Appendix B

Visual Impact Assessment

Bengalla Development Consent Modification 2

Statement of Environmental Effects

Visual Impact Assessment

April 2016

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Statement of Environmental Effects

Visual Impact Assessment

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Glossary and Abbreviations

Areas of Primary Visual Concern	Areas that have potential views to the Project based on a consideration of topography alone as a screening element.
Contrast	The degree to which a development element differs visually from its landscape setting.
Critical Industry Clusters	Critical industry clusters (CICs) are concentrations of highly productive industries within a region that are related to each other, contribute to the identity of that region, and provide significant employment opportunities. Includes equine and viticulture industries.
Field of View	This area includes the total view, consisting of the primary view zones above and the secondary or peripheral view zones around the primary view zone, out to about 70° either side of the central view line in both vertical and horizontal plain.
Integration	The degree to which a development element can be blended into the existing landscape without necessarily being screened from view.
Interburden	Material of any nature that lies between two or more bedded ore zones or coal seams.
Landscape Character Unit (LCU)	The landscape features of the locality (topography, vegetation and land use features) combine in various ways to create areas of relative visual uniformity that can be defined as LCUs.
Overburden Emplacement Area (OEA)	Refers to the placement of waste material (mostly interburden) excavated as part of the coal mining process into a predefined area.
Photomontage	Photomontage is the process and result of making a composite photograph by cutting and joining a number of other photographs or graphic images for illustrative effect. The composite picture or image aims to give a visualisation of a projected visual effect.
Primary View Zone (PVZ)	This zone is the central most critical part of a view that is seen with the greatest clarity. It is that part of a view that is within a horizontal arc of 30° either side of the centre line of a view and a vertical arc of 30° m above the horizontal.
Scenic amenity	This term encapsulates people's aesthetic experience of the environment; their appreciation and value of a physical environment whether it be an urban, coastal, bushland, rural or industrial setting. Aesthetic appeal is often associated with the reinforcement of cultural or social values and identity.
Screen	The degree to which a development element is unseen due to intervening landscape elements such as topography or vegetation.
The Modification	Modification to the landform design as described in this report.
Visual Absorption Capacity (VAC)	The Visual Absorption Capacity is defined as the ability of that VCU to screen and or visually integrate the project elements or activities of the coal mine and transmission, exploration and production infrastructure project elements.
Visual Character Unit (VCU)	Visual Character Unit. Areas of landscape that have similar topographic, vegetation and land use features that create areas of similar visual character.

Visual Effect	A measure of the visual interaction between the Project and the landscape setting within which it is located.
Visual Impact	A measure of a joint consideration of both visual sensitivity and visual effect that considered together determine the visual impact of a development.
Visual Sensitivity	The degree to which a change to the landscape will be perceived in an adverse way.
View Shed	A view shed is an area of land, water, or other environmental element that is visible to the human eye from a fixed vantage point.
Primary Visual Catchment	The primary visual catchment includes the most significant parts of the total visual catchment from which the Project potentially could be seen. This is the area containing the most critical locations with potential views to the Project, which will be the focus of visual impact assessment.

1. Introduction

JVP Visual Planning and Design has been engaged on behalf of Bengalla Mining Company Pty Limited (BMC) to complete a visual impact assessment for the Bengalla Mine Development Consent Modification 2 (the Modification).

The purpose of this assessment is to form part of a Statement of Environmental Effects (SEE) being prepared by Hansen Bailey Environmental Consultants (Hansen Bailey) to support an application for a Modification of consent under Section 96(2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The primary objective of this assessment is to identify the visual effects and assess visual impacts of the proposed modifications herein referred to as the Modification.

This report will provide a detailed assessment of:

- Changing landforms on the site during the various stages of the Modification by comparing the scale of the Modification with the existing approved mine plans;
- Potential visual impacts on private landowners in the surrounding area as well as key public vantage points in the public domain, including consideration of lighting impacts; and
- A detailed description of the measures that would be implemented to minimise visual impacts of the Modification.

1.1 Current Approved Operations

BMC operates the Bengalla Mine (Bengalla) which is located approximately 4 km west of Muswellbrook in the Upper Hunter Valley, NSW (see Figure 1.1). BMC was initially granted DA 211/93 following submission of the 1993 Bengalla Environmental Impact Statement (Bengalla EIS) under the *Environmental Planning and Assessment Act 1979* (EP&A Act) in August 1995.

In March 2015 BMC received development consent for State Significant Development (SSD) 5170 and has approval to operate until February 2039, producing up to 15 Million tonnes per annum (Mtpa) of Run of Mine (ROM) coal.

1.2 Regulatory Framework

Modifications in accordance with Section 96(2) of the EP&A Act allows for an existing development consent to be modified if the consenting authority is satisfied that the modification relates substantially to the same development as the one the consent was originally granted.

The Modification will also consider the Muswellbrook Local Environmental Plan and Development Control Plan as appropriate.

1.3 This Modification

This visual impact assessment has been prepared to support an application for modification to Development Consent SSD-5170 under Section 96 (2) of the EP&A Act to facilitate the following:

- Alterations to the approved height of the Main Overburden Emplacement Area (Main OEA) to improve visual amenity from primary viewing locations in and surrounding the township of Muswellbrook and Denman Road, in two selected locations (Visual Relief Areas):
    - The Northern Relief Area constructed to a maximum height of Reduced Level (RL) 300;

  - The Southern Relief Area constructed to a maximum height of RL 290; and
- Establishment of a gravel access road from Wybong Road to the Dry Creek Diversion Project Construction Site Office being a former homestead (Homestead Access).

Figure 1.1 | *Bengalla Mine Regional Context*

2. Assessment Methodology

2.1 Introduction

The methodology to determine the level of visual impact of the Modification involves consideration how the modification to the approved Project elements as described in Section 1.3 affect the existing assessed levels of visual impact.

This assessment includes a consideration of existing landscape settings, and how they are seen from various viewing locations. In this way the visual character of the landscape as well as visual sensitivity of the various viewing locations can be determined.

Secondly, the visual effect of the Modification is determined by considering the visual characteristics of the Modification in the context of the approved Project.

A combined consideration of both visual sensitivity (Section 5) and visual effect (Section 6) identifies impacts (Section 7) and directs if any mitigation measures are required (Section 8). The overall method of visual assessment of the existing landscape has been outlined in Figure 2.1.

This has been completed by utilising the following visual impact assessment methodology:

- Consideration of relevant guidelines, policies and plans;
- Review of appropriate background information including the Continuation of Bengalla Mine Environmental Impact Statement (Hansen Bailey, 2013) and specifically the Visual Impact Assessment (JVP, 2013);
- Establishing the visual character and visual effect created by the Modification;
- Review of the approved mine plans within the context of the existing visual settings created by various landscapes in and around Bengalla;
- A consideration of the visibility of the Modification from sensitive receivers using photomontages;
- The likely visual impacts created by the Modification (including both short term and long term) with regard to visual effect and sensitivity;
- Consideration of cumulative visual impacts in the locality; and
- A review of the mitigation strategies to ameliorate adverse visual impacts to determine additional requirements.

2.2 Statutory Framework

2.2.1 Draft Land Use Development Strategy (Coal Mine Land Use Component)

This plan developed by Muswellbrook Shire Council recognises the economic and employment benefits of the coal mining industry to the region. The plan draws attention to the need to consider the impacts of mines in the operational and post operational phases, especially in relation to impacts on surrounding land use especially tourism and amenity values. It recognises the importance of quality rehabilitation and post land use viability.

