside lights
- Preventing inside lights shining outside. Using heavy curtains, blinds, or shutters and keeping doors closed achieves this. Do not forget skylights
- Preventing lights reflecting from white or other surfaces
- Using the minimum number and size of lights
- Switching lights off when they are not needed
- Installing time switches or, preferably, motion detector switches

Areas in this plan

This plan operates in rings from the observatory. These are shown on the map. These areas are -

Area	*Distance from Observatory* (radius in kilometres)
A	Less than 3
B	3 - 18
C	More than 18 - (includes all urban areas in the shire)

In Areas A and B, all new outdoor lighting (and indoor lighting which can be seen from outside) needs council consent and must be assessed by the Director. Indoor lighting includes lighting shining through skylights.

In Area C, all exterior lights over 420 lumens need council consent (except for complying motion sensor lights up to 1200 lumens), but only applications for lights totalling 15 000 lumens or more need to be assessed by the Director. This includes light from skylights. 15 000 lumens is roughly the amount of light from one 150 watt metal halide lamp. This is explained in the Dictionary and the Lamp Light Output Annex.

Making a development application - what to include

Please discuss your development with council staff before you prepare your application. The staff may be able to save you time, money and worry by helping you make a better application, which can gain a quicker consent. They may be able to advise you on the most suitable types of lights.

Your development application should include -

- Plans showing the location of the development
- Plans showing the location and type of lighting fixtures and their lamps
- A description of the lighting fixtures and lamps, their method of mounting and screening, and their aim. This description may include drawings (including sections where required), excerpts from manufacturers' catalogues and other useful information
- For commercial developments, certified photometric data for all specified lighting fittings. This should also include illuminance values for horizontal and vertical surfaces in the form of computer-generated output
- Where the council considers it necessary, NATA certified photometric data to IESNA standard, on computer diskette or CD.

These plans and descriptions should be sufficient to enable the council to determine quickly whether your application complies with this plan.
For a development application in Area C, the council may waive these requirements for such detailed plans if the total light will be less than 12 000 lumens.
The council will delegate to nominated council staff the power to decide whether a development application qualifies for this waiver.

Dictionary

Baffle An opaque or translucent element to shield a light source from direct view.

Brightness The strength of the sensation that results from the eye viewing the surfaces which the light comes from.

Bulb or lamp The source of electric light. To be distinguished from the whole assembly (see luminaire).

Candela (cd) Unit of luminous intensity. One candela is one lumen per steradian. Formerly called the candle.

CIE Commission Internationale de l'Eclairage. The International Commission on Illumination.

Colour rendering The effect of a light source on the colour appearance of objects in comparison with their colour appearance under a reference source at the same colour temperature.

Cut-off angle of a luminaire The angle measured between the line straight down and the line of sight at which all surfaces of high luminance (of lamps and of the luminaire) just cease to be visible.

Cut-off Luminaire A luminaire that provides a cut-off (shielding) of the emitted light so that no light is emitted above the horizontal. This applies to all lateral angles around the luminaire. This kind of luminaire is often referred to as Full Cut Off (FCO) or Fully Shielded.

Director In this plan, Director means the Director of the Australian National University Research School of Astronomy and Astrophysics, or her delegate.

Fully Shielded See definition for Cut-off Luminaire. If a luminaire is to be used which does not comply with this requirement then some form of permanent physical opaque material must be used to provide the cut-off requirement. This can be a cover or part of a building. Care must be taken to ensure that adjacent surfaces, especially if they are light coloured, are also shielded to prevent excessive reflected light from adding to unwanted sky glow or glare The shielding should be constructed to minimise emission in the 10 degrees below horizontal.

Glare Intense and blinding light. Never helps visibility. This is further described as either **discomfort glare** which, while causing discomfort, does not necessarily diminish visual performance, or **disability glare** which results in reduced visual performance and visibility.

