UNITED WAMBO OPEN CUT COAL MINE PROJECT

ENVIRONMENTAL IMPACT STATEMENT

August 2016

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UNITED WAMBO OPEN CUT COAL MINE PROJECT

Environmental Impact Statement

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
United Collieries Pty Ltd

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Executive Summary

United Collieries Pty Limited (United) and Wambo Coal Pty Limited (Wambo) operate neighbouring mining operations located approximately 16 kilometres west of Singleton in the Hunter Valley region of New South Wales (NSW). Under a Joint Venture arrangement, United and Wambo propose to develop the United Wambo Open Cut Coal Mine Project (the Project) which will involve combining the existing open cut operations at Wambo with a proposed new open cut coal mine at United. The Project has been designed to optimise future open cut coal mining operations across these two adjoining mining areas, maximising coal recovery and the efficient use of Wambo's existing mining infrastructure, while providing the operational flexibility required to actively manage the mine to minimise environmental impacts.

The existing Wambo underground mine is not part of the Project and will continue to be operated separately by Wambo.

This Environmental Impact Statement (EIS) has been prepared to accompany a Development Application for the Project, which is State Significant Development, and to also accompany associated applications to modify Wambo's existing development consents to harmonise them with the Project.

The Project

The Project includes open cut mining operations in two areas:

- the proposed United Open Cut
- ongoing mining of the approved Wambo Open Cut with a proposed minor surface boundary extension in addition to a depth increase to maximise coal recovery.

The Project will maximise resource recovery by combining these two mines and removing operational constraints, enabling extraction of an additional approximately 150 million tonnes (Mt) of run-of-mine (ROM) coal over 23 years. The Project will provide continued employment for the existing Wambo open cut workforce (approximately 250 positions) and create additional employment from the development of the Project (up to approximately 250 additional positions at peak production).

The Project is anticipated to deliver up to 10 million tonnes per annum (Mtpa) of ROM coal from the combined operations of the United and Wambo Open Cuts. The Project will deliver ROM coal to the Wambo coal handling and preparation plant (CHPP) along with coal deliveries from the Wambo underground. Total production deliveries to the Wambo CHPP will be limited to the currently approved production rate of 14.7 Mtpa ROM.

In addition to seeking approval for integrated open cut mining at United and Wambo, the Project will require changes to existing mining and public infrastructure within the Project Area including:

- ongoing use of the Wambo CHPP, mine infrastructure area and related facilities for the life of the Project (approval sought via a modification to the existing Wambo mine development consent)
- ongoing use of the Wambo train loading facility for the life of the Project (approval sought via a modification to the existing Wambo train loading facility development consent)
- ongoing use of, upgrades to and expansion of the existing Wambo and United mining infrastructure
- realignment of a 2 kilometre section of the Golden Highway and the relocation of sections of 330 kV and 66 kV transmission lines to maximise coal recovery from the United Open Cut.

The design of the Project was developed having regard to the potential environmental and social impacts associated with mining operations, with the aim of minimising potential impacts. A comprehensive stakeholder engagement strategy was implemented as part of the Project design and environmental assessment process and included stakeholder meetings, community information sessions, a community workshop and a series of newsletters distributed to 550 stakeholders. The engagement strategy outcomes assisted in refining the Project design and identifying appropriate management and mitigation measures.

Benefits of the Project

The Project will result in significant benefits at a local, regional and State level. These benefits include:

- an improved final landform across the Wambo and United mining areas, with the proposed mining operation placing overburden extracted as part of the mining process to achieve a more natural final landform. The final landform achieved for the Project will be a substantial improvement on the final landform that would have resulted from two adjoining and separate mines. The approach to developing the final landform has incorporated community feedback to achieve an improved design
- maximising coal resource recovery from the existing disturbed mining footprint and adjoining areas, utilising the existing disturbed landscape, whilst minimising environmental and social impacts
- optimising use of the existing Wambo mining infrastructure, maximising the use of existing capacity and removing the need for duplicating infrastructure to meet production demands
- ongoing employment for the Wambo Open Cut workforce whilst adding up to approximately 250 operational positions at peak production (up to approximately 500 total operational positions), with resultant flow on effects to the local and regional economy
- Wambo currently has approval to produce up to 14.7 Mtpa ROM coal. The Project combined with the separately managed Wambo underground will remain within this existing limit. That is, no change is proposed to total maximum production that is already approved for the Wambo complex
- peak construction phase employment of approximately 120 employees, combined with the economic benefits flowing from the expenditure of approximately $380 million capital required to implement the Project
- recovery of an additional approximately 150 Mt of ROM coal
- an ongoing contribution to the local, regional and State economies from two long standing and well established mining operations
- increase the gross regional product by a projected approximately $2.1 billion in net present value terms, over the life of the Project

- increase the NSW gross State product (including the Hunter region) by approximately $3.0 billion in net present value terms over the life of the Project
- a net benefit of $414 million to NSW over the life of the Project in present value terms
- royalty revenue stream flowing to the NSW government estimated to be $369 million over the life of the Project
- significant export earnings for Australia.

Through implementation of this Project, the Joint Venture believes it can contribute substantial economic benefits at local, regional and State levels whilst coexisting with the local community.

Broad Overview of Environmental, Social and Economic Outcomes

This EIS includes a detailed assessment of the potential environmental, social and economic outcomes of the Project and identifies the management, mitigation and offset measures that will be implemented as part of the Project. A summary of the key findings of the assessment process is provided in **Table 1**.

Table 1 – Summary of the Key Environmental, Social and Economic Impact Assessment Findings

Environmental/ Social Issue	Overview of Key Outcomes (after proposed Management, Mitigation, Offsets)
Air Quality	• Comprehensive air quality management controls have been incorporated into the design of the Project to minimise the contribution of the Project to impacts on local and regional air quality. • Cumulative dust levels and other air quality parameters are predicted to comply with the relevant criteria at all surrounding private residences, with the exception of a single private residence in Warkworth village. This residence has current acquisition rights for Wambo and is expected to be afforded acquisition rights for the Project. • A proactive and reactive dust control strategy will be implemented to minimise dust emissions over the life of the Project.
Noise	• As part of the design of the Project, United has incorporated a range of noise controls to minimise noise impacts. • Operational noise levels are predicted to exceed the noise impact criteria at a number of surrounding private residences. o Seven private residences are predicted to be significantly affected (i.e. more than 5 decibels (dB) above the criteria) – this includes the private residence at Warkworth noted above, which has existing acquisition rights. o Moderate impacts (i.e. 3 to 5 dB above criteria) are expected at 18 private residences. • The Project also has potential to contribute to cumulative noise impacts in Warkworth, Maison Dieu and at the nearest private residences to the northwest of the Project Area. • Noise impacts will be managed through the implementation of a proactive noise management and monitoring program which will be used to adaptively manage mining operations as required.

Environmental/ Social Issue	Overview of Key Outcomes (after proposed Management, Mitigation, Offsets)
Blasting	• Blasting activities will be managed so that relevant blast criteria are met at private residences or at blast sensitive infrastructure. Any impacts in excess of these criteria would only occur where a negotiated agreement is in place. • Blasting impacts will also be managed to avoid adverse effects on the State Significant Wambo Homestead heritage site.
Land Use and Agriculture	• The primary existing land use of the Project Area is mining. A small portion (30 hectares) of the mine owned land within the Project Area is currently used for low intensity grazing. • The mine owned grazing land impacted is primarily low productivity land, with the exception of approximately 4 hectares of biophysical strategic agricultural land (BSAL) which will be subject to relatively minor impacts as a result of construction of water management infrastructure. The BSAL will not be mined. • Much of the surrounding land is mine owned land significantly reducing the potential for impacts on private land uses. The existing mining operations have coexisted with the surrounding land uses since the 1960s without substantial land use conflict, and this is expected to continue. • The Project will have a minimal impact on surrounding land uses.
Water Resources	• A comprehensive water management system (WMS) has been designed for the Project to manage water in accordance with legislative requirements and relevant guidelines. • The WMS for the Project will be integrated with the existing WMS at Wambo to maximise water recycling, reducing external water import and releases. • The Project is not predicted to have significant impacts on downstream water quality, flows, flooding or water users. • The Project will make a minor contribution to impacts on alluvial groundwater systems. The Joint Venture has adequate water licences for the predicted groundwater take for the Project. • One private bore has the potential to be impacted as a result of the Project, however, this bore is not currently serviceable and is on one of the properties within the noise affectation zone. United has committed to make good arrangements with the owner of the bore should the potential impact be realised and the property not be purchased by United.

Environmental/ Social Issue	Overview of Key Outcomes (after proposed Management, Mitigation, Offsets)
Biodiversity	• Impacts to key biodiversity values have been avoided where practical through Project design. • The biodiversity impacts of the Project are being assessed, managed and offset under the framework of the Upper Hunter Strategic Assessment (UHSA). The UHSA is a joint Commonwealth/State government initiative. • Approximately 464 hectares of native woodland/forest vegetation will be removed from the additional disturbance area over the life of the Project. • Approximately 223.5 hectares of the Commonwealth listed Central Hunter Valley Eucalypt Forest and Woodland Critically Endangered Ecological Community will be impacted by the Project. • Four State listed endangered ecological communities will also be impacted by the Project. • United has committed to a biodiversity offset strategy under the UHSA to offset the biodiversity impacts of the Project. • The assessment of biodiversity matters of national environmental significance concluded that there are no significant residual impacts not addressed by the UHSA that need to be addressed in accordance with the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) Environmental Offset Policy.
Cultural Heritage	• A comprehensive Aboriginal Cultural Heritage Assessment process was completed for the Project in consultation with the 83 registered Aboriginal parties for the Project (including three Native Title claimant groups). • The Project will impact on 128 sites (81 artefact scatters, 45 isolated finds and 2 potential archaeological deposits) of which 122 were assessed as having low scientific significance and 6 were assessed as low-moderate scientific significance. • The Aboriginal Cultural Heritage Assessment found that the surrounding area is held to be of higher significance to many members of the Wonnarua community, however, the sites and/or places within the Project Area were considered to be of lower significance. • United will implement an impact mitigation strategy as part of the Project in consultation with the registered Aboriginal parties.
European Heritage	• The State Heritage Register listed Wambo Homestead occurs to the south of the proposed open cut mining operations. A detailed assessment found that the Project will not adversely impact on Wambo Homestead. • Several other heritage sites have been identified within and surrounding the Project Area. This includes a 'Dog-leg' fence which has been assessed as having State level significance. Part of the Dog-leg fence will be removed and/or impacted by the Project. A detailed survey and photographic/archival recording of the Dog-leg fence will be undertaken following relevant guidelines. Part of the fence will be re-erected in a new location determined in consultation with representatives of the local community. • Local heritage values impacted by the Project will be managed by archival recording.

Environmental/ Social Issue	Overview of Key Outcomes (after proposed Management, Mitigation, Offsets)
Visual	• Views of the existing mining operations are currently available from residences to the south, northwest, northeast and along the Golden Highway. • Similar views to the existing will continue, with overburden emplacement areas increasing in height in some areas and remaining visible as the Project progresses. • The active mining face within the approved Wambo Open Cut will be the most visible element for residences to the northwest and from the Golden Highway as mining progresses through the main ridgeline. This mining activity is currently approved. • The progressive rehabilitation of emplacement areas and shaping of the final landform using natural landscape principles is expected to reduce the visual impact of emplacement areas. Additional tree planting is proposed to assist in screening views of the Project from the Golden Highway.
Rehabilitation and Final Landform	• The Project will provide an improved, more natural final landform across the Wambo and United mining areas. The final landform achieved for the Project will be a substantial improvement on the final landform that would have resulted from two adjoining and separate mines. • The rehabilitation strategy for the Project aims to minimise environmental impacts throughout the life of the Project, as well as upon completion of the Project, and considers community feedback. • Ecological rehabilitation on the site will contribute to the biodiversity offset strategy for the Project. • The strategy will improve local and regional biodiversity outcomes through establishment of strategic habitat corridors, while also providing areas for managed agriculture.
Greenhouse Gas	• A range of energy and greenhouse gas management initiatives will be implemented as part of the Project to improve energy efficiency and reduce greenhouse gas emissions.
Transport	• The Project will require the realignment of a 2 kilometre section of the Golden Highway. The realignment will be designed in accordance with Roads and Maritime Service (RMS) and Austroads requirements and will be constructed prior to the closure of the section of the Golden Highway impacted by the Project to minimise the potential for disruption. • The predicted changes in traffic resulting from the Project are well within the capacity of the existing road network. • The total approved maximum annual tonnage of coal transported by train from the Wambo train loading facility will remain unchanged.

Environmental/ Social Issue	Overview of Key Outcomes (after proposed Management, Mitigation, Offsets)
Social and Economic	• The Social Impact and Opportunities Assessment found that from a technical social perspective, it is unlikely that the Project will result in significant change across any of the key community capitals (natural, economic, human, physical and social), thus affording a risk ranking of 'low' for impact on community sustainability. • A range of strategies will be implemented to seek to minimise social impacts and maximise benefits. • The Project will provide significant ongoing benefits for local and wider communities through employment, local and regional expenditure and payment of royalties and taxes. • A cost benefit analysis of the Project indicates that the overall net benefits of the Project to NSW (after full incorporation of costs, including environmental costs) would be in the order of $414 million in current terms.

Further details of the predicted environmental and social impacts of the Project are provided in the main text of the EIS and associated technical reports. The EIS includes commitments by United to the implementation of comprehensive management, mitigation and offset measures to minimise and counterbalance the predicted impacts of the Project.

The detailed cost benefit analysis undertaken for the Project has identified that the benefits of the Project will outweigh the costs, including consideration of environmental and social costs. The Project will provide significant economic benefits.

With the implementation of the management, mitigation and offset measures proposed by United, the assessment has concluded that the Project would result in a net benefit to the NSW community.

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Section 1.0

Introduction

1.0 Introduction

United Collieries Pty Limited (United) and Wambo Coal Pty Limited (Wambo) operate neighbouring mining operations located approximately 16 kilometres west of Singleton in the Hunter Valley region of New South Wales (NSW) (refer to **Figures 1.1** and **1.2**). The United Wambo Open Cut Coal Mine Project (the Project) will combine the existing open cut operations at Wambo with a proposed new open cut coal mine at United.

Mining has been occurring at Wambo since the late 1960s and at United since 1989, with both mines previously undertaking both open cut and underground mining operations. Over this time the two mines have regularly cooperated, including sharing access to coal resources where appropriate, to provide for more efficient recovery of the State's coal resources. The two mines have also shared some mining infrastructure including the joint use of the Wambo train loading facility, and share water to minimise external water demand.

Building on this long history of cooperative operations, in November 2014 United and Wambo announced a 50:50 Joint Venture between the two companies. The Joint Venture agreement outlines how the two companies will work together to further develop open cut coal resources held by the two mines. This Environmental Impact Statement (EIS) has been prepared to accompany a Development Application for the Project and associated applications to modify Wambo's existing development consents to harmonise them with the Project.

The Project proposes open cut coal mining for a period of 23 years, with mining in a new open cut mining area at United combined with ongoing mining at the existing, approved Wambo Open Cut mine under a modified mine plan. The Project has been designed to undertake future mining operations across these two adjoining open cut mining areas to maximise coal recovery and the efficient use of existing mining infrastructure, while providing the operational flexibility required to actively manage the mine to minimise environmental impacts. United will manage the proposed open cut mining operations on behalf of the Joint Venture. Wambo will continue to manage the ongoing Wambo underground mine operations, that are not subject of this application, and the Wambo coal handling and preparation plant (CHPP) and train loading facility that will be used for coal from the Project as well as from the continued Wambo underground operations.