The plan makes specific reference to the need to respect the visual settings of specific land uses that include thoroughbred horse studs, winery cellar doors and other tourist facility or public places, including public areas within national parks.

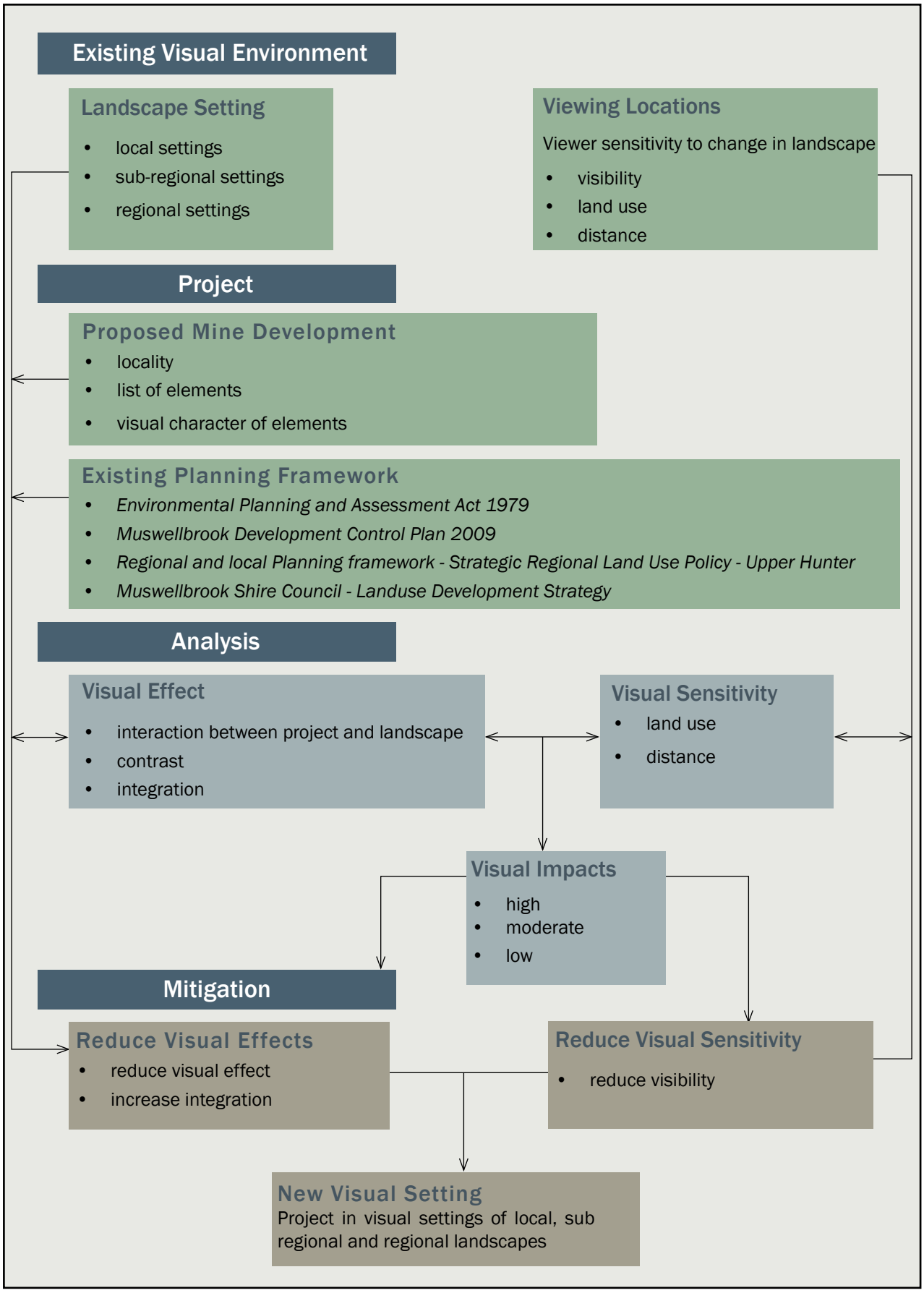

Figure 2.1 | ***Visual Assessment Methodology***

Muswellbrook Local Environmental Plan 2009

All of the elements of the Modification are located within the Muswellbrook local government area on land zoned as "RU1 Primary Production" and "E3 Environmental Management" under the Muswellbrook LEP.

Under the Muswellbrook LEP, the relevant land objectives for the two land zonings are as follows:

Zone RU1 Primary Production

- To maintain the rural landscape character of the land in the long term.
- To ensure that development for the purpose of extractive industries, underground mines (other than surface works associated with underground mines) or open cut mines (other than open cut mines from the surface of the flood plain), will not:

  (a) destroy or impair the agricultural production potential of the land or, in the case of underground mining, unreasonably restrict or otherwise affect any other development on the surface, or

  (b) detrimentally affect in any way the quantity, flow and quality of water in either subterranean or surface water systems, or

  (c) visually intrude into its surroundings, except by way of suitable screening.

Zone E3 Environmental Management

- To protect, manage and restore areas with special ecological, scientific, cultural or aesthetic values.
- To provide for a limited range of development that does not have an adverse effect on those values.
- To maintain, or improve in the long term, the ecological values of existing remnant vegetation of significance including wooded hilltops, river valley systems, major scenic corridors and other local features of scenic attraction.
- To limit development that is visually intrusive and ensure compatibility with the existing landscape character.
- To allow agricultural activities that will not have an adverse impact on the environmental and scenic quality of the existing landscape.
- To promote ecologically sustainable development.
- To ensure that development in this zone on land that adjoins land in the land zoned E1 National Parks and Nature Reserves is compatible with the objectives for that zone.

Muswellbrook Development Control Plan, 2009

The Muswellbrook Shire Development Control Plan 2009 (DCP) applies to all land within the Muswellbrook LGA. The objective of the DCP is to assist proponents of development in achieving development outcomes, consistent with the provisions of the Muswellbrook LEP.

Sections 11.8 (Extractive Industry – Visual amenity and landscaping) and Section 22 – (Land Use Buffers) provide key guiding principles for extractive industry developments. These Sections outline requirements for buffers and setbacks, vegetation screening, time lines and implementation management for any landscape plan associated with the development.

In addition, Section 11.8 requires development of a rehabilitation plan prior to commencement of operations which must be submitted to Council for approval as part of the Environmental Management Plan. Relevant to this assessment is the following clause:

"Final landforms must be consistent with the biodiversity of the surrounding landscape having regard to the proposed post-extraction land use".

2.3 Evaluation of the Existing Visual Environment

An evaluation of the existing visual environment includes an assessment of both the existing landscape setting and viewing locations within it, as described below.

2.3.1 Landscape Setting

The visual character of the regional and local landscape in the vicinity of Bengalla is created by a mosaic of topographic form, vegetation and land cover, hydrological features and land use patterns. This includes the existing mining areas of Bengalla and Mt Arthur.

These landscape features combine in various ways to create areas of relative visual uniformity that can be defined as Visual Character Unit (VCU). The VCUs are rarely seen in isolation but rather in combination with one another in various vistas that are obtained from viewing locations such as residences and roadways.

This is significant as the Modification is therefore always seen in the context of an existing landscape setting made up of one or more of the VCUs. The Modification then combines with one or more VCU to create a view seen from various locations.

Defining the landscape in terms of these VCUs assists in understanding the visual character of the landscape as a whole with which the Modification interacts.

2.3.2 Viewing Locations

Viewing locations are those areas where people are likely to obtain a view of the Modification. These viewing locations have different significance based on numerous factors, collectively evaluated through land use and viewing distance to the Modification. Viewing locations could include residences, roads, commercial and recreation areas as well as urban and other rural areas.