HID lamp In a discharge lamp, the emitted energy (light) is produced by the passage of an electric current through a gas. High-intensity discharge (HID) includes mercury, metal halide, and high pressure sodium lamps. Other discharge lamps are low pressure sodium and fluorescent.

Illuminance - horizontal The density of luminous flux incident on a horizontal surface. The unit is lux (lumens/meter^2).

Illuminance – vertical The density of luminous flux incident on a vertical surface. The unit is lux (lumens/metre²).

IES – The Lighting Society The Illuminating Engineering Society of Australia and New Zealand. This body is the professional society of lighting engineers, including those from manufacturing companies and others professionally involved in lighting in Australia and New Zealand.

IESNA - Illuminating Engineering Society of North America The US professional society of lighting engineers, including those from manufacturing companies and others professionally involved in lighting. It is the major standardising body for illuminating engineering in the US.

IESNA format One of the recognised electronic formats used to store and present the photometric information which describes the light technical characteristics of luminaries.

Incandescent lamp Light is produced by a filament heated to a high temperature by electric current.

Intensity The degree or amount of energy or light in a given direction(s). The unit is candela (cd).

Light pollution Any adverse effect of artificial light. Often used to denote urban sky glow, but also includes glare, light trespass, visual clutter, and other adverse effects of lighting.

Light trespass Light falling where it is not wanted or needed. The terms Stray Light, Spill Light and Obtrusive Light can also be used to describe this.

Lumen The unit of luminous flux which is the light emitted by a lamp.

Luminaire The complete lighting unit, including the lamp, the fixture, and other parts.

Luminance The amount of light emitted in a given direction from a surface by the light source or by reflection from a surface. The unit is candela per square metre.

Lux One lumen per square metre. The unit of illuminance.

Mounting height The height of the fixture or lamp above the ground.

NATA National Association of Testing Authorities. This is Australia's authority for accreditation of laboratories producing certified reference materials.

Photometry The quantitative measurement of light level and distribution. Strict International and National Standards apply to ensure accuracy.

Photometric Requirements Photometric measurements for describing the light technical characteristics of a luminaire, so that they can be used to assess its performance and to enable accurate design calculations to be made. International Standards apply to ensure accurate presentation.

Reflected Light Not all light which causes sky glow is emitted directly from the luminaire. Reflected light from surfaces illuminated by the luminaire can cause varying amounts of sky glow. Light colours reflect more light than darker colours. When