The Project has been designed through a multi-disciplinary social and environmental risk-based approach that aimed to maximise resource extraction efficiency and optimise the use of existing mining infrastructure, whilst minimising impacts on the environment and community. As discussed in later sections of this EIS, the key learnings from the history of mining operations at the site; the stakeholder engagement program; the comprehensive social impact assessment; and the detailed environmental studies undertaken for the Project, have all been considered in the Project design.



FIGURE 1.1

Locality Plan

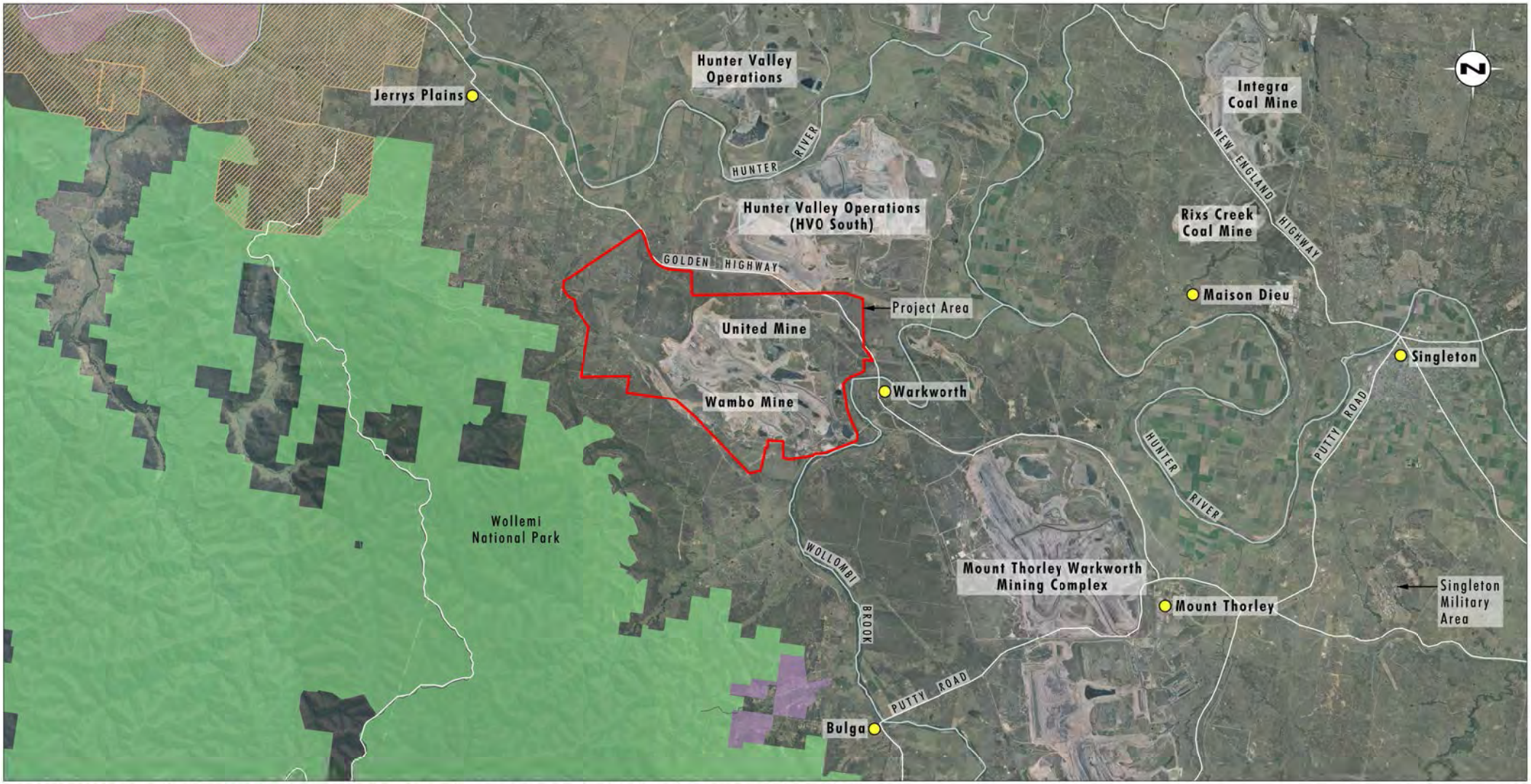


Image Source: AAM (2012), United (2015), Google Earth - CNES/Astrium 2016, Sinclair Knight Merz 2016, (2008)
Data Source: Glencore (2015), Minview (2015)

0 2.5 5.0 7.5km
1:150 000

Legend

- Project Area
- National Park
- SRLUP Viticulture CIC
- SRLUP Equine CIC
- Road
- River

FIGURE 1.2

Regional Context

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The Project will provide the following key benefits:

- an improved final landform across the Wambo and United mining areas, with the proposed mining operation placing overburden extracted as part of the mining process to achieve a more natural final landform. The final landform achieved for the Project will be a substantial improvement on the final landform that would have resulted from two adjoining and separate mines. The approach to developing the final landform has incorporated community feedback to achieve an improved design

- maximising the coal resource recovery from the existing disturbed mining footprint and adjoining areas, utilising the existing disturbed landscape, whilst minimising environmental and social impacts

- optimising use of the existing Wambo mining infrastructure, maximising the use of existing capacity and minimising the need for new infrastructure to meet production demands

- it improves the viability of open cut mining across the United and Wambo mining areas, retaining employment opportunities and providing ongoing economic benefits

- ongoing employment for the Wambo Open Cut workforce whilst adding up to approximately 250 operational positions at peak production (up to approximately 500 total operational positions), with resultant flow on effects to the local and regional economy

- Wambo currently has approval to produce up to 14.7 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal. The Project combined with the separately managed Wambo underground will remain within this existing production limit. That is, no change is proposed to total maximum production that is already approved for the Wambo complex

- peak construction phase employment of approximately 120 employees, combined with the economic benefits flowing from the expenditure of approximately $380 million capital required to implement the Project

- recovery of an approximate additional 150 Mt of ROM coal. The impacts of supplying this coal from within an existing mining area are significantly reduced when compared to supply from a new, 'greenfields' mine development

- an ongoing contribution to the local, regional and State economies from two long standing and well established mining operations

- increase the gross regional product by a projected approximately $2.1 billion in net present value terms, over the life of the Project

- increase the NSW gross State product (including the Hunter region) by approximately $3.0 billion in net present value terms over the life of the Project

- a net benefit of $414 million to NSW over the life of the Project in present value terms

- royalty revenue stream flowing to the NSW government estimated to be $369 million over the life of the Project

- significant export earnings for Australia.

Through implementation of this Project, the Joint Venture believes it can contribute substantial economic benefits at local, regional and State levels whilst coexisting with the local community.

This EIS has been prepared to assess the environmental and social impacts of the Project and will accompany a Development Application for the Project under Division 4.1 of Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). As noted above, the Project will also require modifications to existing Wambo development consents to harmonise these existing approvals with the Project. These modifications will be sought under section 75W of the EP&A Act.

1.1 The Proponents

United is owned 95 per cent by Abelshore Pty Limited, a wholly owned subsidiary of Glencore Coal Pty Limited (Glencore) and 5 per cent by the Construction, Forestry, Mining and Energy Union (CFMEU), and is managed by Glencore. Wambo is a subsidiary of Peabody Energy Australia Pty Limited (Peabody).

The Project will be managed by United on behalf of the Joint Venture. The proponent for the Development Application under Division 4.1 of Part 4 of the EP&A Act is United Collieries Pty Limited.

As discussed above, a modification to the existing Wambo development consents will also be required to harmonise the existing approvals with the Project. These modifications will be sought under section 75W of the EP&A Act. Wambo is the proponent for the proposed modifications to its consents. This EIS should be read as an Environmental Assessment (EA) in support of the two section 75W modifications.

1.2 The Joint Venture

As discussed above, in November 2014 United and Wambo entered into a 50:50 Joint Venture which will combine the extraction and exploration rights for a number of mining tenements held by United and Wambo. Currently, a number of lease boundaries and depth limits (stratified leases) restrict access to some of the coal reserves held by the two mines (refer to **Figure 1.3**). The Joint Venture will combine the management and operation of exploration and mining extraction within the Joint Venture tenements, being Exploration Lease (EL) 7211, Authorisation (A) 444, Mining Lease (ML) 1572, Consolidated Coal Lease (CCL) 775 and Coal Lease (CL) 374.

As part of the Joint Venture, United will manage Joint Venture tenements while Wambo will continue to manage its underground mining operations which do not form part of the Joint Venture or this Project. The existing mining infrastructure including the CHPP and train loading facility will be used for both the Project and Wambo's underground operations, and it is anticipated that they will continue to be managed by Wambo (subject to any changes in the commercial arrangements that exist between United and Wambo).

The Joint Venture arrangements allow for the most effective recovery of coal resources through the integration of the Joint Venture tenements, provide for efficient use of existing mining infrastructure and provide greater flexibility during mining operations to manage environmental impacts. Importantly, in a challenging market context, the Joint Venture arrangements also provide for reduced capital expenditure to develop these resources and improved flexibility to respond to market conditions.

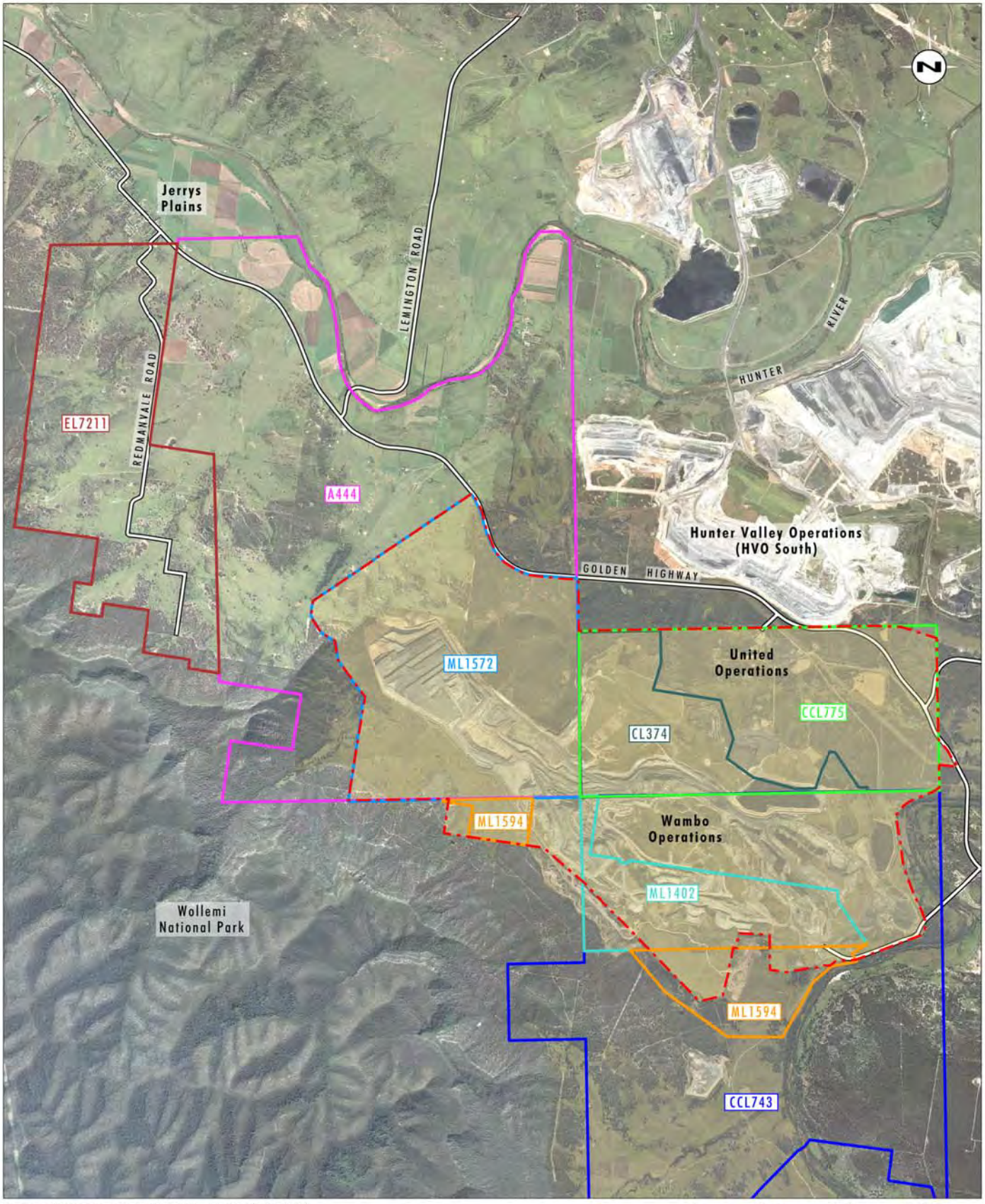


Image Source: AAM (2012), United (2015)
Data Source: Glencore (2015)

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1:70 000

Legend

- Project Area
- A444
- CL374
- CCL743
- CCL775
- EL7211
- ML1402
- ML1572
- ML1594

FIGURE 1.3

Existing Mining and Exploration Lease Titles Relevant to the Project Area

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1.3 Brief History of Mining Operations

The United and Wambo coal mining operations were established in 1989 and the late 1960s, respectively. There have been a range of underground and open cut coal mining operations at both of these adjoining coal mines since that time, with much of the Project Area having been subject to either disturbance by open cut mining operations or undermined (refer to **Figure 1.4**).

Whilst open cut coal mining has previously been undertaken at United, over the last two decades the focus has been on underground mining. Mining operations at United were suspended in March 2010 with the mine entering a period of care and maintenance. At that time, exploration and pre-feasibility works were commenced to determine the potential for future mining activities within United's mining tenements. Ongoing exploration has identified substantial reserves of coal suitable for open cut mining.

The existing and approved Wambo Open Cut adjoins the United mine operations and is approved to produce up to 8 million tonnes per annum (Mtpa) of ROM coal up to and including 2017, with underground operations currently approved to continue until March 2025. The combined Wambo underground and open cut operations have approval to extract up to 14.7 Mtpa ROM coal and to transport up to 15 Mtpa product coal via the approved train loading facility until 2025. Wambo has lodged a modification to development consent DA 305-7-2003, which includes an extension to the life of the open cut up to and including 2020, and an extension to the life of the underground operations to 2032 (refer to **Section 2.2.3**).

A brief overview of the history of mining at United mine and Wambo mine is included below with further details provided in **Section 2.0**.

United Mine

From July 1989 until July 1992, United comprised an open cut and auger mining operation extracting from the Whynot and Wambo seams. Underground mining operations at the mine commenced in 1992, continuing until March 2010 when, as noted above, operations were suspended with the mine entering a period of care and maintenance. At the time mining ceased, underground longwall mining operations at United were approved to provide up to 2.95 Mtpa of product coal.