2.3.3 Visual Character of Modification

The Modification will have certain visual characteristics. The elements of the mine will express themselves in terms of form, shape, line, and colour and to a lesser extent texture.

An understanding of this visual character will provide an appreciation of how various mine elements will be seen in the landscape. Therefore it has been determined that a 20-30 m height increase at two locations on the Main OEA would improve the visual character of the final landform.

2.4 Consideration of Visual Effect and Sensitivity

The analysis of the interaction between the existing visual environment and the Modification provides the basis for determining impacts and developing mitigation strategies. The impact levels of the Modification are determined by the defined visual effects of a project in the landscape and visual sensitivity at specific viewing locations.

The Modification is evaluated to define the visual elements that are most significant from a visual perspective in the context of the existing environment. The key Modification elements from a visual context are defined as being *"major"* or *"minor"* and are considered in terms of how they contrast with the main elements of the existing visual environment.

2.4.1 Visual Effect

Visual effect is a measure of the level of visual contrast and integration of the Modification with the existing landscape. The degree of this contrast with the existing landscape will determine the level of visual effect. A new mining development will have a higher visual effect due to strong contrast with the existing visual environment. Extensions to the operations of an existing mine will have a lesser visual effect due to elements of the development being present in the landscape. The successful completion of rehabilitation would be likely to have a low visual effect due to limited contrast with the existing landscape.

In a similar way, a development is considered to be integrated with the existing landscape based on issues of scale, position in the landscape and contrast with the surrounding environment. High visual integration is achieved if a development is dominated by the existing landscape, is of small scale and or of limited contrast.

The magnitude of the visual effect for a development, outlined in Table 2.1 is determined by a balanced analysis of the following factors.

Contrast and Integration

The level of contrast and integration of the Modification with its surrounding landscape determines visual effect. Modification elements as expressed through the visual expression elements (i.e. form, shape, pattern, line and colour with minor consideration in relation to texture) contrast to varying degrees with the surrounding landscape and will also create some level of integration with it.

The Proportion of a View that includes Modification Areas

For any given level of contrast and integration, a lower proportion of the view that is occupied by the Modification elements will result in a lower level of visual effect. This is determined by defining the proportion of the total field of view that is occupied by the Modification. This is most appropriately determined by defining what percentage of the Primary View Zone (PVZ) it occupies (see Figure 2.2). The PVZ is the area that is occupied by an arc created by sight lines from the eye radiating out vertically and horizontally at angles of 30^0 around a centre view line from a nominated viewing location.

Distance from Project Site	Area of Primary View Zone
1 km	0.60 km²
2 km	2.4 km²
3 km	5.43 km²
4 km	9.66 km²
5 km	15.09 km²
6 km	21.73 km²
7 km	29.57 km²
8 km	38.62 km²
9 km	48.88 km²
10 km	60.35 km²
11 km	73.02 km²
12 km	86.9 km²
13 km	101.99 km²
14 km	118.29 km²
15 km	135.79 km²

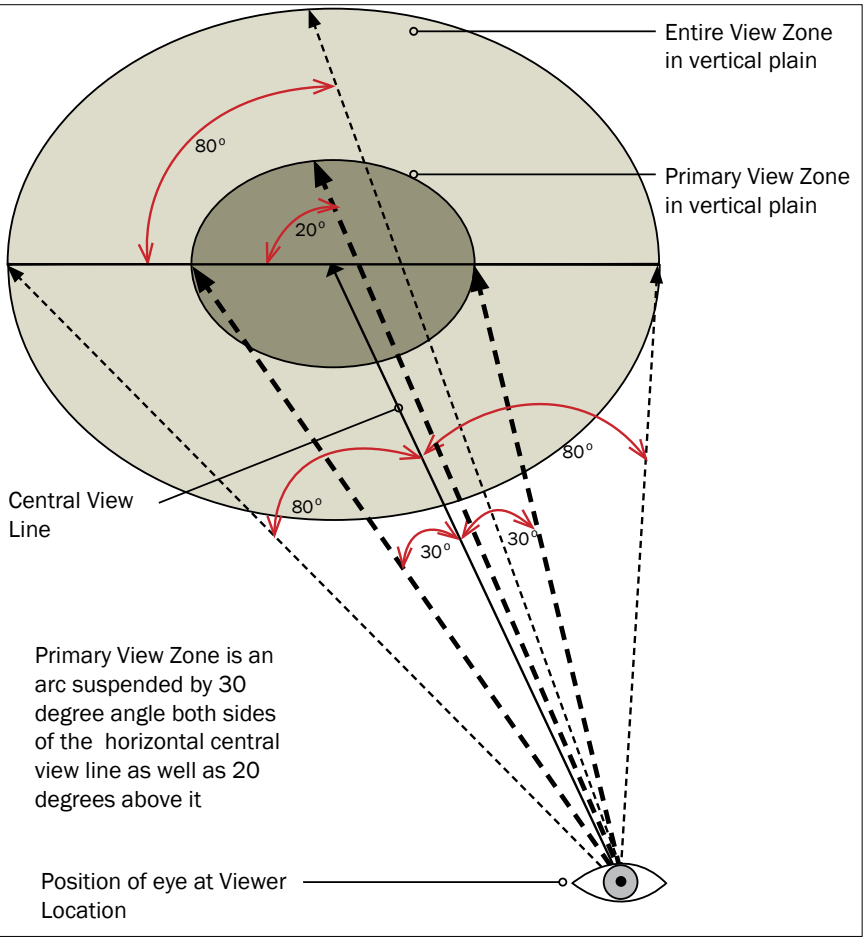

Figure 2.2 | *Primary View Zone*
The Area of Primary View Zone at Various Distances from the Project

	Visual Properties		Visual Effect Levels			
	Visual Contrast	Visual Integration	Proportion of View Occupied by the Project			
Visual Properties in Primary View Zone	High Development elements do not borrow, form, shape, line, colour or texture or scale from existing features of the visual setting and contrast levels are high with existing landscape and or.... eg. Active face of OEA	Low The development lacks integration with visual setting because of scale totally dominating the ability of site or surrounding features, vegetation and or topographic features to integrate the development.	It occupies more than 2.5% of the primary view shed	It occupies between 1 - 2.5% of the primary view shed	It occupies less than 1% of the primary view shed	Type 1
	Moderate Development elements borrow from some features of the visual setting in terms of form, shape, line pattern and or colour and scale, reducing visual contrast with existing setting and or..... eg. newly rehabilitated pit area	Moderate The development has some degree of visual integration with setting from other features, vegetation and or topography achieve some level of integration	It occupies more than 20% of the primary view shed, generally when in a foreground location	It occupies between 20-10% of the primary view shed	It occupies less than 10%	Type 2
	Low Development elements borrow extensively from features in visual setting in terms of form, shape, line, pattern colour and scale minimizing contrast with the existing setting. eg. rehabilitated landscape pattern	High Visual integration is high due to other features, vegetation and or topography achieving dominance and screening or filtering	It occupies more than 40% of the primary view shed	It occupies 40-30% of the primary view shed	It occupies less than 30% of the primary view shed	Type 3
Note: The visual effect of the mine pits changes through time with the process of rehabilitation. The more advanced the level of rehabilitation, the higher the visual integration, and the higher the percentage of PVZ the project can occupy.			**High Visual Effect**	**Moderate Visual Effect**	**Low Visual Effect**	

Table 2.1 | *Visual Effect*

The PVZ is the most critical and central part of a view. It is not representative of the total view, but is the most important part. Measuring the percentage of the PVZ occupied by a development will provide a more conservative measure than the consideration of the development in the context of the whole view zone, which would include both primary and secondary view areas (representing a total view arc of 120^0 instead of the PVZ view arc of 60^0).