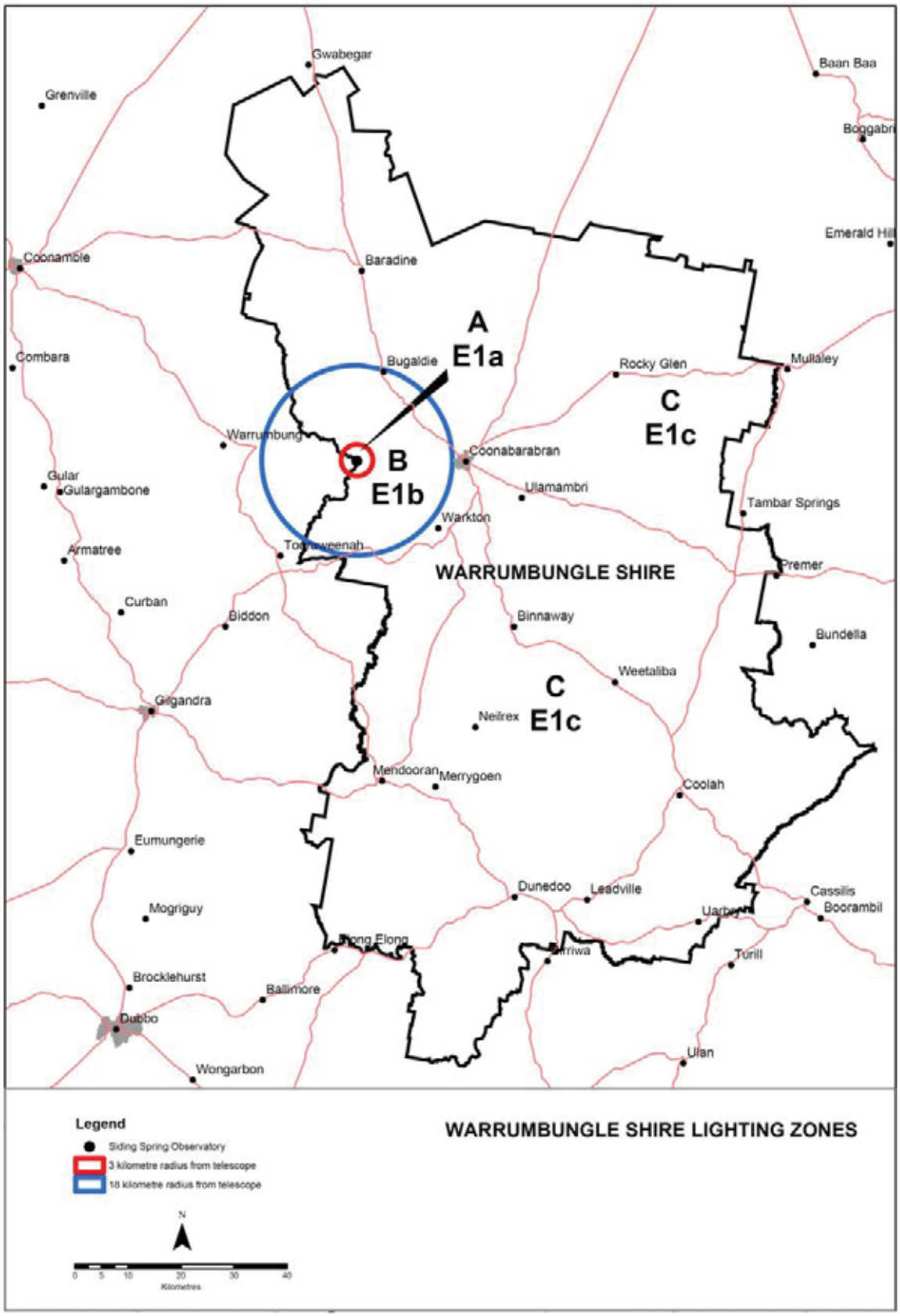
floodlights aimed at a grazing angle illuminate a vertical surface which has a specular (shiny) finish (such as windows), up to 70 percent of the light reaching that surface can be directed into the night sky at an equivalent angle.

Spotlight A fixture or lamp designed to light only a small area.

Steradian Light radiates in a sphere from a single bulb or lamp unless it is modified by a luminaire or baffle. A steradian is the angle, measured at the centre of a sphere, which cuts off an area on the surface of the sphere, that is equal to a square with sides the same length as the radius of the sphere.

Sky glow The brightening of the night sky due to artificial lighting.

Visibility Being perceived by the eye. Seeing effectively. The goal of night lighting.


Gwabegar
Grenville
Baan Baa
Boggabri
Emerald Hill
Coonamble
Baradine
A
E1a
Combara
Bugaldie
Rocky Glen
Mullaley
C
E1c
Warrumbungle
B
E1b
Coonabarabran
Gular
Gulargambone
Ulamambri
Tambar Springs
Warkton
Armatree
Premer
WARRUMBUNGLE SHIRE
Curban
Biddon
Binnaway
Bundella
Weetaliba
C
E1c
Gilgandra
Neilrex
Merrygoen
Coolah
Eumungerie
Dunedoo
Leadville
Cassilis
Boorambil
Mogriguy
Turill
Brocklehurst
Ballimore
Dubbo
Ulan
Wongarbon
Legend
Siding Spring Observatory
3 kilometre radius from telescope
18 kilometre radius from telescope
N
0 5 10 20 30 40
Kilometres
WARRUMBUNGLE SHIRE LIGHTING ZONES

Technical Annex – Warrumbungle DCP No. 1

Introduction

The purpose of this annex is to provide easily understood light technical parameters used in achieving the lighting requirements necessary to control skyglow and obtrusive light. These unwanted and adverse effects of lighting not only interfere with the work undertaken at Siding Spring Observatory but also cause discomfort to residents.