United has a CHPP at the site which washed ROM coal from the underground operation for delivery to the export market. From 1989 until 2006, product coal was transported from United by road along the Golden Highway to the Mount Thorley Coal Loader. Following the construction of the Wambo rail spur and loop in 2006, product coal from United was transported via the Wambo train loading facility, which subsequently allowed for the removal of United's coal haulage trucks from the Golden Highway.

Prior to entering a period of care and maintenance, United operated up to 24 hours per day, 7 days per week.

Wambo Mine

A range of open cut and underground mining operations have been conducted at Wambo since mining operations commenced in 1969. Mining under the current Wambo mine development consent commenced in 2004. The approved ROM coal production rate is 14.7 Mtpa of ROM coal from the complex (open cut and underground operations combined) and product coal is transported from Wambo by train. The train loading facility has an approved capacity of 15 Mtpa of product coal.

The current approved Wambo Open Cut is authorised to produce up to 8 Mtpa of ROM coal. The open cut is bordered by United and the Golden Highway to the east and north, Wollombi Brook to the east and south, and Wollemi National Park to the west (refer to **Figure 1.2**).

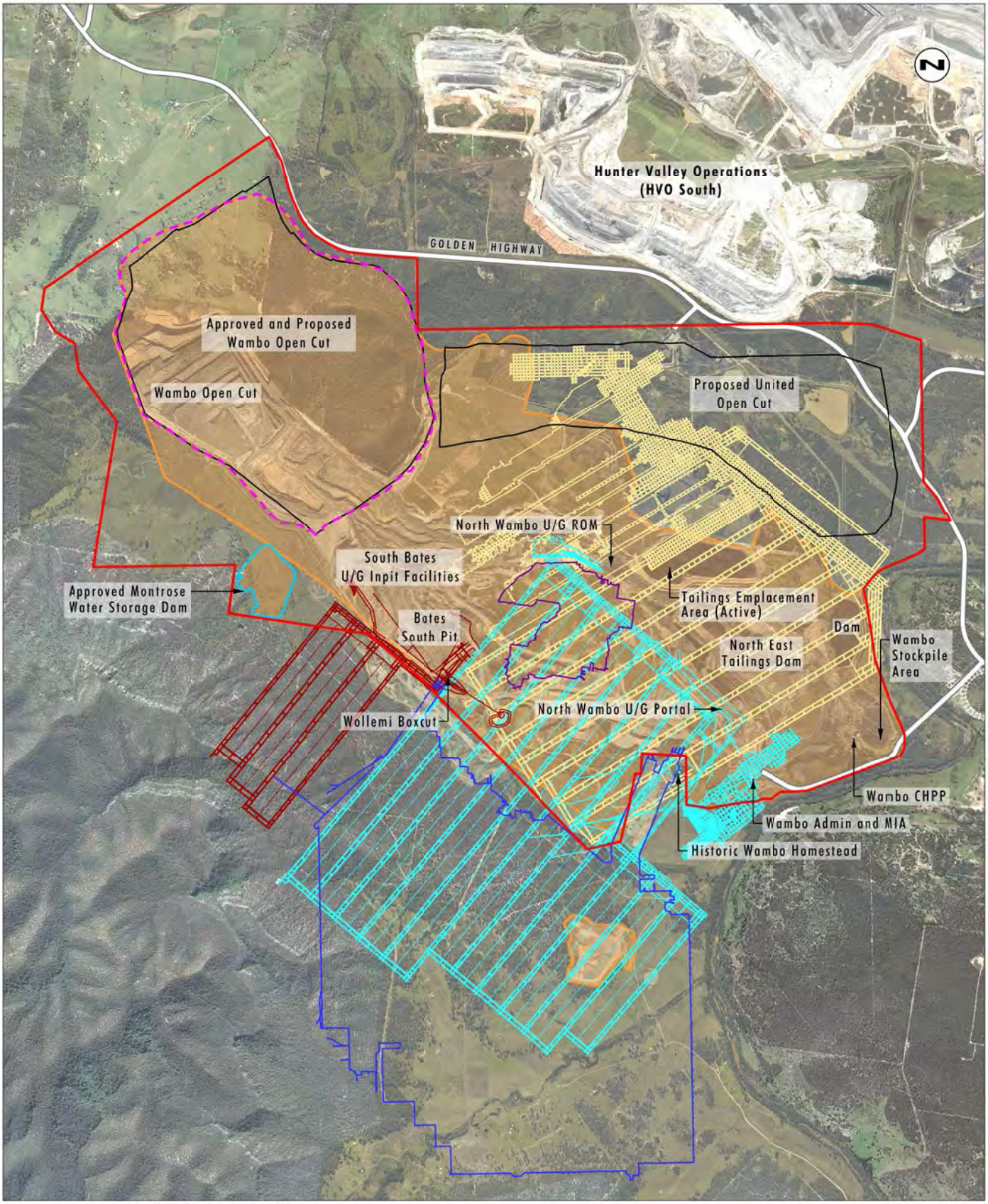


Image Source: AAM (2012), United (2015)
Data Source: Glencore (2014)

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1:50 000

Legend

- Project Area
- Proposed Conceptual Extraction Area
- Approved Wambo Surface Development Area
- Approved Wambo Open Cut Boundary
- Previous United Underground Workings
- Approved North Wambo Underground Mine
- Approved South Bates Underground Mine
- Ridge Underground Extents (Whybrow Seam)
- Wollemi - Homestead Underground Extents (Whybrow Seam)

FIGURE 1.4

Extent of Previous and Approved Mining Operations

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Wambo has four approved underground mining operations, being:

- North Wambo Underground Mine (commenced 2005 and now completed)
- South Bates Underground Mine (commenced 2014 and currently operational)
- Arrowfield Underground Mine (not yet commenced)
- Bowfield Underground Mine (not yet commenced).

ROM coal from the Wambo mining operations is delivered to the Wambo CHPP for processing.

Product coal from Wambo's operations is conveyed from the CHPP to the Wambo train loading facility. An average of four trains is loaded each day, with a maximum of six trains per day being loaded during peak coal transport periods.

Wambo operates up to 24 hours per day, 7 days per week.

1.4 Project Overview

United has sought to design a Project that aims to maximise the efficient extraction of open cut coal resources and optimises the use of existing mining infrastructure, whilst minimising impacts on the environment and community.

The Project includes open cut mining operations in two areas; the proposed United Open Cut and ongoing mining of the approved Wambo Open Cut with a proposed boundary extension (refer to **Figure 1.5**) and depth increase to maximise coal recovery. The Project will maximise resource recovery by combining the two mining operations and removing operational constraints, enabling extraction of an additional approximately 150 Mt of ROM coal over 23 years. The Project will provide continued employment for the existing Wambo open cut workforce (up to approximately 250 positions) and create additional employment from the development of the Project (up to approximately 250 additional positions at peak production).

The extent of the approved Wambo Open Cut is shown on **Figure 1.5** as is the approved Wambo Surface Development Area. The 2004 EIS for the Wambo mine indicated that open cut mining would be complete by approximately 2017. Due to the progression of mining being slower than originally planned, there will be substantial coal resources remaining in this approved mining area at the end of 2017 and the Project proposes to continue mining in this approved area. The Project also seeks some minor extensions to the approved Wambo Open Cut mining area (refer to **Figure 1.5**) and will seek approval to mine deeper resources below the approved Wambo Open Cut.

The Project is anticipated to deliver up to 10 Mtpa of ROM coal from the combined operations of the United and Wambo Open Cuts. The Project will deliver ROM coal to the Wambo CHPP along with ROM coal deliveries from the Wambo underground. Total ROM coal throughput at the Wambo CHPP will be limited to the existing approved production rate of 14.7 Mtpa ROM.

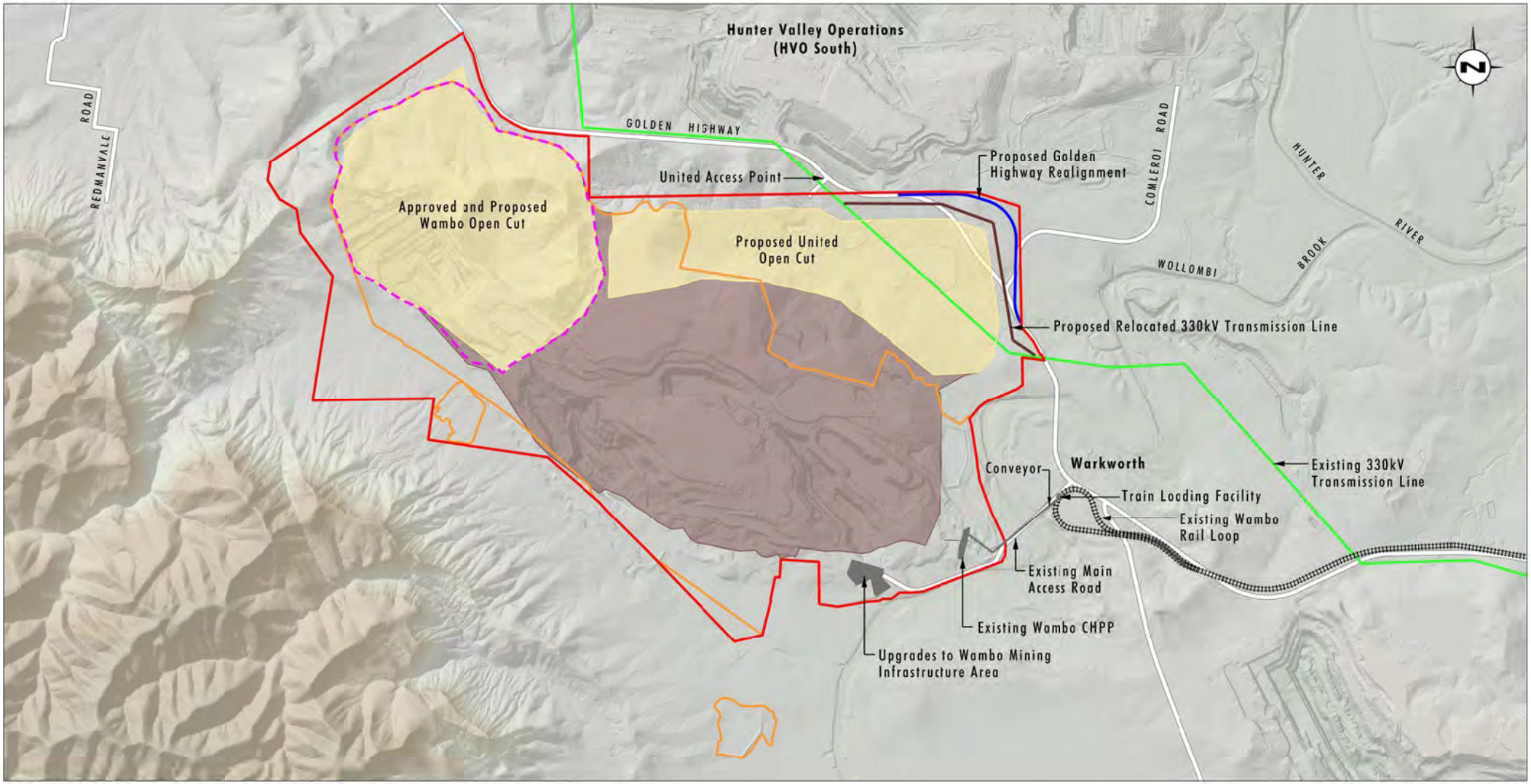


Image Source: United LiDAR (2015)
Data Source: Glencore (2015)

0 1.0 2.0 3.0km
1:60 000

Legend

- Project Area
- Proposed Conceptual Extraction Area
- Active Mining Area
- Approved Wambo Surface Development Area
- Approved Wambo Open Cut
- Proposed Golden Highway Realignment
- Existing 330kV Transmission Line
- Proposed Relocated 330kV Transmission Line

FIGURE 1.5

Overview of The Project

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In addition to seeking approval for integrated open cut mining at United and Wambo, the Project will require a number of changes to existing mining and public infrastructure within the Project Area. These proposed modifications are described in detail in **Section 3.0** and in summary include:

- ongoing use of, as well as upgrades and expansion of the existing Wambo and United mining infrastructure, including changes to the Wambo Mining Infrastructure Area (MIA) to accommodate the proposed mining fleet and increased workforce numbers

- ongoing use of the Wambo CHPP and train loading facility for the life of the Project, including changes to coal stockpiles at the CHPP and an increase in maximum daily train movements at the CHPP from six to eight (no change to the total annual rail volumes permitted by the existing approvals)

- realignment of a 2 kilometre section of the Golden Highway and the relocation of sections of 330 kV and 66 kV transmission lines to maximise coal recovery from the United Open Cut

- changes to the existing mine water management system and other ancillary infrastructure and services to provide for the Project

- construction and use of temporary construction facilities.

A key benefit of the Project is that it will provide for an improved final landform across the Project Area, with the proposed mining operation placing overburden to result in an integrated final landform. The final landform achieved for the Project will be a substantial improvement on the final landform that would have resulted from two adjoining, but separate mines, which would likely have occurred without the Joint Venture. The approach to developing the final landform for the Project was subject to community consultation and the local community's views have been incorporated into the design.

1.5 Project Development Application and Modification Applications

The Project will require development consent under Division 4.1 of Part 4 of the EP&A Act. Being development for the purpose of coal mining, the Project is declared to be a State Significant Development under the provisions of State Environmental Planning Policy (State and Regional Development) 2011 and the NSW Planning and Assessment Commission (PAC) is the consent authority for the Project acting under delegation from the Minister for Planning.

The Project Development Application relates to proposed open cut coal mining for a period of 23 years, with mining in the new United Open Cut combined with ongoing mining at the existing, approved Wambo Open Cut under a modified mine plan. The Project seeks some minor extensions to the approved Wambo Open Cut surface mining area and will seek approval to mine deeper resources below the approved Wambo Open Cut area. The Project also involves changes to existing and proposed new mining and public infrastructure.

The existing Wambo mine development consent (DA 305-7-2003) which allows for both open cut and underground mining, and coal processing and the Wambo train loading facility development consent (DA 177-8-2004) which allows for train loading and coal transportation, will remain in place. These two consents will, however, require modification to harmonise them with the Project (refer to **Sections 3.0** and **4.0**). The harmonisation will include extending the period of approved operation of the CHPP, MIA and train loading facility (and associated facilities) to match the life of the Project. The existing Wambo underground mining operations will not be modified as part of this application.

It is intended that the Wambo Open Cut will continue to operate under the existing conditions of the Wambo mine development consent until such time as mining operations commence under a development consent which is granted for the Project. This will provide for ongoing operation of the Wambo Open Cut under its existing approvals until mining operations comprising the Project have commenced, at which point it is appropriate for these operations to be regulated by a new development consent for the Project. It is noted that some construction activities may be undertaken under the new development consent prior to United commencing mining operations for the Project.

If development consent is granted for the Project, various approvals, licences and permits under other NSW legislation will also be required prior to the commencement of certain activities associated with the Project. These are discussed in detail in **Section 4.0**.

In addition to the approvals required for the Project under NSW legislation, consideration of the Project is required under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Project was referred to the Commonwealth Department of the Environment (DoE) to determine whether it constitutes a controlled action under the EPBC Act. On 7 December 2015 DoE determined that the Project is a Controlled Action and therefore requires approval from the Commonwealth Minister for the Environment. The assessment of the Project under the EPBC Act will occur via the bilateral assessment agreement between the Commonwealth and NSW Governments. Further discussion of the requirements of the EPBC Act as they relate to the Project is included in **Section 4.0**.