Generally, a high visual effect will result if a visible element of the Modification in the PVZ has a high visual contrast and low integration to the surrounding landscape.

A low or very low visual effect will occur if there is minimal contrast between the visible area of the Modification in the PVZ and the existing landscape setting and or the area occupied by the Modification represent only small parts of a total view.

2.4.2 Visual Sensitivity

Visual sensitivity is a measure of how critically a change to the existing landscape is viewed by people from different land use areas in the vicinity of a development.

In this regard, residential, tourist and / or recreation areas generally have a higher visual sensitivity than other land use areas including industrial, agricultural or transport corridors. This is because land uses with a higher visual sensitivity, such as residential, use the scenic amenity values of the surrounding landscape and may be used as part of a leisure experience and often over extended viewing periods (such as Denman Road). Table 2.2 indicates the levels of visual sensitivity associated with land uses relevant to the Modification.

The visual sensitivity of individual viewing locations may range from high to low, depending on the following additional factors:

- Screening effects of any intervening topography, buildings or vegetation. Viewing locations with well screened views of the Modification will have a lower visual sensitivity than those with more open views;
- Viewing distance from the viewing location to visible areas of the Modification. The longer the viewing distances, the lower the visual sensitivity; and
- General orientation of residences to landscape areas affected by the Modification. Viewing locations with strong visual orientation towards the Modification (i.e. those residences with areas such as living rooms and/or verandas orientated towards it) will have a higher visual sensitivity than those not orientated towards the Modification, and which do not make use of the views toward the Modification.
- For any area to be given a sensitivity rank, it must have views to the Modification. This visibility was determined based on field assessment, evaluation and computer analysis of topographic and vegetation data.

2.5 Visual Impact

The visual impact of the Modification has been determined by considering both visual effect and visual sensitivity. The way in which the parameters of visual sensitivity and visual effect are utilised to determine visual impacts is illustrated in Table 2.3.

2.6 Mitigation

Visual and landscape impact mitigation strategies are typically recommended for both within the Project Boundary (on site) and outside of the Project Boundary (off site) as required. This ensures that either visual effects and or visibility/visual sensitivity factors are decreased in appropriate time frames to achieve mitigation of impacts. General strategies to reduce visual impacts that may be recommended are outlined below.

Land Use / Visibility			Visibility to Modification (High ← → Low)			
			Nearest visible mine elements less than 2.5km away	Nearest visible mine elements between 2.5 - 7.5 km away	Nearest visible mine elements between 7.5 - 12.5km away	Nearest visible mine elements more than 12.5km away
Sensitivity of Land Use	High	Urban and rural houses	High Sensitivity	High/Moderate Sensitivity	Moderate Sensitivity	Low Sensitivity
		Tourist destination of visually sensitive land uses eg. horse studs, vineyards etc.	High Sensitivity	High/ Moderate Sensitivity	Moderate/Low Sensitivity	Low Sensitivity
		Designated tourist & main roads - New England Highway, Denman Road	High Sensitivity	Moderate Sensitivity	Low Sensitivity	Low Sensitivity
		Other roads - Roxburgh, Edderton, Wybong, Thomas Mitchell Drive	Moderate Sensitivity	Low Sensitivity	Low Sensitivity	Low Sensitivity
		Minor local roads in rural zone	Moderate/Low Sensitivty	Low Sensitivity	Very Low Sensitivity	Very Low Sensitivity
	Low	Broad acre rural lands	Low Sensitivity	Low Sensitivity	Very Low Sensitivity	Very Low Sensitivity

Table 2.2 | *Visual Sensitivity*
Land Use and Project Visibility combine to create Visual Sensitivity

Visual Effect	Visual Sensitivity: High	Visual Sensitivity: Moderate	Visual Sensitivity: Low
High	High Visual Impact	High/Moderate Visual Impact	Moderate/Low Visual Impact
Moderate	High/Moderate Visual Impact	Moderate Visual Impact	Moderate/Low Visual Impact
Low	Moderate/Low Visual Impact	Moderate/Low Visual Impact	Low Visual Impact
Very Low	Low Visual Impact	Very Low Visual Impact	Very Low Visual Impact

Table 2.3 | *Visual Impact*
Visual Impact is the interaction between visual effect and sensitivity

2.6.1 Reduce Visual Effects

Rehabilitation of disturbed areas associated with the Modification will decrease the visual contrast created by mining operations to the existing landscape. Rehabilitation strategies that emulate patterns, shapes, line and colour of the existing landscape can reduce the contrast between the Modification, the approved OEA and the existing landscape, reducing visual effect.

2.6.2 Reduce Visual Sensitivity

Reducing visual sensitivity is achieved by carrying out treatments to minimise the visibility to the Modification. Due to the scale of open cut coal mine components (such as the OEAs) screening, if required, would best be completed at or close to the point of viewing. Such screening treatments can also be used to redirect views to areas not affected by mining activities as well as generally enhancing the landscape at the viewing point.

2.6.3 Reduce Visual Impacts

Reducing visual impacts is also achieved by the mine plan design and siting that maximises screening of Modification elements by utilising existing topographic features. Maintaining significant high points and topographic and vegetation features also contributes to a reduction of visual impact.

2.6.4 Post-mining Visual Setting

On completion of mining operations and following rehabilitation, a post-mining local landscape will be created. This landscape would reflect post-mining landforms and land use.

2.7 Implementation of Study Method

The methodology set out above was implemented through a combination of different evaluation processes and analyses. These are outlined below and included:

- Evaluation of Modification mine plans, maps, aerial photography and reports;
- Field assessment;
- Photomontage development; and
- Computer analysis.

2.7.1 Evaluation of Plans and Reports

Evaluation of the various components of the Modification was based on the Modification Design (see Section 4).

Topographic mapping and aerial photography provided the basis for the establishment of landscape and visual character. A field assessment undertaken in areas within and surrounding the Project Boundary assisted in establishing LCUs for the Modification.

Aerial photography, along with computer analysis also assisted in evaluating the visibility, sensitive receptor locations and extent of views to the Modification.

Modification plans, (such as the conceptual mine plans), rehabilitation and final landform maps were used to assist in defining visual effects and where they will occur through the life of the Modification.

2.7.2 Field Assessment

The field assessment involved visitation to locations within the PVC including New England Highway, Denman Road, Wybong and Roxburgh Road and Ironbark Road.

Views toward the Modification were also evaluated from other selected viewing locations in the PVC.

Such an assessment was made to give an indication of likely visibility conditions of the Modification from each area (e.g. foreground screening, vegetation, open views, etc.), the experience of different LCUs, and

how these are seen together, to consider cumulative effects.

2.7.3 Photomontage Analysis

Photomontages are images that bring a computer model of the terrain and the Modification together with a photograph of the existing landscape to illustrate what the Modification may look like from a given location at various points in time. Photomontages for six locations were developed to illustrate likely visual effects as seen from various locations around the Project Boundary (refer Section 6).

Photographs of the Modification were taken at standing eye level from the two viewing locations. The precise location of each of these photograph positions was recorded by a registered surveyor using a GPS. The photography provides a realistic representation of the site landscape and how it is seen from each viewing location in response to light and atmospheric conditions.