While every effort has been made to simplify the application of this important part of the Development Control Plan, if any queries arise they should be directed to the staff at Warrumbungle Shire Council.

CIE Zoning System

The introduction of the CIE Zoning System follows the acceptance of zoning as a well established base for environmental regulations. This system employs clearly defined environmental zones where limits can be set for both light emission and equipment performance specifications. Only the first (darkest) zone is used in the shire, divided into three sub zones.

Siding Spring is the site of an astronomical observatory of international standing and as such it demands the highest degree of protection. To establish this it is necessary to introduce the 3 sub zones described in this Development Control Plan.
These are -
Area A (0-3km) becomes Zone E1a
Area B (3-18km) becomes Zone E1b
Area C (over 18km) becomes Zone E1c.
The E stands for Environmental.

For the area beyond the 18 kilometre radius to the boundary of the shire, CIE Zone E1c will apply, with limited exceptions for some specific activities. These exceptions will be approved by the Council, in consultation with the Director, after nomination by either the Council or the Department of Infrastructure, Planning and Natural Resources.

Lighting Requirements

Zone E1a 0-3 km

Only two external lighting fittings are allowed for each property. Each lighting fitting must have lamps with a light output of not more than a total of 940 lumens per unit. Refer to the Lamp Light Output Annex for lamps which will comply with this requirement. All fittings must have an opaque top and/or shielding to prevent any light being emitted above the horizontal, thus complying with the Fully Shielded definition. Where aiming is possible any adjustment must be such that no light is emitted above the horizontal.

In order to prevent sky glow, glare and unwanted light trespass, the lamp (light source) in the luminaire (lighting fitting) shall not be directly visible when viewed by a person standing 4 metres from a point directly below the unit.

Where permitted, any lighting fitting employing an internal reflector type lamp must be shielded so that no light is emitted above the horizontal. Downlights must be deeply recessed with effective low glare baffles.

The use of any other spot lighting luminaires or floodlights of any type is prohibited in this zone. Bollard lights are also prohibited.

Any structural part of the luminaire or the surrounding material providing the cut off must be securely and permanently fixed. Where the luminaire is bracket mounted from a white or similar highly reflective surface, the light emitting surface of the luminaire facing the wall must be rendered opaque in a permanent manner, to reduce the amount of light reflected from the wall.

If intended as a security light during periods of non attendance etc, such luminaries must be fitted with a motion detector (sensor) switch rather than used continuously. Such a switch should be configured to shut off the luminaire a maximum of 5 minutes after activation.

In order to prevent light escaping through doors, windows and skylights into the night sky, the installation of heavy duty blinds, curtains or shutters is essential and the use of high powered interior lighting is prohibited.

All exterior lighting other than that specified above is prohibited. Note that this includes temporary decorative lighting and post top (bollard) lighting. Sign lighting and sports lighting of any type are also prohibited in this zone.

Zone E1b 3-18 km

Exterior lighting is limited to a total of 4 luminaires (lighting fittings), each with a single or multiple lamp combination producing not more than a total of 1800 lumens per unit. Refer to the Lamp Light Output Annex for lamps which will comply with this requirement. All units must have an opaque top and shielding to prevent any light being emitted above the horizontal, thus complying with the Fully Shielded definition. Where aiming is possible any adjustment must be such that no light is emitted above the horizontal.