1.5.1 Environmental Assessment of the Project

This EIS has been prepared by Umwelt (Australia) Pty Limited (Umwelt) on behalf of United and Wambo in accordance with the requirements of the EP&A Act and the *Environmental Planning and Assessment Regulation 2000*, including the Secretary of the Department of Planning and Environment (DPE) Environment Assessment Requirements (SEARs) for the Project. The SEARs for the Project were originally issued on 7 July 2015 and reissued on 15 December 2015 inclusive of the assessment requirements from DoE and identify the specific requirements to be addressed by this EIS. A copy of the SEARs is contained in **Appendix 1**. A checklist of the SEARs and where they have been addressed in this EIS is outlined in **Section 4.2**.

This EIS includes a description of the existing mining operations in the Project Area (**Section 2.0**), a detailed description of the Project (**Section 3.0**), a discussion of the planning context (**Section 4.0**), an overview of the stakeholder engagement process (**Section 5.0**), a detailed environmental and social impact assessment including proposed management and mitigation measures (**Sections 6.0** and **8.0**), and an overall conclusion of the findings of the assessment process including consideration of the principles of ecologically sustainable development.

As noted above, this EIS has been prepared to accompany both a Development Application for the Project and associated applications to modify Wambo's existing development consents to harmonise the Project with the approved Wambo operations.

1.6 Site Context

1.6.1 Environmental Setting

The Project Area is dominated by existing mining including open cut mining areas, underground mining infrastructure associated with United and the existing Wambo Open Cut along with areas of rehabilitated land and native vegetation (refer to **Figure 1.2**). The majority of the remainder of the Project Area has been historically cleared, with an analysis of historical aerial photography indicating that most of the area had been cleared by the 1960s (refer to **Section 6.3**). As discussed in **Section 1.2**, United and Wambo have a number of existing mining tenements which cover the entirety of the Project Area with the exception of the Golden Highway (refer to **Figure 1.3**).

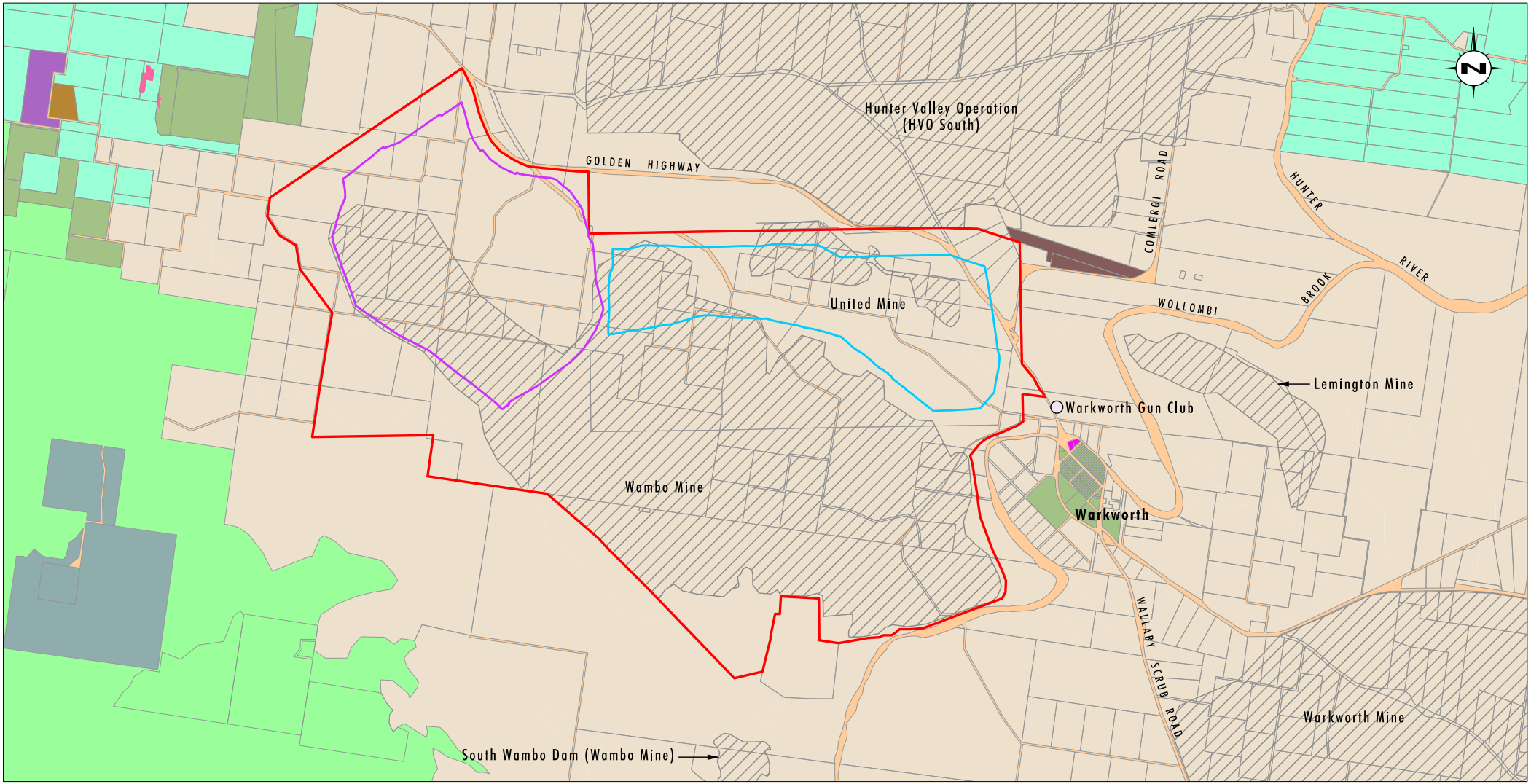
The Project Area exists within a locality dominated by mining (refer to **Figure 1.6**) and is surrounded by other mining operations, including Wambo's underground operations and Coal and Allied's Hunter Valley Operations (HVO) and their associated mine owned land. Several other mines are located further south including Mount Thorley Warkworth and Bulga Mine (refer to **Figure 1.2**). Outside of mine owned land, the local area is dominated by agricultural land uses, predominantly grazing, and the Wollemi National Park to the west.

The village of Warkworth is located approximately 1 kilometre to the southeast of the Project Area. As discussed in **Section 1.6.2**, all but one of the residences in Warkworth Village is owned by mining companies (there are also seven privately owned vacant rural lots). The village of Jerrys Plains is located approximately 6 kilometres northwest of the Project Area and has an approximate population of 370, with the village of Bulga (population of approximately 358) and rural residential area of Maison Dieu (population of approximately 162) located approximately 7 kilometres to the south and approximately 4 kilometres to the northeast of the Project Area respectively (refer to **Figure 1.2**).

The topography of the Project Area is characterised by an undulating and hilly landscape with lower topographic areas associated with the drainage lines. An important topographical feature is a minor ridgeline in the northwest position of the Project Area which extends to a height of approximately 200 mAHD (refer to **Figure 1.7**). This ridgeline provides a topographic barrier between the area proposed for the open cut operations at United Mine and the private land to the northwest, including Jerrys Plains. Approximately 0.5 kilometres to the west of the Project Area lie the foothills of the Wollemi National Park which form the dominant landscape feature of the land surrounding the Project Area (refer to **Figure 1.2**), with steeper slopes and escarpment areas fringing the Hunter Valley floor. Wollemi National Park and the adjacent Yengo National Park provide a large expanse of conservation land stretching south to the west of Sydney.

The remaining surrounding topography is characterised by gently sloping alluvial plains and undulating hills (refer to **Figure 1.7**). The Project Area is located within the catchments of Redbank Creek, Wollombi Brook, North Wambo Creek, Hunter River and Waterfall Creek, as described in **Section 6.8.1**. The catchment context within and surrounding the Project Area is shown on **Figure 1.7**.

Prior to the establishment of mining operations, the Project Area had a long history of agricultural land uses, such as grazing. Grazing operations are still relatively wide spread throughout the surrounding area, whilst the extent of dairy operations has declined over the last two decades. Irrigated agriculture is currently being undertaken along the alluvial floodplains of the Hunter River to the north of the Golden Highway.



Data Source: LPMA (2009), Department of Natural Resources (2005)
Note: Refer to Figure 1.8 for Receiver Locations

0 1.0 2.0 3.0km
1:60 000

Legend

- Project Area
- Proposed Conceptual United Open Cut Pit
- Proposed Conceptual Wambo Open Cut Realignment
- Woodland Area - Private Management
- Mixed Grazing Land
- Cropping Land
- Mining Operations and Buffer Land
- National Park
- Private Vineyards
- Vineyards on Mine Owned Land
- Gliding Club
- Government Authority (Federal, State or Local)
- Rural Residential
- Equine Veterinary Facility
- Extent of Existing Surface Mining and Associated Activities (as at 2015)

FIGURE 1.6

Land Use

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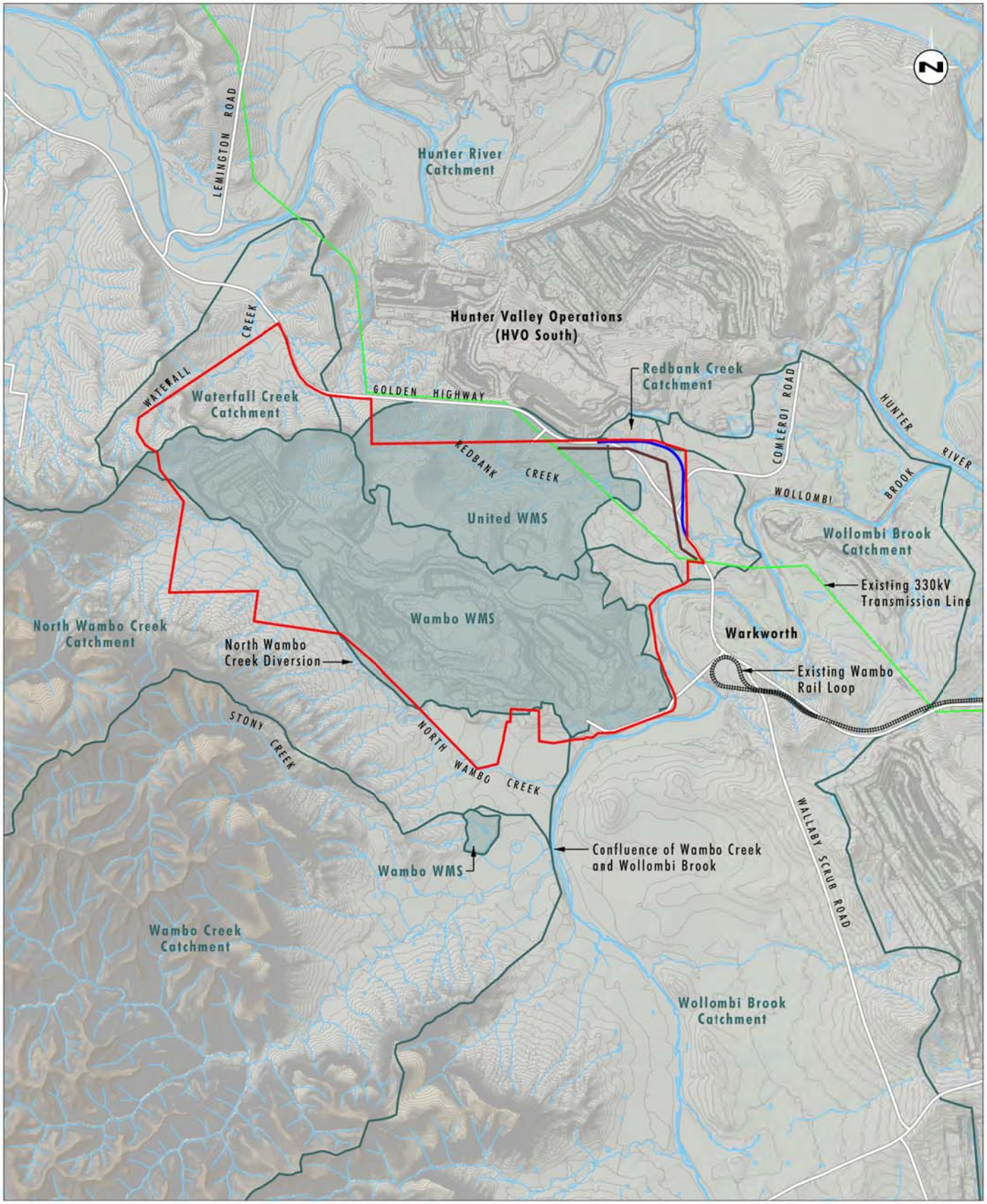


Image Source: United LiDAR (2015)
Data Source: Glencore (2014)
Note: 5m Contour Interval

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1:80 000

Legend

- Project Area
- Proposed Golden Highway Realignment
- Existing 330kV Transmission Line
- Proposed Relocated 330kV Transmission Line
- Catchment Area
- Water Management System Catchment

FIGURE 1.7

Topography and Drainage of Project Area and Surrounds

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The Strategic Regional Land Use Plan (SRLUP) prepared by the NSW Government identifies an area of land to the northwest of the Project Area as an equine Critical Industry Cluster (CIC) (refer to **Figure 1.2**). The nearest boundary of this CIC is located approximately 6 kilometres northwest of the Project Area. This land appears to be associated with horse grazing, with the nearest more intense horse stud activities (Coolmore stud) being more distant, approximately 14 kilometres from the Project Area. Coolmore stud is visually separated from the Project Area by intervening topography as well as the significant separation distance. The closest viticulture CIC is located in the Bulga area approximately 5 kilometres south of the Project Area however, there are some small areas of vineyard located approximately 2 kilometres northwest of the Project Area (refer to **Figure 1.6**).

1.6.2 Land Ownership

Land ownership in the Project Area and surrounds is shown on **Figure 1.8**. United and Wambo own the majority of freehold land within the Project Area other than road reserves, some small parcels of land owned by Coal and Allied, two small private parcels of land at the intersection of the Golden Highway and Comleroi Road and an area of Crown land. United's land interests in the area are held by the CFMEU on behalf of United. The two small private parcels of land are owned by a deregistered company and enquiries are being made with ASIC in relation to the acquisition of this land.