Three dimensional computer models of the Modification at representative stages of the mine's progression were created from digital surface topography and project mine plans. The models enabled accurate views of the Modification to be generated from any specified viewing location and account for screening of views by natural topography. The photographs of the Modification and its landscape setting were overlain on the model view from the same viewing location. The locations of future visible components of the Modification were determined taking into account any foreground screening from topography or vegetation in the photograph.

Realistic colours and textures were applied to the visible project components taking into account viewing distances to the visible components. The end result is realistic photomontage of the likely future view of the Project from the selected representative viewing locations.

The photomontages were used to assist in determining the level of visual effect of the Modification from each of the representative viewing locations (see Section 6).

2.7.4 Combined Analysis

In completing this assessment, a joint consideration of all the analysis techniques summarised above were used to outline view sheds, sensitive receptors, visual sensitivity and visual effect.

3. Existing Environment

3.1 Introduction

This section of the report describes the visual character of the existing environment. This is necessary in order to establish a baseline on which changes are compared against and the Visual Effect is measured.

As shown in Figure 3.1, the existing environment surrounding Bengalla is comprised of a range of different landscapes and features. This variety is based on differences in topography, vegetation cover and land use patterns.

3.2 Primary Visual Catchment

Bengalla is located 4 km west of Muswellbrook in the Upper Hunter Valley of NSW. The PVC represents the area within which the majority of critical views of the Modification are obtained. The Bengalla Mine PVC is defined by the ranges to the west and north of the site, and the town of Aberdeen to the north-east. The catchment area is further defined by Muswellbrook to the east, the hills behind, and by the existing Mt Arthur Coal Mine to the south. The small ridge located in the centre of the Mt Arthur Coal Mine marks the south-eastern corner of the PVC. See Figure 3.1.

3.3 Land Ownership

The land ownership around Bengalla is dominated by land within mining leases held by various mining companies, Figure 3.2. To the north, land is within the Mount Pleasant Project Area. To the south, land is dominated by Mt Arthur Coal Mine and to the west, but in a different visual catchment is land within the Mangoola Coal Project.

Private lands are mainly located to the east and west. To the east the visual catchment is dominated by Muswellbrook. This township area represents an area of high visual sensitivity. To the west there are a number of small scale rural holdings and rural residences and some rural/tourist destinations that are also sensitive to the Modification.

3.4 Visual Character of the Landscape

The visual character of the landscape in the vicinity of the approved Bengalla Mine is created by Visual Character Units (VCU) that combine to make up a particular view from any viewing location.

While the visual character of the Modification is defined in Section 4 of this report, the visual character of the existing landscape into which the Modification will be placed is defined by several separate VCUs.

The Visual Character Units within the PVC include:

- Hunter River Floodplain;
- Foothills;
- Mine and industrial uses;
- Town areas; and
- Surrounding ranges.