Any structural part of the luminaire or the surrounding material providing this cut off must be permanently fixed. Where the luminaire is bracket mounted from a white or similar highly reflective surface the light emitting surface of the luminaire facing the wall must be rendered opaque in a permanent manner to reduce the amount of light reflected from the wall.

In order to prevent sky glow, glare and unwanted light trespass the lamp (light source) in the luminaire shall not be directly visible when viewed from a standing position 4 metres from directly below the unit.

If intended as a security light during periods of non attendance etc, such luminaries must be fitted with a motion detector (sensor) switch rather than used continuously. Such a switch should be configured to shut off the luminaire a maximum of 5 minutes after activation.

Any lighting fitting employing an internal reflector type lamp (maximum light output of 1300 beam lumens) shall be shielded (see above) so that no light is emitted above the horizontal and in any case must be fastened so that it cannot be aimed above 45 degrees below the horizontal.

Any dedicated flood lighting luminaire must be of the full cut off (horizontal glass) type and shall be fastened to prevent it from being aimed above the horizontal.

Post top, bollard or similar luminaires which are to be mounted along driveways or at entrances to properties in this zone are discouraged even if they comply with the light distribution requirements detailed above. But if used they must be included in the total number of luminaires specified in this sub zone and shall be limited to using lamps with a maximum output of 600 lumens. A curfew of 11pm applies.

Sign lighting and sports lighting of any type is prohibited.

Zone E1c over 18km

All luminaires with a light source(s) producing more than 420 lumens must be fully shielded to ensure that no light is emitted above the horizontal. Unshielded luminaires fitted with lamps exceeding 420 lumens but less than or equal to 1200 lumens are permitted provided that they are activated by a motion sensor of the type in which fail safe is ‘off’, they are located to prevent glare and light trespass, and they have a total activation time of 5 minutes maximum.

Any luminaire which employs a lamp with a light output exceeding 1200 lumens must either be fully shielded or have a full cut off light distribution characteristic.

All floodlights and similar area lights – no matter for what application – must have a full cut off light distribution characteristic and be aimed so that no light shines above the horizontal.

Property owners (including residential) must be aware of the location and direction of light so as to minimise glare and light trespass impacts onto neighbouring property and/or public thoroughfares etc. Property owners must also comply with other requirements to protect the night time environment.
Great care must be exercised in the selection of lighting fittings and their use in all applications, small or large. (Please see the illustrations above).

All lighting fittings, except as detailed above, or specially approved for specific applications, must not emit light above the horizontal.

Exceptions include building façade lighting which is permitted subject to the following restrictions -

(a) Upward aimed building façade lighting which must not exceed 1800 lumens with the luminaires being fully shielded, and fully confined from projecting light into the sky, by eaves, roofs, or overhangs combined with special luminaire shielding
(b) Where luminaire light output exceeds 1800 lumens, all lighting must be fully shielded, aimed downward and restricted to illuminating only the nominated vertical wall surface. Light trespass beyond the nominated surface is not permitted.

Heritage buildings should be lit with small light sources to highlight their architectural details.

Any luminaire which emits light above the horizontal for decorative purposes is prohibited eg ground level lights illuminating trees.
However, small cottage style business identification signs may have single, small, low-powered lights shining up, but only if they are carefully directed onto the sign without spill light.

All lights totalling15 000 lumens or more on a development need to be assessed by the Director. Also, lights added to an existing development site that take the total over 15 000 lumens must be assessed by the Director.

Signs
The most easily read signs have white or light–coloured lettering or logos on a dark background that covers most of their area.
No flashing or moving signs are permitted.
All signs must be turned off when a business closes or at 11pm, whichever is earlier. Special exceptions can be made for essential all night businesses. These applications must be referred to the Director.

Australian Standards
Compliance is necessary with the current requirements of -
AS 4282 Control of the obtrusive effects of outdoor lighting and
AS/NZS 1158 Road lighting series.