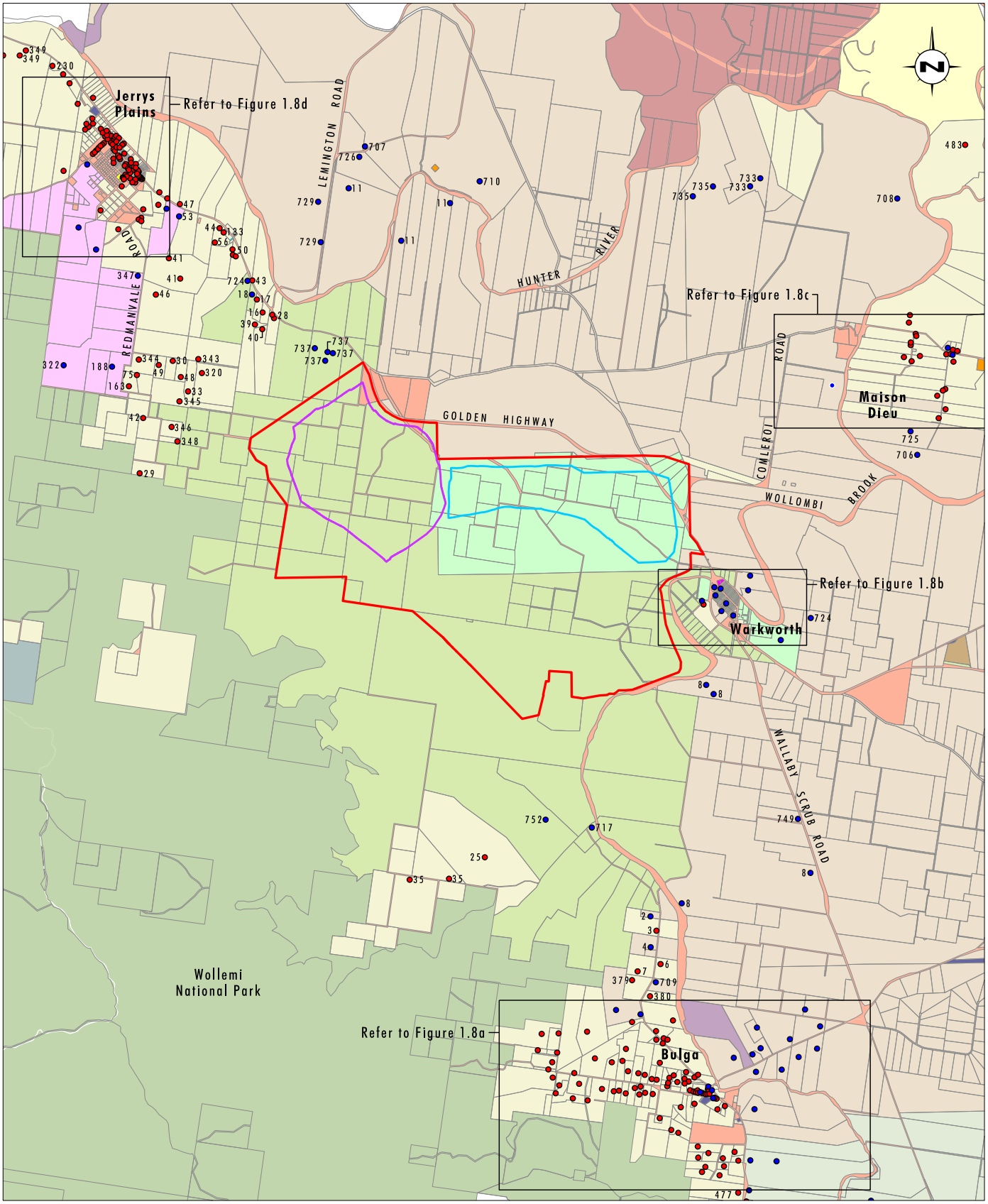
The land ownership immediately surrounding the Project Area is dominated by mining operations which are the major landholders within the area (refer to **Figure 1.8**).

As discussed in **Section 1.6.1**, Warkworth Village is located approximately 1 kilometre southeast of the Project Area. There is one privately owned residence and 10 mine owned residences within the village of Warkworth. There are also seven privately owned vacant land areas within Warkworth Village (two owned by the Wanaruah Local Aboriginal Land Council). The one remaining privately owned residence within Warkworth Village has current acquisition upon request rights under Wambo's existing development consent.

The seven privately owned vacant land areas within Warkworth Village are all small lots, are all zoned RU1 Primary Production and do not have a dwelling entitlement under the Singleton Local Environment Plan (LEP) 2013. Clause 4.2A(3)(a) of the Singleton LEP states that development consent must not be granted for the erection of a dwelling house on land zoned rural unless it is to be located on a lot that is at least a minimum lot size of 40 hectares (or unless other exemptions apply which are not known to be relevant in this circumstance).

The nearest private residence to the northwest is located approximately 1.5 kilometres from the Project Area boundary, whilst the nearest private residence to the south is located approximately 2.5 kilometres from the Project Area boundary. The intervening land between the Project Area and the nearest private residence to the northeast, located approximately 5 kilometres from the Project Area boundary at Maison Dieu, is primarily mine owned.

The Schedule of Lands for the Project (including for the new State Significant Development Application and for the Harmonisation Modifications) is provided in **Appendix 2**. The approved Development Application areas for the Wambo mine development consent and the Wambo train loading facility development consent are shown on **Figure 1.9**.



Data Source: LPMA (2009), United (2015)

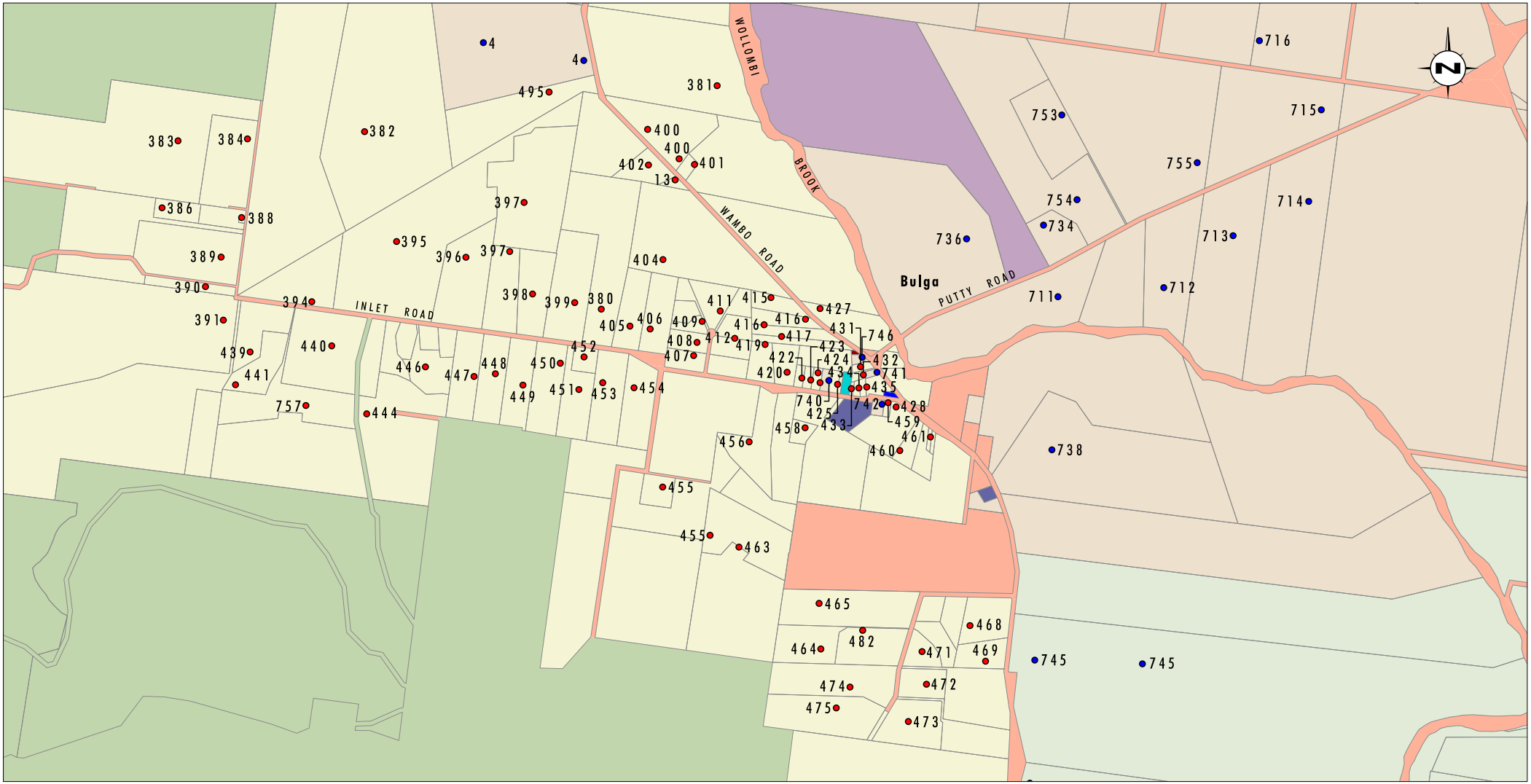
0 1.0 2.5 5.0km
1:100 000

Legend

- Project Area
- Proposed Conceptual United Open Cut Pit
- Proposed Conceptual Wambo Open Cut Realignment
- Mine Owned (Ashton)
- Mine Owned (Bulga)
- Mine Owned (Coal and Allied)
- Mine Owned (Doyles Creek)
- Mine Owned (Glencore)
- Mine Owned (Integra)
- Mine Owned (Peabody)
- Mine Owned (Ravensworth)
- Mine Owned (Wambo)
- AGL Energy
- Ausgrid
- Bulga Community Centre
- Government Authority (Federal, State or Local)
- Department of Education and Communities
- Diocese of Newcastle
- National Parks and Wildlife Service
- Private
- Redbank Energy
- Singleton Council
- Telstra
- Wanaruah Local Aboriginal Land Council
- Private Residence
- Mine Owned Residence

FIGURE 1.8

Land Ownership



Data Source: LPMA (2009), United (2015)

0 0.5 1.0 1.25km
1:25 000

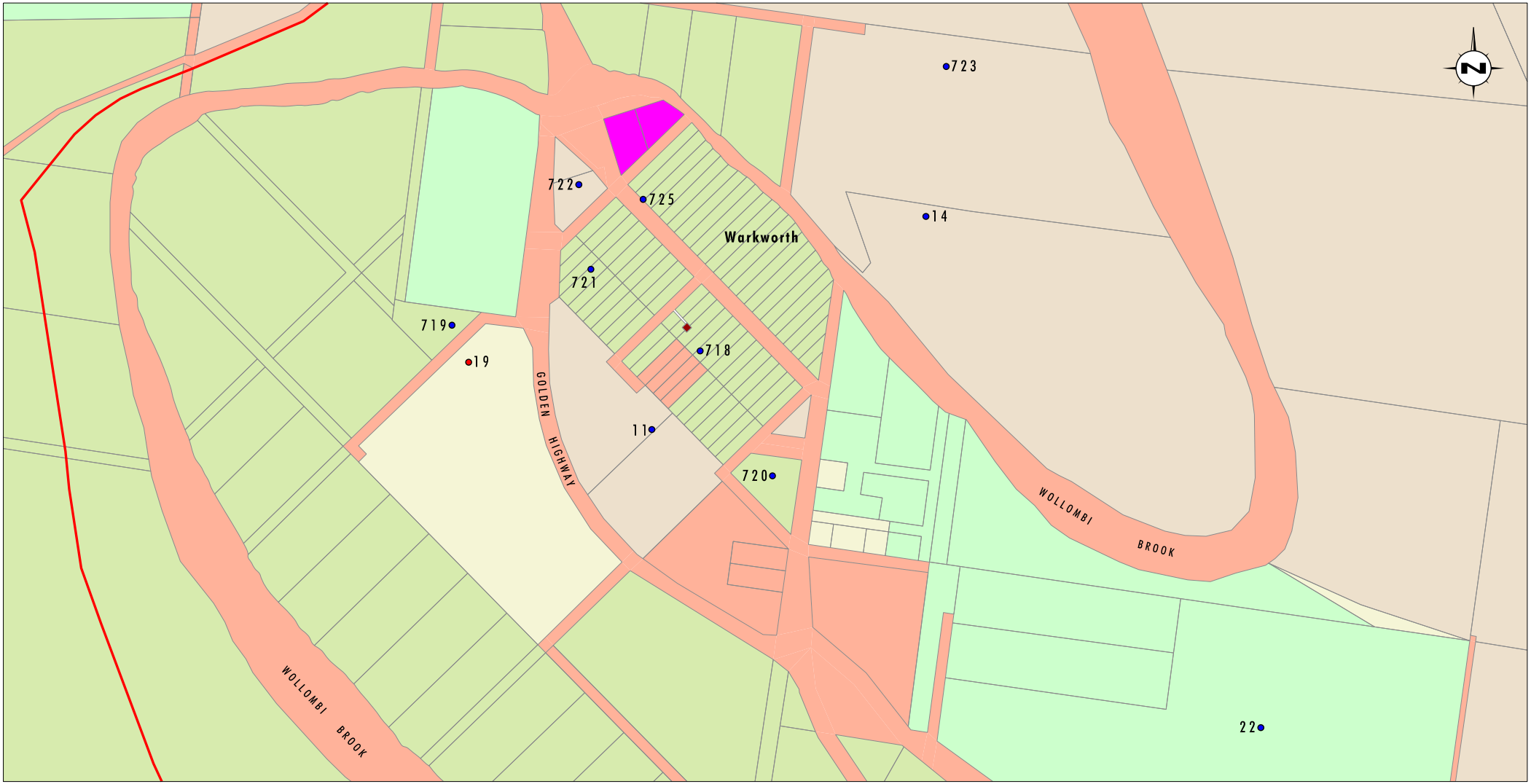
Legend

- Mine Owned (Bulga)
- Mine Owned (Coal and Allied)
- Private
- AGL Energy
- Singleton Council
- Telstra
- Diocese of Newcastle
- Bulga Community Centre
- Government Authority (Federal, State or Local)
- National Parks and Wildlife Service
- Private Residence
- Mine Owned Residence

FIGURE 1.8a

Land Ownership - Bulga

File Name (A4): R06/3509_428.dgn
20160728 13.43



Data Source: LPMA (2009), United (2015)

0 100 250 500km
1:10 000

Legend

- Project Area
- Mine Owned (Coal and Allied)
- Mine Owned (Wambo)
- Mine Owned (Glencore)
- Private
- Telstra
- Government Authority (Federal, State or Local)
- Wanaruah Local Aboriginal Land Council
- Private Residence
- Mine Owned Residence

FIGURE 1.8b

Land Ownership - Warkworth

File Name (A4): R06/3509_429.dgn
20160728 13.45



Data Source: LPMA (2009), United (2015)