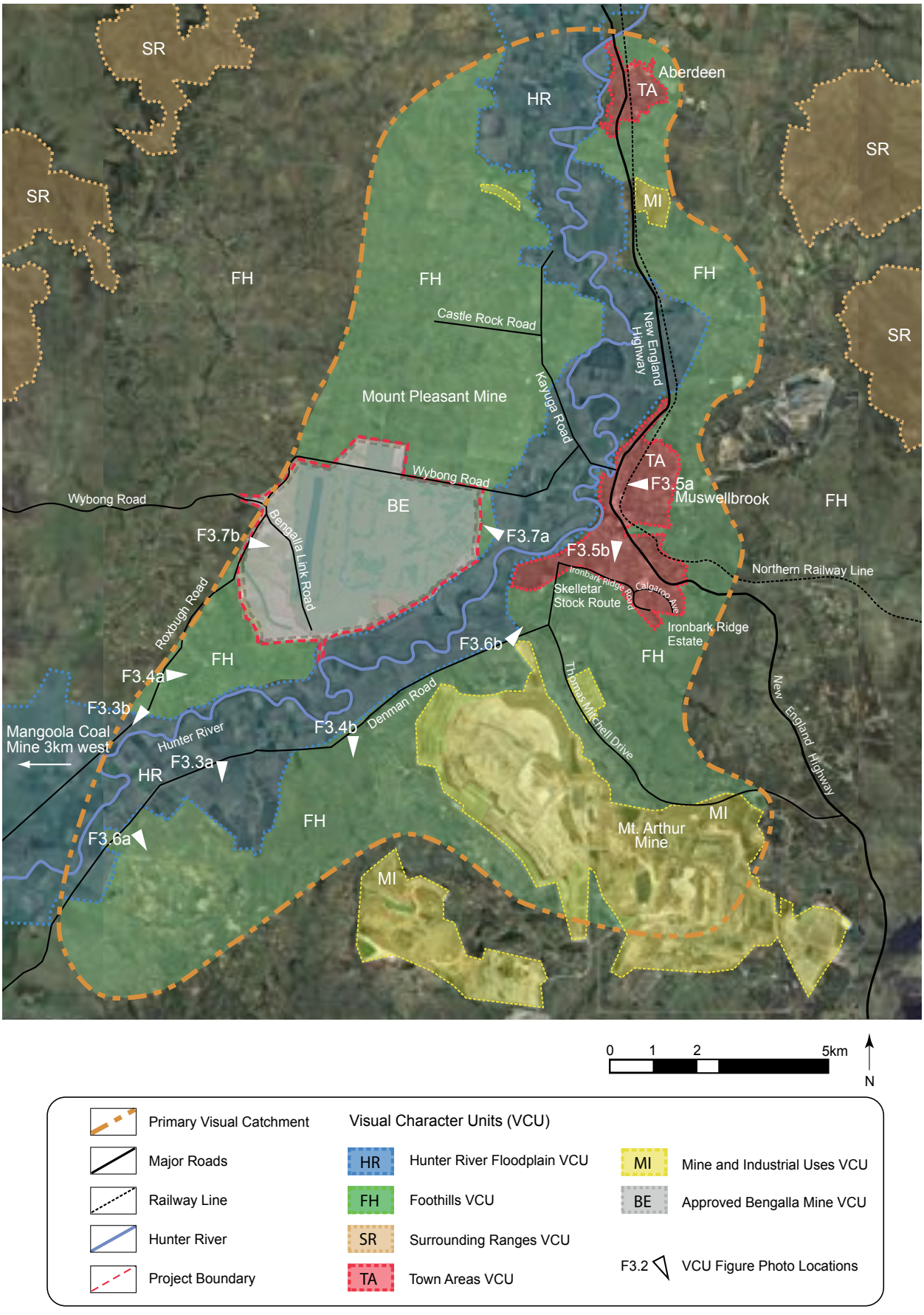

Figure 3.1 | *Existing Environment*

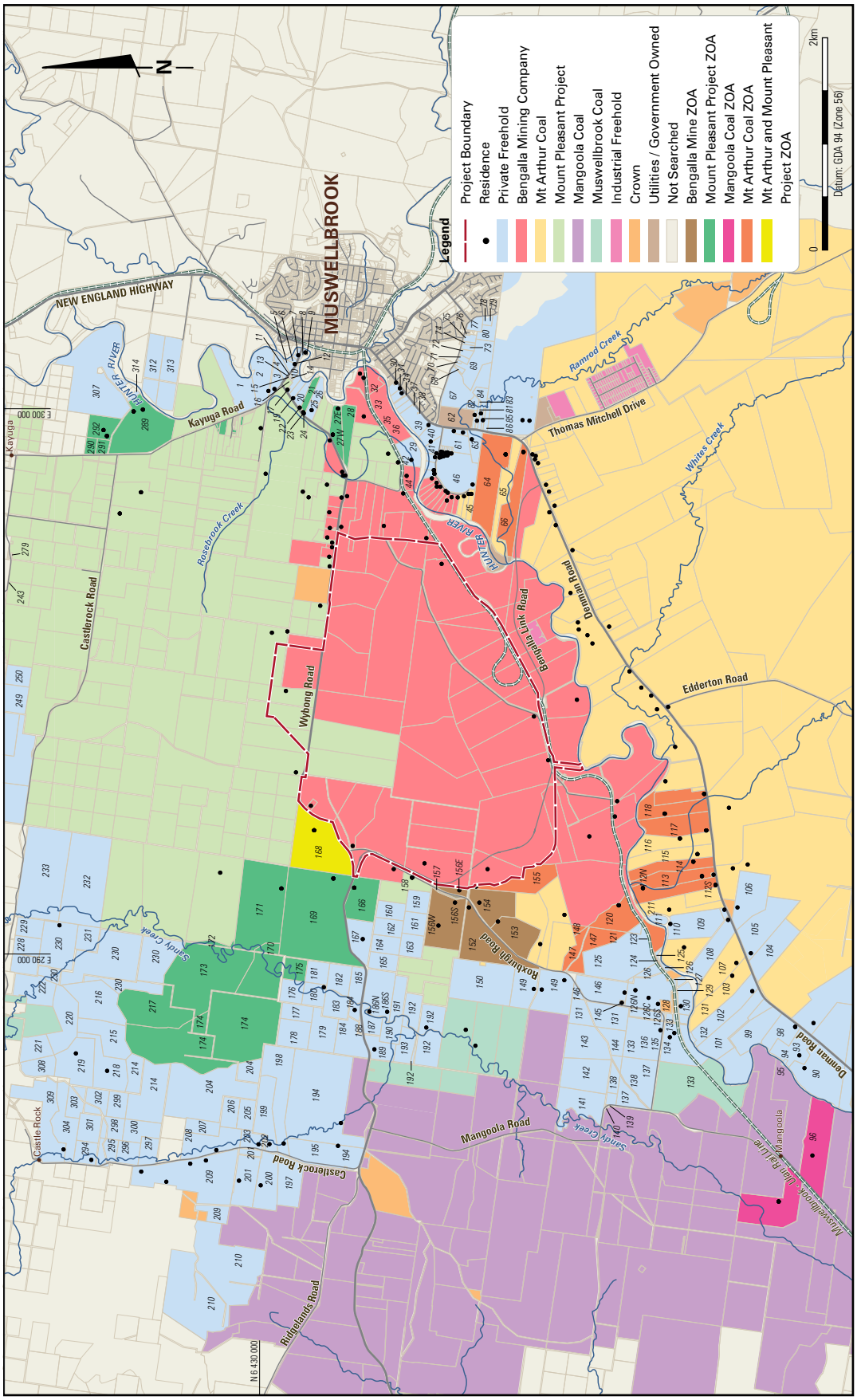

Figure 3.2 | *Land Ownership*

Within each VCU there may be a range of visual receivers. These receivers have varying sensitivity to landscape modification. The more critical visual receivers include:

Towns:

- Muswellbrook; and
- Aberdeen.

Roads:

- Wybong Road;
- Kayuga Road;
- New England Highway;
- Denman Road; and
- Roxburgh Road.

Rural Areas:

- Houses along Denman Road;
- Houses in Northern Foothills;
- Houses on the edge of the Hunter River Floodplain; and
- Historic houses on Hunter River Floodplain.

The PVC is strongly defined by the Hunter River Floodplain, which runs from the south-west corner around Bengalla and north to the western edge of Aberdeen. A further critical element of this PVC is the existing mining operations in the area. This includes the existing Bengalla operations and Mt Arthur Coal Mine located to the south of Bengalla, and Mangoola Coal to the west. It also includes the future approved mine area to the north in the Mount Pleasant Project.

Figure 3.1 illustrates the environment and individual VCUs which are briefly described below.

3.4.1 Hunter River Floodplain VCU

As discussed above, the Hunter River Floodplain dissects the PVC, running generally from south-west to north-east. Visually, this VCU is dominated by the river flats, which as a result of soil type and irrigation, support pasture and croplands that create vivid rectilinear patterns in the midst of dry land grass and woodlands on adjoining slopes.

The Hunter River Floodplain unit creates strong contrast and visual interest to surrounding landscapes. Perhaps its greatest significance is its flatness and grass / crop cover that allows for long views from distant locations such as Aberdeen and distant highway locations.

There are some residences within this unit that have visual contact with Bengalla (see Figure 3.3). These include a cluster of houses on Kayuga Road to the north of Wybong Road. While there are also houses on Denman Road, most of these are owned by BMC or Mt Arthur Coal. Parts of Muswellbrook, including the Racecourse Area are also within the Hunter River Floodplain Unit. Due to flooding, rural dwellings within the unit are generally restricted to raised knolls that are less prone to flooding.

The Hunter River Floodplain Unit supports parts of the New England Highway and Muswellbrook-Ulan Railway Line to the south and east of Bengalla and the Project. To the south, Denman Road skirts between the Floodplain and the Southern Hills. In addition, the Hunter River Floodplain supports numerous minor rural roads. See Figure 3.2.

Figure 3.3 | *Hunter River Flood Plain VCU*

Cropland and grassland dominate this VCU, forming strong rectilinear patterns in an open landscape

Historic houses on Hunter River Floodplain

The historic homesteads of '*Bengalla'*, '*Edinglassie*' and '*Rous Lench'*, (Figure 3.1) are located on the edges of the floodplain. They are small visual focal points as currently seen from public roads. All three are under the ownership of either Bengalla Mining Company and or Hunter Valley Energy Coal (HVEC). '*Bengalla*' and '*Rous Lench'* are single houses with a limited number of outbuildings and sheds, while '*Edinglassie*' is a much larger complex of main house, extensions to it and a series of outbuildings. All houses share the landscape concept of enclosing gardens of exotic trees and hedges with views beyond this in various directions to the landscapes beyond.

3.4.2 Foothills VCU

The foothills include the Southern Foothills south of Denman Road and Northern Foothills north of Denman Road around Bengalla and are adjacent to the Hunter River Floodplain, Figure 3.4. These hills are generally gently sloping with the Northern Foothills in the vicinity of Roxburgh Road having the greatest elevation (240 -260 m) within proximity of the Project.

The Eastern Hills are generally low elevation hills to the east of Thomas Mitchell Drive. The land cover is a mixture of grasslands, woodlands and open forest, see Figure 3.4. The hills have low elevations, generally in the order of 250 m with Little Grass Tree Hill having an elevation of 258 m. These hills generally continue to the east of Muswellbrook where Skelletar Stock Route has an elevation of 333 m.

The Southern Hills again have similar elevations but are flanked by the higher elevation ridges and hills that include Mt Arthur and Ogilvie Hill. These hills for the greater part have been cleared for grazing purposes and support grasslands with scattered trees with woodland or open forest on steeper areas and along some gully lines. The gentle slopes with a mixture of grasslands, woodlands and open forest create the typical rural landscapes of the region. An area adjacent to South Muswellbrook and to the east of Thomas Mitchell Drive, Ironbark Estate has been developed as a park land living estate.

The Foothills, although not highly populated, do support a limited number of private rural residences that to varying degrees have views of the Modification. Most significant of these are a limited number of residences along Roxburgh Road and some residences on Denman Road. In addition, there are some houses to the north of Wybong Road, which are within the approved Mount Pleasant Project.