Restricted and Prohibited Lighting in all Areas

The operation of searchlights (including xenon types used for advertising purposes) and lasers is prohibited. So are all upward-directed floodlights including those associated with advertising signage and billboards, except for small cottage style business identification signs.

Non cut off (unshielded) floodlights used for sports lighting and showground activities are also prohibited, although application can be made for special temporary installations associated with major community events.

The use of exposed linear lamps – including fluorescent, cold cathode (neon lighting and signage) and light emitting diodes (LEDs) – primarily intended as an architectural feature or for advertising, is also prohibited except for approved signage.

Compliance Requirements

<u>Lighting Plans and Supporting Information</u>.

A lighting plan must be submitted with any Development Application for a development that includes lights. This plan should include the following for all types of installations -

1 A scaled site plan plus plan and elevation(s) of buildings included in the installation. This should preferably show adjacent property details.

2 The location and mounting height of all proposed and existing luminaires.

3 The type of light source with power (watts) and light output (lumens).

4 The general style of each luminaire type with a copy of the manufacturer's catalogue information sheet and where necessary the photometric information in digital form from a NATA accredited laboratory, preferably in IESNA format.

5 Details of all shielding necessary to meet the requirements of this document, including those incorporated in the luminaire construction.

6 For area and sporting floodlight installations the results of computer based calculations performed by using a recognised calculation program, as required by the relevant Australian Standards, must be submitted. This includes showing compliance with AS 4282 Control of the obtrusive effects of outdoor lighting.

Replacing Light Fittings
If any existing, non-complying external light fitting is replaced, it must be replaced with a complying fitting. If 25 percent or more of these are replaced at any development site, then all must be replaced. If an existing, non-complying external light fitting can be made to comply by replacing the lamp (light source) with a different type, then this must be done when the lamp fails.

Lamp Light Output Annex

To assist you to select complying lamps for Areas A (Zone E1a), B (Zone E1b) and C (Zone E1c), the following table provides typical light output information of some most-used types. Note that the parameter 'Beam Lumens' applied to reflector lamps is specifically excluded from this list.

Area A (ZoneE1a) 0 to 3 km from the Observatory

Compact Fluorescent Lamps

5W Compact Fluorescent lamp	=	250 lumens
7W Compact Fluorescent lamp	=	400 lumens
9W & 10W Compact Fluorescent lamps	=	600 lumens
11W & 13W Compact Fluorescent lamps	=	900 lumens

General Lighting Service (GLS) Incandescent Lamps

25W Incandescent lamp	=	225 lumens
40W Incandescent lamp	=	420 lumens
60W Incandescent lamp	=	700 lumens
75W Incandescent lamp	=	940 lumens

Area B (ZoneE1b) 3 to 18 km from the Observatory

The following list is not intended to be a complete itemisation of all applicable lamp types for this zone and it is additional to those listed above for Zone E1a . This list is intended to provide some guidance but the light output of unlisted types should be checked before specification or purchase. Note that the parameter "Beam Lumens" applied to reflector lamps is specifically excluded from this list.

Compact Fluorescent Lamps.

18W Compact Fluorescent lamp	=	1200 lumens
26W Compact Fluorescent lamp	=	1800 lumens

Tubular Fluorescent Lamps

14W Tubular Fl. lamp (T5)	=	1350 lumens
18W Tubular Fl. lamp – Standard	=	1150 lumens
18W Tubular Fl. lamp – Tri-Phosphor	=	1350 lumens

General Lighting Service (GLS) Incandescent Lamps

100W Incandescent lamp	=	1360 lumens

Area C (Zone E1c) over 18 km from the Observatory

The following list gives some lamp types with outputs close to the threshold outputs for this zone.

7W Compact Fluorescent lamp	=	400 lumens
40W Incandescent lamp	=	420 lumens
18W Tubular Fl. Lamp – Standard	=	1150 lumens
18W Compact Fluorescent lamp	=	1200 lumens
26W Compact Fluorescent lamp	=	1800 lumens