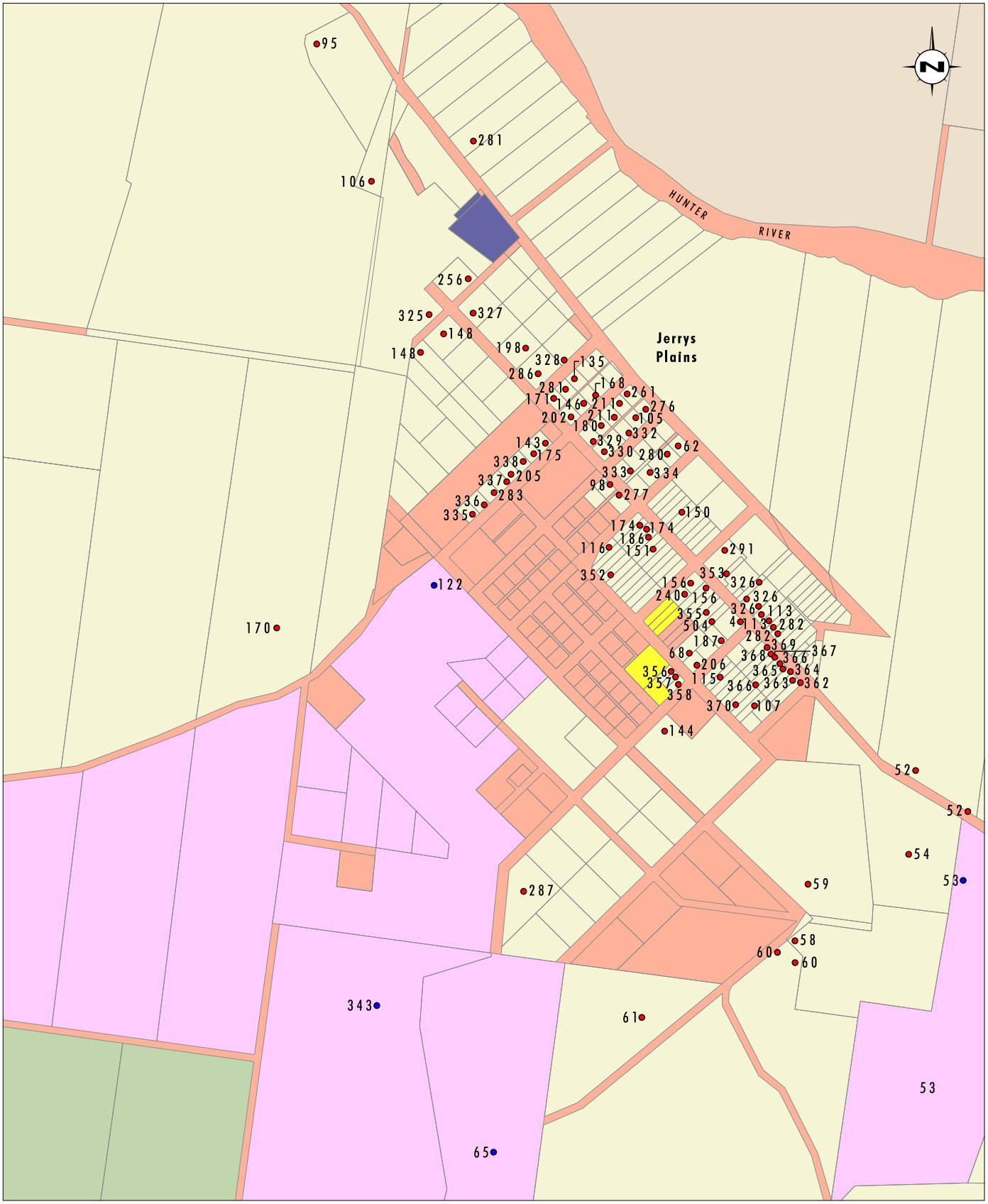
Legend

- Mine Owned (Coal and Allied)
- Private
- Ausgrid
- Government Authority (Federal, State or Local)
- Private Residence
- Mine Owned Residence

FIGURE 1.8c

Land Ownership - Maison Dieu

File Name (A4): R06/3509_430.dgn
20160728 13.46



Legend

- Mine Owned (Doyles Creek)
- Private
- Singleton Council
- Department of Education and Communities
- Government Authority (Federal, State or Local)
- National Parks and Wildlife Service
- Private Residence
- Mine Owned Residence

FIGURE 1.8d

Land Ownership - Jerrys Plains

File Name (A4): R06/3509_431.dgn
20160728 13.47

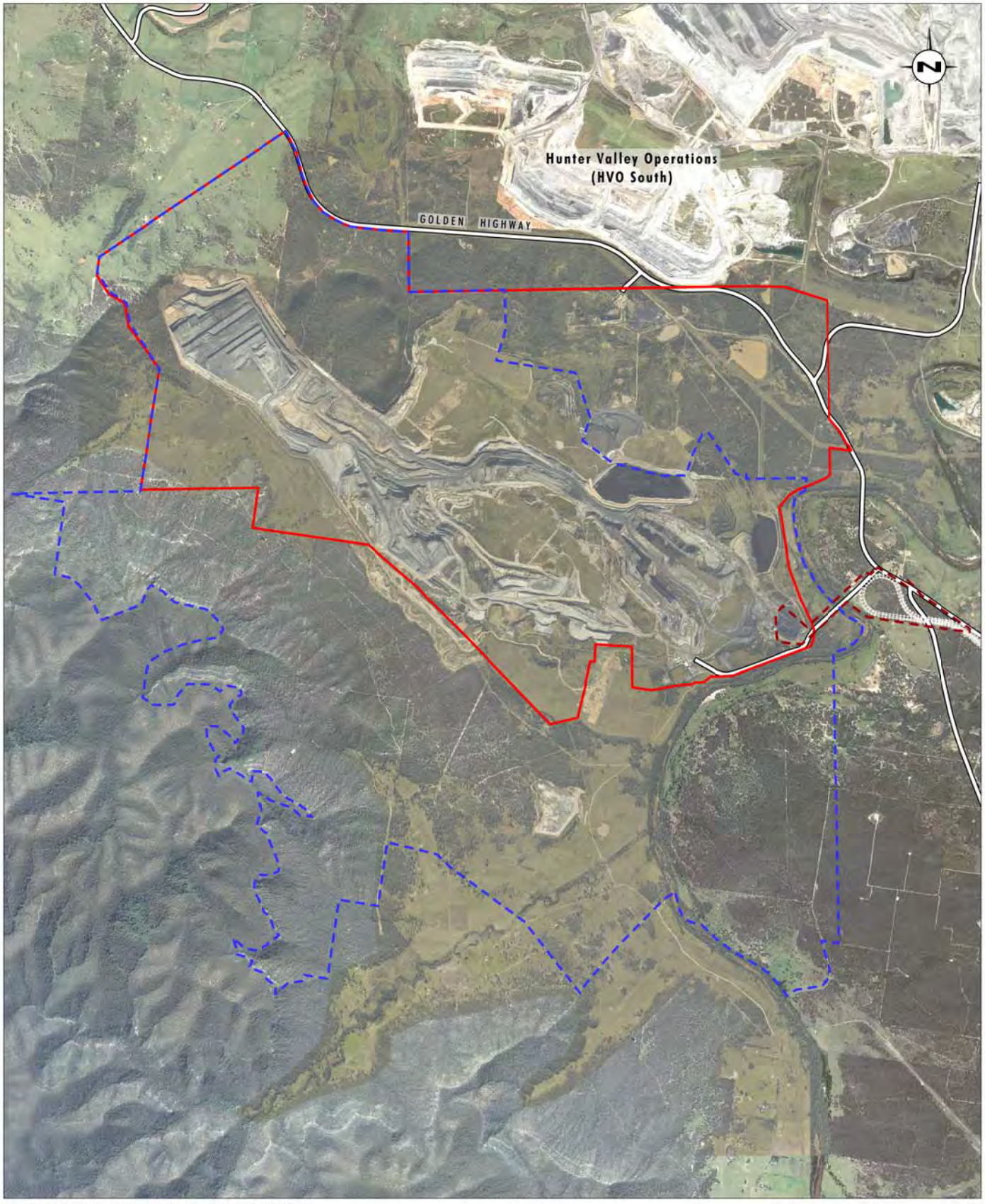


Image Source: AAM (2012), United (2015)
Data Source: Glencore (2014)

0 1.0 2.0 3.0km
1:60 000

Legend

- Project Area
- Wambo Mine Development Consent Development Application Area
- Wambo Train Loading Facility Development Application Area

FIGURE 1.9

Approved Wambo Development Application Area

1.7 Working with the Community and Stakeholders

United is committed to maintaining and further establishing a relationship with the surrounding community and other stakeholders and is committed to working with the community to minimise the impacts of its operations such that it can coexist with the local community. United recognises that achieving this outcome requires ongoing commitment and the development of strong working relationships with the local community.

United mine has been in a period of care and maintenance since 2010. Over this time United has continued to operate a Community Consultative Committee (CCC) which is a mechanism for feedback between the operation and the community. United is committed to maintaining ongoing open and honest communication by actively engaging and consulting with the surrounding community to provide information relating to the environmental, social and operational performance of its operations. Glencore, as the manager of United, has extensive local experience working with the community at its nearby open cut mining operations including the Bulga Mine. The learnings from these existing operations will be used by the Project to assist in effectively engaging with the community.

Wambo has an established community engagement program which includes a CCC, community meetings, the distribution of community information sheets and a 24-hour community response line for community members to raise any concerns they may have directly with relevant personnel. A review of the issues previously raised by the community in relation to the Wambo Open Cut was undertaken as part of the assessment process to provide background information on the local community's key issues.

As discussed in **Section 5.0**, extensive Project specific engagement has been undertaken with interested and potentially affected people and groups in the form of one-on-one meetings, community information sessions in the School of Arts hall in Jerrys Plains and an issue specific workshop focussing on landform and visual impacts. Detailed stakeholder engagement was also undertaken as part of the social and economic impact assessment processes for the Project. The most commonly raised issues concerning the Project included air quality/dust and noise, followed by more social related impacts such as impact to sense of community, property value, future uncertainty relating to mining and opportunities for local employment.

The Project Area is located within the traditional lands of the Wonnarua people. Extensive consultation has been undertaken as part of the Aboriginal Cultural Heritage and Aboriginal Archaeology Assessment process for the Project with 83 Registered Aboriginal Parties (RAPs) and the Wonnarua Knowledge Holders (refer to **Sections 5.0** and **6.10**).

1.8 Project Team

This EIS was prepared by Umwelt on behalf of United. Studies contributing to and included in the EIS were undertaken by a number of technical specialists, including:

- Agricultural Impact Assessment – Umwelt
- Air Quality Assessment – Jacobs Group (Australia)
- Greenhouse Gas and Energy Assessment – Umwelt
- Noise Impact Assessment – Umwelt
- Blasting Assessment – Enviro Strata Consulting (ESC)
- Surface Water Resources Assessment – Umwelt

- Water Balance Assessment – Hydro Engineering and Consulting Pty Limited (HEC)
- Groundwater Impact Assessment – Australasian Groundwater and Environmental Consultants (AGE)
- Biodiversity Impact Assessment – Umwelt
- Stygofauna Assessment – Stygoecologia
- Aboriginal Cultural Heritage Assessment
    - OzArk Environmental and Heritage Management
    - Australian Cultural Heritage Management.
- Historical Heritage Assessment – Umwelt and EJE Heritage
- Traffic Impact Assessment – Transport and Urban Planning
- Preliminary Hazard Analysis – Umwelt
- Social Impact and Opportunities Assessment – Umwelt
- Economic Impact Assessment – Deloitte Access Economics.

Further details of the Project Team are provided in **Appendix 2**.

1.9 Environmental Impact Statement Structure

This EIS has been prepared in accordance with the EP&A Act and the *Environmental Planning and Assessment Regulation 2000* (refer to the EIS Statement of Authorship in **Appendix 2**). An overview of the structure of this EIS is provided below.

The **Executive Summary** provides a brief overview of the Project and the major outcomes of the EIS.

Section 1.0 introduces the Project, outlines the background, provides an overview of existing operations and environmental context, provides a summary of the key Project details and outlines the EIS Project team and the EIS structure.

Section 2.0 provides a description of the existing and approved operations at both United and Wambo Mine.

Section 3.0 contains a detailed description of the Project and alternatives considered in the design of the Project.

Section 4.0 outlines the planning and environmental context for the Project, including the applicability of Commonwealth and State legislation to both the new Development Application and the modification applications.

Section 5.0 describes the stakeholder consultation program and details the environment and community issues identified as part of this process for consideration in the EIS.

Section 6.0 contains a description of the existing environment and a comprehensive analysis and assessment of the key environmental, social and economic issues relevant to the Project, including the Project specific and cumulative impacts.

Section 7.0 provides an assessment of the impacts of the Project on matters of national environmental significance.

Section 8.0 sets out a summary of the measures proposed to be adopted throughout the life of the Project in order to mitigate impacts.

Section 9.0 summarises the key conclusions arising from the detailed environmental assessment process.

Section 10.0 lists references cited in the EIS.

Section 11.0 provides a list of abbreviations and a glossary of technical terms.

Section 2.0

Existing Operations

2.0 Existing Operations

As discussed in **Section 1.0**, mining has been occurring at Wambo since the late 1960s and at United since 1989, with both mines previously undertaking both open cut and underground mining operations. This section provides a discussion of the history of operations at both mines and of the approvals in place for the current operations.

2.1 United Collieries

2.1.1 History of Operations

An Authorisation to prospect for coal was granted over the United area in 1980. Development Consent for mining within mining lease CL257 (now consolidated into CCL775, refer to **Figure 1.3**) was granted in the early 1980s, with mining operations commencing in 1989.

From July 1989 until July 1992, United comprised an open cut and auger mining operation extracting coal from the Whynot and Wambo seams. In 1991, a lease exchange was effected with the neighbouring Wambo mine, enabling Wambo to secure greater open cut reserves and United to secure greater underground reserves.

Underground mining operations commenced at United in January 1992 within the Woodlands Hill seam using a continuous miner with shuttle cars, and in May 1994 bord and pillar mining techniques were introduced. Changes to mining equipment and techniques over the following years resulted in increased production with longwall mining techniques implemented in May 2002, increasing the approved production capacity at United to 2.95 Mtpa of product coal. The majority of United's previous underground mining operations are located beneath Wambo's previous open cut operations (refer to **Figure 2.1**).

United has a CHPP at the site which washed ROM coal from the underground operation for delivery to the export market. From 1989 until 2006, product coal was transported from United by road along the Golden Highway to the Mount Thorley Coal Loader. Following the construction of the Wambo train loading facility in 2006, product coal from United was transported to the Wambo facility initially via the Golden Highway until an internal private haul road was completed in December 2007. The product coal from United was then transported to, and stockpiled at, the Wambo CHPP prior to being loaded onto trains bound for the Port of Newcastle for export.

United's current development consent, granted in November 2003, allowed for underground mining until the end of 2012. However, in 2009 the then Xstrata Coal (now Glencore) announced that United would mine the last of the currently approved economically recoverable underground reserves in the Arrowfield Seam following the completion of Longwall 10. In March 2010, United entered into a period of care and maintenance and subsequently commenced exploration and pre-feasibility works for future mining potential. The mine entries to the former underground operations were sealed in December 2015.

The previous mining operations and approved site infrastructure at United Mine are shown on **Figure 2.1**.