3.4.3 Town Areas

Town VCUs vary in size and visual character between one town and the next (i.e. Muswellbrook and Aberdeen). They share common elements of residences, streetscapes, commercial areas, and recreation areas. The mix of these factors creates visual character of the towns. The significance of the towns is the concentration of sensitive receivers in the form of residential development areas, Figure 3.5.

The township of Muswellbrook is located on foothills to the east of Bengalla. Some parts of the town are on or adjacent to the Hunter River Floodplain. The most significant area in this regard is the Racecourse Road Precinct that contains the racecourse and some residences in close proximity to Bengalla. In the Racecourse Road Precinct there are residences to the north and east of the racetrack itself, with the race club and associated facilities to the west of the track.

A significant part of the town is located on foothills with views to Bengalla. This includes North Muswellbrook on the eastern side of the New England Highway and South Muswellbrook to the south-east of Denman Road. This includes the residential estate of Ironbark Ridge. The commercial areas of the town centre on lower slope areas that are generally not visually affected by Bengalla. However there are some views from more elevated commercial areas, such as Muswellbrook Market Place on Sowerby Street which has existing views.

Another significant feature of the town is the transport corridors of the New England Highway and the Main Northern Railway Line, both of which run through the town, Figure 3.1.

Figure 3.4 | *Foothills VCU*

The foothills are generally hills with low elevation, with a landscape mix of grassland, scattered trees and open forest. Foothills have generally been cleared for grazing purposes.

Figure 3.5 | *Town Area VCU*

Town areas have differing densities to support various functions, and the variety of landscapes also reflects this.

The township of Aberdeen is located some 12 km to the north-east of Bengalla. Some parts of the town are on elevated slopes with easterly and south-easterly aspects. These town areas would have some views to Bengalla as well as other mine areas such as Mt Arthur Coal Mine, Dartbrook Underground Mine facilities and approved (but yet to be developed) Mount Pleasant Project.

3.4.4 Surrounding Ranges

The surrounding ranges define the edges of the Hunter Valley and occur on both the eastern and western sides of the valley. These mountain ranges have significant elevation above the valley and foothills, are steep and forest covered however are located at significant distances from Bengalla.

The visual significance of the Ranges is that they often create the background to valley views from a full range of view locations. Areas that experience views to these distant ranges over existing mine developments include elevated areas in the foothills, and those residential areas on the western edge of Muswellbrook, Figure 3.6.

3.4.5 Mine and Industrial Uses VCU

This VCU consists of the existing Bengalla operations, as well as the larger Mt Arthur Coal Mine to the south, and the Thomas Mitchell Drive Industrial Estate. It will during the life time of the Modification and Project also include Mount Pleasant to the north. Beyond the PVC, there are also further extensive mining operations to the south-east and Mangoola to the west.

Mt Arthur Coal to the south of Denman Road and Bengalla, within the Southern Foothills contributes to the 'mine' visual character in this section of the foothills. From various locations such as Aberdeen and the adjoining areas within the Southern Foothills, Mt Arthur Coal mine operations are also seen in the context of Bengalla.

The Thomas Mitchell Drive Industrial Estate is an industrial area that also occurs in the Southern Foothills. Although the area would have views to Bengalla the area is not visually sensitive or significant because of its industrial use.

Bengalla

Currently Bengalla consists of the active mining area and associated Main OEA, with the latter being the element that is visually prominent from off-site areas to the north, east and south. The CHPP and other infrastructure are visually evident only from a limited number of locations to the south and west. The site has a strong industrial visual character due to its established use as a coal mine and coal handling area.

The OEA has two profiles: the first being the outer edge that has been progressively rehabilitated as overburden and topsoil emplacement is completed and the active edge to which new waste material is deposited. The rehabilitated side of the OEA integrates with the existing landscape of rolling hills within the Northern and Southern Hills VCUs, (refer Figure 3.7). The active face remains a high contrast and with low visual integration into the existing landscape. The steep back slope of the OEA dominates this face. These faces retain the light earth colours of the removed overburden, (refer Figure 3.7).

The existing Main OEA has both of these faces and visual features, and sections of the OEA have an approved maximum elevation of RL 270 m.

The CHPP is a large scale industrial facility clad in natural tones (greens and creams), that is large in both vertical and horizontal dimension. The largest scale horizontal elements are the rail loop and the coal stockpiles. The vertical elements of the plant are also significant as these can be seen, to varying degrees, from neighbouring areas. The major vertical elements include the CHPP main building, the rail loading bin and various elevated conveyors.

Both the existing OEA and CHPP are significant parts of the approved Project which now are part of the existing visual. Alterations to the existing mining activities that will result in changes to the OEA are part of the current Modification and are discussed in following Section 4.

Figure 3.6 | *Surrounding Ranges VCU*

The surrounding ranges have higher elevations and steeper slopes than those of the foothills, and are often more densely forested. The surrounding ranges are often the backdrop to views across and within the valley.

Figure 3.7 | *Mine and Industrial Uses*

The Bengalla existing OEA rehabilitated face (top) has colours and textures that are beginning to take the form of Foothills VCU. The Bengalla OEA active face (bottom) still has colour and texture indicating active mining.

4. The Modification

4.1 General

This section, together with Section 1 describes the proposed modification sought to the mining operations at Bengalla. More specifically, it considers those changes that are significant to the visual values of the environment and the approved operations.

Throughout the life of the mining operations, the ongoing rehabilitation of the overburden emplacement is a key component of the OEA implementation. This is the most significant element in relation to visual effects and impacts on the surrounding landscape.

4.2 Modification Components

As stated in Section 1.0 of this report, development components associated with the proposed modification of the approved mine plan that have visual implications include:

- Alterations to the approved height of the Main Overburden Emplacement Area (Main OEA) to improve visual amenity from primary viewing locations in and surrounding the township of Muswellbrook and Denman Road, in two selected locations (Visual Relief Areas):
    - The Northern Relief Area constructed to a maximum height of Reduced Level (RL) 300; and
    - The Southern Relief Area constructed to a maximum height of RL 290.
- Establishment of a gravel access road from Wybong Road to the Dry Creek Diversion Project Construction Site Office being a former homestead (Homestead Access).

The staged modifications included in this assessment are illustrated in the following mine plans.

4.2.1 Modification Components

- Northern and Southern Relief Areas – (OEA Modification)
- Homestead Access

4.3 Existing & Proposed Conditions

The existing and approved OEAs are the major mine components visible from surrounding viewing locations. The OEA has two primary faces, the active face and the eastern face. The active face is unshaped, steep, angular, and contains raw overburden material creating a high visual contrast and low integration with the environment, due to colour, form and scale.

The approved OEA at Bengalla as provided by SSD-5170 is illustrated Figure 4.1. The eastern face of the OEA is predominantly rehabilitated with established grass and areas of tree plantings which have reduced levels of visual contrast and improved levels of visual integration with surrounding landscape patterns and colours. The northern and southern outer edges continue to be actively formed and rehabilitated.

4.4 Northern and Southern Relief Areas – (OEA Modification)

The OEA Modification primarily relates to an increase in the height of the OEA from 270 m to a maximum height of approximately 300 m. This increase in height will be constructed by emplacement of overburden in two key areas (Northern Relief Area and Southern Relief Area) above the currently approved RL of 270m creating more articulated final ridgeline profile as illustrated in Figure 4.2 and Figure 4.3.

The modified OEA with two Visual Relief Areas will continue to expand in a westerly direction as per the approved OEA, as the pit moves west. The height of the final landforms of this emplacement will increase above the currently approved maximum elevation of 270 m by 30 m (Northern Relief Area) and 20 m (Southern Relief Area) respectively. The additional OEA mass at the increased height will be achieved in a staged emplacement program, in two adjacent separate areas resulting in a profile that reflects more naturally occurring undulating rural profiles. The staged emplacements of this modification are illustrated in Figure 4.2 to Figure 4.4.

4.4.1 Staging

The two relief areas of this modification are scheduled to commence in approximately Year 4.

By approximately Year 8 the two relief areas have extended to the west, the two separate mounds becoming more distinct. By Year 15 the visual relief areas are scheduled to be complete.

By Year 24 the conceptual final landform has been achieved. The northern relief area is higher with a finished maximum RL of 300 m, with a broader east west profile. The southern relief area has a maximum RL of 290 m.

4.4.2 Visual Character

A significant part of the visual environment in this locality are the existing mine areas and OEAs. Any existing approvals for mining activity also need to be considered as part of the existing visual environment. This includes the existing approved Bengalla OEA and how it is proposed to develop over time. These elements provide an immediate context and backdrop to the Modification. Due to the similar visual character and contrast, visual effect levels are minimised.

4.4.3 Visual Effects of the Modified OEA

The extents of visual effects of the OEA Modification are shown in plan on Figure 4.2 to Figure 4.4 and in schematic elevation in Figure 4.5 and Figure 4.6. Illustration of the visual effects in photomontages at Figure 6.2 to Figure 6.4 will result from:

- The staged increase in the height of the Main OEA
- Changes to the final OEA profiles

All other visual effects are consistent with the previously approved visual effects including:

- Rehabilitation of Modified OEA areas and
- Implementation of visual impact mitigation as described in Schedule 3 – Environmental Performance Conditions (37), (40) and (41) of Development Consent SSD-5170.

Height increase and profile changes to the Main OEA

The visual effect of altering the maximum height of the OEA and articulating the profile may result in a change in the line of view. The active areas of modified OEAs will be visible to viewing locations, as its vertical elevation is higher in the viewshed. It may also become visible to more view locations previously outside the line of view.

The approved OEA is a broad flat single OEA profile. The Modification, which seeks to improve visual outcomes, will create two smaller higher areas above the approved profile. As the Relief Areas achieve final design they are progressively shaped and rehabilitated. The modified relief of this final profile will reflect naturally occurring local topographic features such as found in the Foothills VCU.

4.4.4 Rehabilitation

Rehabilitation of the relief areas will be consistent with SSD-5170 and Bengalla Mine – Mine Operations Plan (2015) (MOP) which will be updated should the Modification be approved.

Schedule 3 Condition 44 of SSD-5170 (as Modified) further requires the Main OEA exposed to Muswellbrook and Denman Road to be rehabilitated with dense woody vegetation as soon as reasonable and feasible following the completion of mining operations. SSD-5170 Schedule 3, Condition 45 notes that rehabilitation should be conducted progressively as soon as practicable following disturbance (particularly on the face of the emplacements that are visible off-site).

Over time rehabilitation objectives will contribute to an improved rural landscape of grass and tree cover that will be more consistent with natural landscapes and will continue to be greater in elevation than the active face of the OEA. The increased height will maintain the visual dominance of the Main OEA particularly when viewed from the east and south-east.

4.5 Homestead Access

4.5.1 Visual character

The Homestead Access will be an unsealed track rising slightly from Wybong Road towards the north and will be similar to many existing unsealed rural roads in the area.

4.5.2 Visual effects

The Homestead Access will have a Type 3 visual effect with high levels of visual integration and low levels of visual contrast with surrounding existing rural features and landscape.

Figure 4.1 | ***Approved Mine Plan Layout***

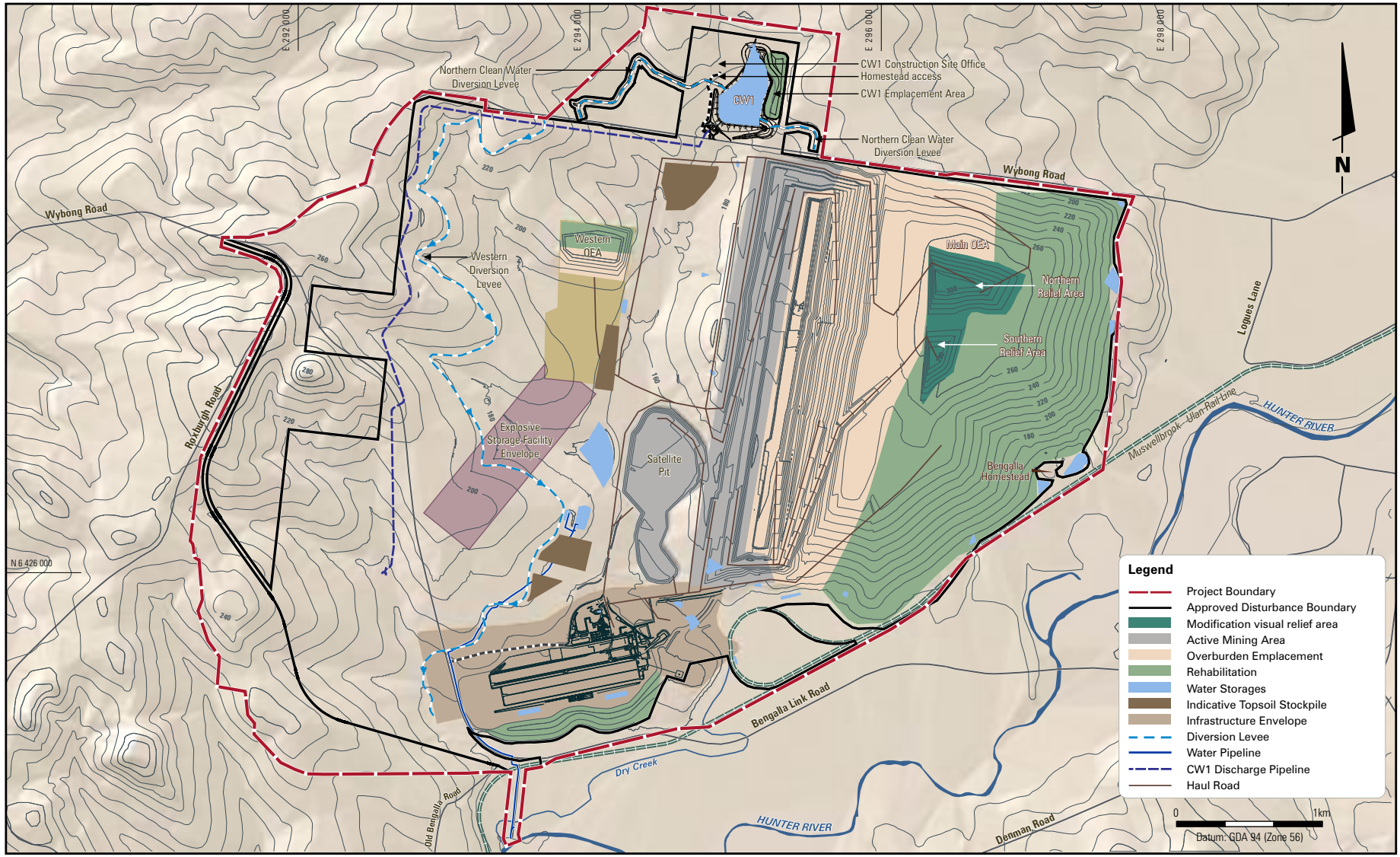

Figure 4.2 | *Modification Overview - Year 4 Mine Plan*