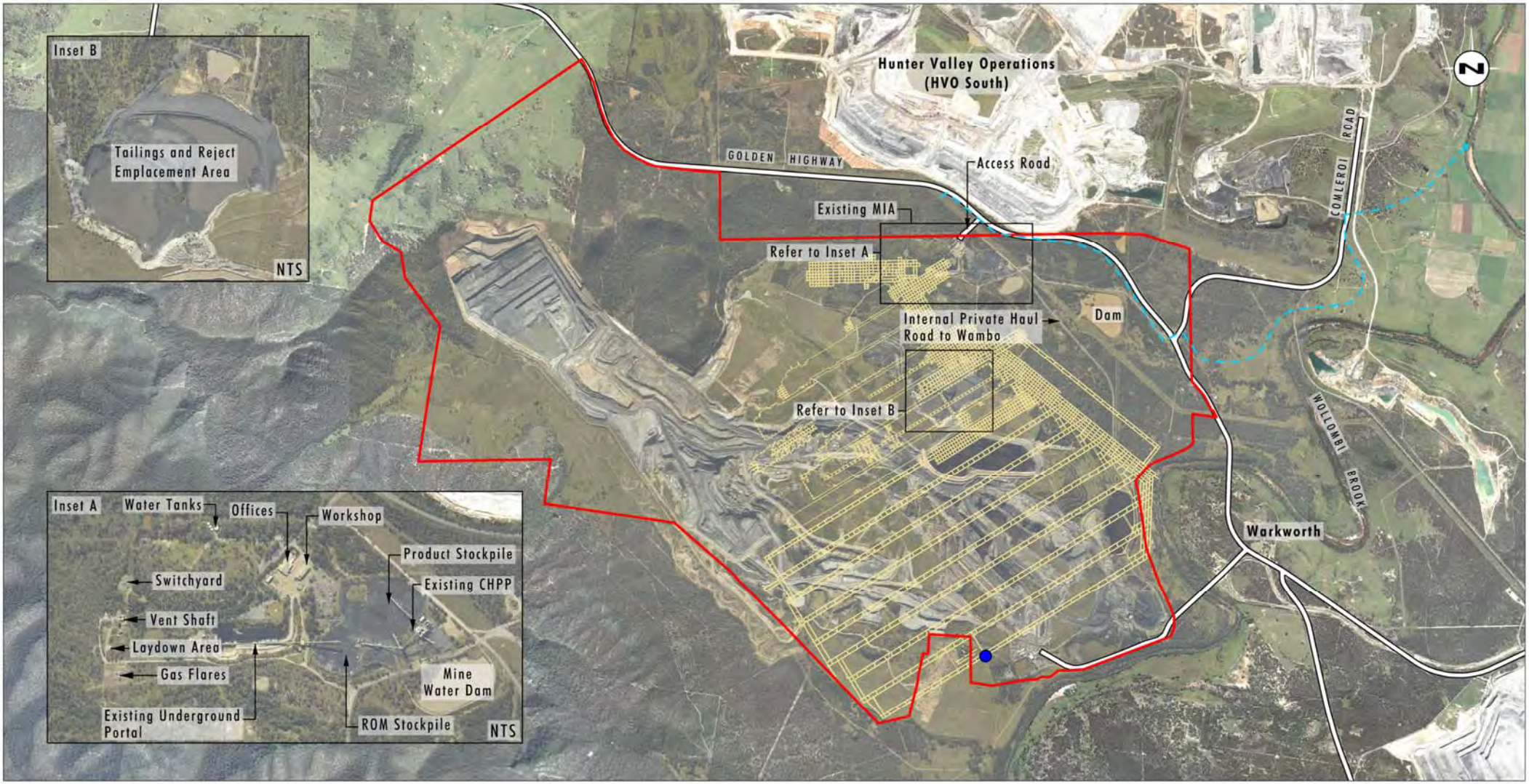


Image Source: AAM (2012), United (2015)
Data Source: Glencore (2014)

0 1.0 2.0 2.5km
1:55 000

Legend

- Project Area
- Existing 330kV Line
- Previous United Underground Workings
- Dewatering Bore
- Existing Water Pipeline Discharge

FIGURE 2.1

Previous United Mining Operations and Approved Site Infrastructure

File Name (A4): R06/3509_251.dgn
20160411 16:47

2.1.2 Current Development Consents

As discussed in **Section 2.1.1**, United Mine operated within CCL775 and most recently in accordance with development consent DA 410-11-2002 (United Mine development consent). The United Mine development consent approved:

- continued underground mining
- a maximum production rate of 2.95 Mt of saleable coal per year
- using and upgrading the mine's existing infrastructure and increasing reject emplacement capacity
- hauling coal from the site to the Mount Thorley Coal Loader or the Wambo Coal Loader on public roads until United could secure access to an operational rail coal loader in the vicinity of the site
- hauling coal from the site by rail once access to an operational rail coal loader in the vicinity of the site was secured, with haulage approved for 24 hours per day, 7 days per week
- operating the mine 24 hours per day, 7 days per week.

The key details of the United development consent and the subsequent modifications to this consent are presented in **Table 2.1**. As discussed above, the right to conduct mining operations under this consent lapsed in 2012, however, the consent remains in place with regard to the mine care and maintenance, rehabilitation and mine closure activities that are currently being undertaken.

Table 2.1 United Development Consents

Number	Approval Name	Date Granted
DA 410-11-2002	United Mine development consent	21/11/2003
DA 410-11-2002 MOD 1	Modification to allow for extension of longwall mining	10/03/2004
DA 410-11-2002 MOD 2	Modification for the haul road intersection and ancillary surface infrastructure	20/01/2006
DA 410-11-2002 MOD 3	Modification for the realignment of the internal haul road	16/03/2006
DA 410-11-2002 MOD 4	Extension of temporary haulage of coal on public roads to allow the use of the Wambo Coal Loader	11/02/2007
DA 410-11-2002 MOD 5	Modification for mining of longwall panels 10 and 11	16/09/2008
DA 410-11-2002 MOD 6	Modification of consent to extend coal haulage to the Wambo Coal Loader	08/08/2007
DA 410-11-2002 MOD 7	Modification to longwall panel 7	06/11/2007
DA 410-11-2002 MOD 8	Modification for mining of longwall panel 12 and mine development areas	03/12/2009

2.1.3 Existing Mining Leases

United's mine lease interests are held by the CFMEU on behalf of United and include mining lease CCL775 and the exploration authorisation A444 which is held jointly with Wambo. CCL775 generally applies from the surface to 5 metres above the Bayswater seam. Through commercial agreements with Wambo, United's allocated rights in respect of A444 permit the exploration of coal seams from below the Whynot seam to 5 metres above the Bayswater seam. **Table 2.2** provides an overview of the United mining leases and authorisations.

Table 2.2 Existing United Mining Leases and Exploration Licences

Lease	Date Granted	Expiry Date
Consolidated Coal Lease 775	02/09/1992	02/03/2033
Exploration Licence A444	04/10/2007	16/05/2016 (renewal lodged and pending)

2.1.4 Other Approvals

United holds a number of other environmental and planning approvals required for various aspects of the existing operations. This includes Environment Protection Licence (EPL) No. 3141 for coal works up to 2 Mt handled and mining of coal up to 500,000 tonnes produced. United also holds a number of water licences. These approvals are discussed in further detail in **Sections 4.0** and **6.0**.

2.1.5 Existing Environmental Management System

United has developed and implemented a comprehensive Environmental Management System (EMS) to guide the management of its activities at the mine so that environmental and social impacts are managed and minimised. The EMS provides a framework for managing environmental and social issues in a systematic and integrated way. It has been designed using a continuous improvement approach so that the approach to managing environmental and social issues relevant to the site achieves ongoing performance improvements.

The EMS includes standards, procedures, objectives and targets, which help the operation maintain and continually improve environmental and social performance. Routine inspections and regular environmental audits are undertaken to assess performance against objectives and targets and identify opportunities for improvement.

The United EMS has been developed in a manner that is generally in accordance with ISO 14001, the international standard for EMSs. The EMS includes a number of environmental management plans that have been prepared and are periodically reviewed and updated to assist in the management of key environmental issues. Many of these plans have been prepared to satisfy the requirements of the development consent which applied to United operations and have therefore been prepared in consultation with relevant government agencies and approved for implementation by DPE. The key existing management plans have been recently modified due to United being in care and maintenance and include:

- Environmental Management Strategy
- Environmental Monitoring Program

- Groundwater Monitoring Program
- Surface Water Monitoring Program
- Air Quality Monitoring Program
- Greenhouse Gas Minimisation Plan

- Water Management Plan, including an Erosion and Sediment Control Plan
- Compensatory Habitat Plan
- Pollution Incident Response Management Plan.

Details of how some of these plans will be applied to the Project, including required revisions or updates, are discussed in the relevant environmental assessment section of this report (refer to **Section 6.0**). As these plans were originally developed to address an underground mining operation and subsequently amended to address a mine under care and maintenance, the existing EMS will undergo a significant revision to address issues specific to the Project, namely the management of open cut operations. The EMS will be developed following Glencore's standards which have been developed based on Glencore's extensive experience operating mines in NSW to guide the environmental and social performance of its mining operations.

2.1.5.1 Existing Environmental Monitoring Program

United has an existing environmental monitoring program in place to monitor compliance with statutory requirements along with other external and internal requirements. Due to the mine currently being in care and maintenance, the Environmental Monitoring Program implemented at United has been reduced from that which was in place during operation of the mine and currently includes monitoring of the following environmental parameters:

- air quality
- biodiversity
- surface water and groundwater quality
- groundwater level
- surface water and groundwater extraction.

Noise monitoring was suspended with agreement of DPE, following cessation of operations.

The existing United Mine environmental monitoring network will be revised and integrated with the Wambo environmental monitoring network to address the monitoring requirements of the Project. The existing network and additional monitoring associated with the Project are further discussed in **Section 6.0**.

2.2 Wambo Coal

2.2.1 History of Operations

A range of open cut and underground mining operations have been conducted at Wambo since mining operations commenced in 1969. Mining under the current development consent DA 305-7-2003 (Wambo development consent) commenced in 2004 and existing open cut and underground operations are conducted under this consent. The approved ROM coal production rate is 14.7 Mtpa of ROM coal from the Wambo complex (open cut and underground operations combined). Product coal is transported from Wambo by train, with an approved rail capacity of 15 Mtpa of product coal under the Wambo train loading facility development consent (DA 177-8-2004).

The current approved Wambo Open Cut is authorised to produce up to 8 Mtpa of ROM coal from the Whybrow, Redbank Creek, Wambo and Whynot coal seams. The open cut is bounded by United mine and the Golden Highway to the east and north, Wollombi Brook to the east and south, and Wollemi National Park to the west.

The existing Wambo Open Cut is a truck and excavator operation. The open cut mining fleet includes excavators, dozers, front end loaders, haul trucks, water trucks, service trucks, graders and drills.

Mining in the existing Wambo Open Cut is currently progressing in a northwest direction and is scheduled to reach the northwest limit of approved mining during 2016 (refer to **Figure 2.2**). Once mining to the approved northwest limit has been completed, the Wambo Open Cut will turn and progress in a southeast direction.

The existing Wambo Open Cut operates 24 hours per day, 7 days per week. Blasting is currently approved between 9 am and 5 pm Monday to Saturday, inclusive. No blasting is allowed on Sundays, public holidays or any other time outside of these permitted hours without the written approval of the Environment Protection Authority (EPA). Wambo is currently approved to carry out a maximum of three blasts per day, unless an additional blast is required following a misfire, with a maximum of 15 blasts per week.

Wambo has four approved underground mining operations (refer to **Figure 2.2**), being:

- North Wambo Underground Mine (completed)
- South Bates Underground Mine (currently operational)
- South Wambo Underground (not yet commenced), including
    - Arrowfield Underground Mine
    - Bowfield Underground Mine

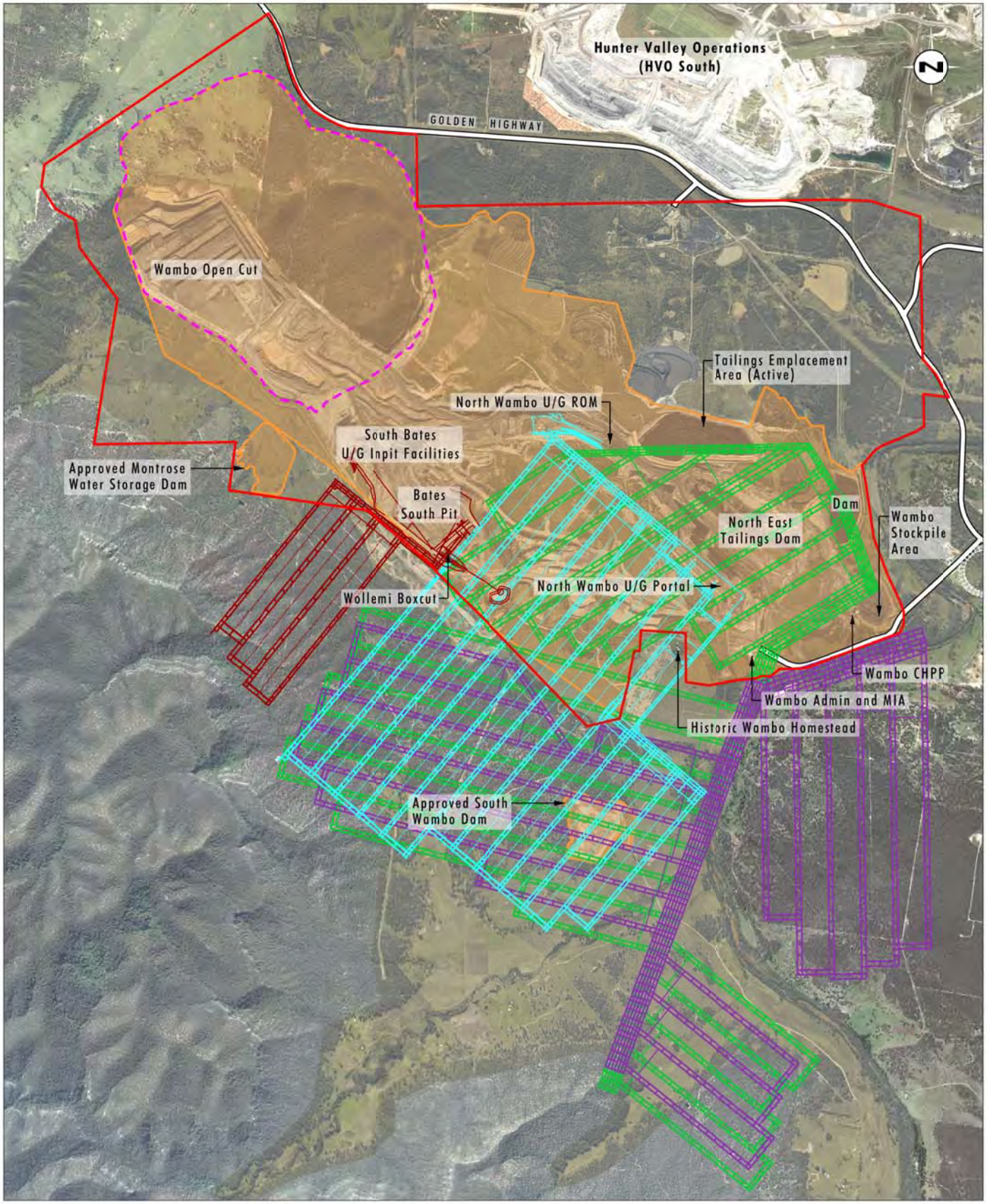


Image Source: AAM (2012), United (2015)
Data Source: Glencore (2014)

0 1.0 2.0 2.5km
1:50 000

Legend

- Project Area
- Approved Wambo Surface Development Area
- Approved Wambo Open Cut Boundary
- Proposed Arrowfield Underground Mine (Subject to Modification)
- Proposed Bowfield Underground Mine (Subject to Modification)
- Approved North Wambo Underground Mine
- Approved South Bates Underground Mine

FIGURE 2.2

Existing and Approved Wambo Mine Operations

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20160524 14.35

Figure 2.2 shows the Arrowfield and Bowfield Underground Mines as proposed under Wambo's South Wambo Underground Mine Modification (Modification 12) (refer to **Section 2.2.3**). Modification 12 proposes to replace approved mining in the Bowfield Seam with mining in the Woodlands Hill Seam.

Development of the North Wambo Underground Mine commenced in 2005 and production (using longwall mining methods) commenced in 2007. Access to the North Wambo Underground Mine was via the open cut highwall, with mining being completed in 2016.

Development for the South Bates Underground Mine commenced in 2014 and production commenced in 2016. Access to the approved South Bates Underground Mine is via the Bates South open cut pit. ROM coal is conveyed to a stockpile where it is loaded into haul trucks and hauled to the ROM bin or the ROM coal stockpile for subsequent processing at the Wambo CHPP.

Mining at the approved South Wambo (Arrowfield and Bowfield Seams) Underground Mine is planned to commence after completion of mining the South Bates Underground Mine. Access to the South Wambo Underground Mine is approved via a box cut and portal (known as the CHPP portal) and associated mine entries. As discussed in **Section 2.2.3**, Wambo has submitted an application to modify the South Wambo Underground Mine (referred to as Modification 12) in order to extend and realign longwall panels in the Arrowfield and Bowfield seams.

The main administration buildings and MIA are located at the southeast corner of the open cut operations (refer to **Figure 2.2**). An administration block, bathhouse and workshops are also located at the CHPP (refer to **Figure 2.2**).

Product coal from Wambo's operations is conveyed from the CHPP to the Wambo train loading facility which operates up to 24 hours per day, 7 days per week. An average of four trains is loaded each day, with an approved maximum of six trains per day.

2.2.2 Current Approvals

Wambo operates under two primary consents being DA 305-7-2003 and DA 177-8-2004. The Wambo mine development consent (DA 305-7-2003) allows for the development of open cut and underground mining operations at the Wambo coal mine, which includes:

- continued development of open cut and underground mining operations, generally in accordance with *Wambo Development Project Environmental Impact Statement* (Resource Strategies 2003) and subsequent environmental assessment documentation associated with modifications to the consent
- selective auger mining of the Whybrow, Redbank Creek, Wambo and Whynot seams up to 200 metres beyond the open cut limits within Wambo land
- continued placement of overburden and coarse rejects within overburden emplacement areas
- continued placement of tailings within open cut voids and capping with waste rock and coarse rejects
- an extension to the existing Wollemi Underground Mine Box Cut (within the limits of the open cut mining area) to provide direct access for three underground longwall panels in the Whybrow Seam
- longwall mining of the Wambo Seam via the open cut highwall
- construction of a portal and drift access to facilitate longwall mining of the Arrowfield and Bowfield Seams

- an upgrade of the existing CHPP to facilitate increased coal production
- development of a water control structure across North Wambo Creek at the northwestern limit of the open cut operation, and a channel to allow the passage of flows to the lower reaches of North Wambo Creek around the open cut development
- extraction of up to 14.7 Mtpa of ROM coal per year from combined open cut and underground operations
- operation of the mine 24 hours per day, 7 days per week
- continued haulage of coal by road from Wambo to the Mt Thorley Coal Loader prior to the commissioning of the Wambo train loading facility (which is subject to DA 177-8-2004 and was commissioned in 2006)
- delivery of coal to the Wambo train loading facility.

DA 177-8-2004 (train facility development consent) allows for the development and operation of train loading infrastructure adjacent to Wambo mine until the end of 2025, and includes:

- construction and operation of a rail spur, rail loop, coal reclaim area, product coal conveyor and train load-out bin to enable the transport of coal
- construction of the rail underpass beneath Wallaby Scrub Road
- upgrading of the intersection between Wallaby Scrub Road and the Golden Highway
- transport of product coal to the market 24 hours per day, 7 days per week.

A list of existing development consents applicable to Wambo and associated modifications is presented in **Table 2.3**.

Table 2.3 Wambo Development Consents

Number	Approval Name	Date Granted	Expiry Date
Wambo Mine Development Consent			
DA 305-7-2003	Wambo mine development consent	04/02/2004	04/02/2025
DA 305-7-2003 MOD 1	Modification to allow DA No. 108/91 to remain active	2004	04/02/2025
DA 305-7-2003 MOD 2	Re-orientation of the North Wambo Underground Mine longwall panels	04/05/2005	04/02/2025
DA 305-7-2003 MOD 3	Upgrade of open cut workshop and underground surface facilities	10/01/2006	04/02/2025
DA 305-7-2003 MOD 4	Extraction of the Wollemi remnants	19/04/2006	04/02/2025

Number	Approval Name	Date Granted	Expiry Date
DA 305-7-2003 MOD 5	Construction of a temporary by-pass of North Wambo Creek	20/10/2006	04/02/2025
DA 305-7-2003 MOD 6	Construction of the North Wambo Creek Diversion in a staged manner and construction of gas and dewatering wells	25/01/2007	04/02/2025
DA 305-7-2003 MOD 7	Construction of internal water storage dam (Chitter Dump Dam)	22/06/2009	04/02/2025
DA 305-7-2003 MOD 8	Construction of internal water storage dam (South Wambo Dam)	27/08/2009	04/02/2025
DA 305-7-2003 MOD 9	Modification to subsidence conditions	28/02/2011	04/02/2025
DA 305-7-2003 MOD 11	Wambo Montrose Water Storage Modification	18/01/2013	04/02/2025
DA 305-7-2003 MOD 12	South Wambo Underground Mine (relocation and extension/relocation of Arrowfield and Bowfield longwall panels) Extensions of open cut mining from 2017 to 2020	SEARs (then DGRs) originally issued October 2012 SEARs issued 23 October 2015 Supplementary SEARs issued 3 March 2016	
DA 305-7-2003 MOD 13	North Wambo Underground Mine Modification (Longwalls 9 and 10)	08/07/2013	04/02/2025
DA 305-7-2003 MOD 14	North Wambo Underground Mine Modification (Longwall 10A)	10/04/2015	04/02/2025
DA 305-7-2003 MOD 15	Development of an additional three longwall panels at the South Bates Underground Mine	10/11/2015	04/02/2025
Wambo Train Loading Facility Development Consent			
DA 117-8-2004	Wambo train loading facility development consent	16/12/2004	16/12/2025
DA 117-8-2004 MOD 1	Upgrade of Wallaby Scrub Road/ Golden Hwy Intersection	15/12/2006	16/12/2025

Number	Approval Name	Date Granted	Expiry Date
DA 117-8-2004 MOD 2	Establishment of a locomotive provisioning facility adjacent to Wambo train loading facility	12/02/2012	16/12/2025

Note: MOD 10 was withdrawn

Wambo has also been granted an approval under the EPBC Act (EPBC 2003/1138). This approval was granted in 2004 and allows for the expansion of the open cut and underground mining operations and the development and operation of train loading facilities. Specifically, the main activities associated with EPBC 2003/1138 include:

- construction and operation of a rail spur, rail loop, coal reclaim area, product coal conveyor and train load-out bin
- continued development of open cut mining operations (including limited auger mining beyond open cut mining limits) within existing Wambo mining and coal leases and into new mining lease applications areas (MLA 1 and MLA 2)
- continued development of underground mining operations
- an extension to the existing Wollemi Underground Mine Box Cut
- extension of drifts from the Wollemi Underground Mine to facilitate longwall mining of the Wambo seam
- construction of a portal and drift access adjacent to the CHPP to facilitate longwall mining of the Arrowfield and Bowfield seams
- upgrade of the existing CHPP to facilitate increased coal production
- development of a water control system including a water control structure across North Wambo Creek at the northwestern limit of the open cut operation and an associated channel
- closure of Pinegrove Road and development of new access and internal haul roads
- relocation of the administration area, site offices, existing explosive magazine and construction of additional hydrocarbon storage facilities.

EPBC 2003/1138 has effect until 31 December 2029.

2.2.3 Proposed Modification 12 – Wambo Mine Development Consent

Concurrent with the environmental impact assessment and approval process for this Project, Wambo is undertaking environmental assessments for a proposed modification to the South Wambo Underground Mine (Modification 12). Mining in the South Wambo Underground Mine is currently approved under the Wambo Mine development consent. Following completion of detailed mine planning for the approved South Wambo Underground Mine, Wambo has identified a modified mine arrangement which can be mined more economically than the approved mine arrangement. The modification application was lodged on 10 September 2012.

The proposed Modification 12 includes:

- a realignment and extension/relocation of the approved South Wambo (Arrowfield Seam) Underground Mine longwall panels and mining of the Woodlands Hill Seam rather than the Bowfield Seam
- a minor extension of the approved surface development area to accommodate the relocated South Wambo Underground Mine portal and associated infrastructure
- an extension of the approved underground mine life by 7 years (i.e. to nominally 2032), including the CHPP
- the maximum underground mine ROM coal production rate would increase from 7.5 to 9.75 Mtpa
- an extension to the life of approved open cut mining operations by 3 years (i.e. to nominally 2020). No other changes to the open cut mining operations are sought.

Modification 12 does not involve changes to any aspects of the approved North Wambo Underground Mine or South Bates Underground Mine. Modification 12 would not include any change to the approved total open cut ROM coal production limit or the overall Wambo complex production limit of 14.7 Mtpa.

The proposed Modification 12 is the subject of a separate section 75W modification application by Wambo.

2.2.4 Existing Mining Leases

The current Wambo Open Cut coal extraction operations occur within mining lease ML1572 (refer to **Figure 1.3**). **Table 2.4** provides an overview of the Wambo mining leases and authorisations.

Table 2.4 Existing Wambo Mining Leases and Exploration Licences

Lease	Date Granted	Expiry Date
Coal Lease 365	19/09/1990	19/09/2032
Coal Lease 374	06/12/1991	21/03/2026
Coal Lease 397	04/06/1992	04/06/2013 (renewal lodged and pending)
Consolidated Coal Lease 743	09/03/1990	14/08/2022
Mining Lease 1402	23/09/1996	14/08/2022
Mining Lease 1572	21/12/2005	21/12/2026
Mining Lease 1594	01/05/2007	30/04/2028
Exploration Licence A444	04/10/2007	16/05/2016 (renewal lodged and pending)
Exploration Licence EL7211	29/09/2008	29/09/2018

2.2.5 Other Approvals

Wambo holds a number of other environmental and other regulatory approvals required for various aspects of the existing operations. Wambo operates under EPL No. 529 which allows for coal works greater than 5 Mt handled and mining of coal greater than 5 Mt produced. Wambo also holds a number of water licences. These approvals are discussed in further detail in **Sections 4.0** and **6.0**.

2.2.6 Existing Environmental Management System

Wambo has developed and implemented an EMS which applies to the open cut and underground mines, the coal handling preparation plant and the train loading facility.

Environmental management plans and procedures have been developed by Wambo to address all environmental objectives and specifically to manage the environmental impacts of the operation. Environmental management plans and procedures are considered by Wambo to be dynamic and are revised regularly to reflect changes in operational practices, legislative requirements and industry best practice.

The key existing management plans for Wambo include:

- Environmental Management Strategy
- Flora and Fauna Management Plan
- Blast Management and Blast Fume Strategy Management Plan
- Bushfire Management Plan
- Conservation Management Plan for Wambo Homestead Complex
- Site Water Management Plan including
    - Surface Water Monitoring Program
    - Groundwater Monitoring Program
    - Surface and Groundwater Response Plan
    - Erosion and Sediment Control Plan
    - North Wambo Creek Diversion Plan
- Noise Monitoring Plan
- Air Quality and Greenhouse Gas Management Plan
- Extraction Plans
- Rehabilitation Management Plan
- Pollution Incident Response Management Plan.

The relevant elements of these existing management plans, particularly the components relating to the Wambo Open Cut, will be considered in the preparation of environmental management plans for the Project.

2.2.6.1 Existing Environmental Monitoring Program

Wambo has an existing comprehensive environmental monitoring program in place to monitor compliance with statutory and other external and internal requirements. The Environmental Monitoring Program implemented at Wambo includes monitoring of the following environmental aspects:

- meteorological data
- blasting
- noise
- air quality
- biodiversity
- surface water and groundwater.

As mentioned in **Section 2.1.5.1**, parts of the environmental monitoring network will be revised to address the monitoring requirements of the Project, with the Wambo and United monitoring programs integrated, where appropriate. Further details of the proposed future integrated monitoring program are provided in **Sections 6.0** and **7.0**.

Section 3.0

Project Description

3.0 Project Description

3.1 Need for the Project

United and Wambo have provided substantial economic benefits at Federal, State, regional and local levels for many decades. The Wambo Open Cut has approval until 2017 (with a modification being sought by Wambo to extend this to 2020) and will continue to provide economic benefits until that time. With the Project the benefits will be enhanced and operations continued for a further 23 years. Should the Project not be approved, the closure of the Wambo Open Cut at the end of its approved life (2017 or 2020 subject to current modification) would result in the loss of approximately 250 full-time positions at Wambo, plus the loss of flow on jobs and economic benefits for the local and regional communities.

The Project provides an opportunity to extract approximately 176 Mt of ROM coal, including an additional approximately 150 Mt, from within an area that has a long established history of mining. Significant synergies will be achieved through the integration of the United and Wambo open cut mining operations, allowing for the economic recovery of coal resources while reducing the environmental and social impacts to below those that would likely occur with two stand-alone mining operations. A significant benefit of the Joint Venture is an integrated final landform design across both open cut mining areas, providing a better final landform than that which would have occurred without the Joint Venture and reducing the number of final voids from potentially three voids to two.

The Project will maximise the utilisation of the existing mining facilities, including the MIA at Wambo, the Wambo CHPP and the Wambo train loading facilities for the life of the Project. The Project has also been designed to maximise the use of previously disturbed areas, thereby minimising the additional disturbance area. The optimisation of productivity from the existing infrastructure will assist to minimise impacts by negating the need for new infrastructure.

Not proceeding with the Project would significantly increase the cost of extracting the identified resources at a later date relative to the Project due to the efficiencies inherent in the continued use of the Wambo plant and its infrastructure. The extraction of this ROM coal now, while there is existing mining equipment operating at the site and available mining infrastructure, is substantially more efficient than seeking to mine the resource at some future date following closure of the existing operations. Such future operations may not be commercially viable. It is also unlikely that the deeper coal in the Wambo Open Cut area could be economically extracted if not undertaken as part of this Project, as the completion of mining this area without taking this coal (as currently approved) would likely sterilise this resource. This in turn has implications for royalty and tax revenues from the Project.

The Project will provide the following key benefits:

- the Project will provide for an improved final landform across the Wambo and United mining areas, with the proposed mining operation placing overburden extracted as part of the mining process to achieve a more natural final landform. The final landform achieved for the Project will be a substantial improvement on the final landform that would have resulted from two adjoining and separate mines. The approach to developing the final landform has incorporated community feedback to achieve an improved design

- maximising coal resource recovery from the existing disturbed mining footprint and adjoining areas, utilising the existing disturbed landscape, whilst minimising environmental and social impacts

- maximising coal resource recovery from existing mining leases by removing stratigraphic limitations and boundary constraints

- optimising use of the existing Wambo mining infrastructure, maximising the use of existing capacity and removing the need for duplicating infrastructure to meet production demands

- Wambo currently has approval to produce up to 14.7 Mtpa of ROM coal, the Project combined with the separately managed Wambo underground will remain within this existing limit. That is, no change is proposed to total maximum production that is already approved for the Wambo complex

- ongoing employment for the Wambo Open Cut workforce whilst adding up to approximately 250 operational positions at peak production (up to approximately 500 total operational positions), with resultant flow on effects to the local and regional economy

- peak construction phase employment of approximately 120 employees, combined with the economic benefits flowing from the expenditure of approximately $380 million capital to implement the Project

- recovery of an additional approximately 150 Mt of ROM coal

- an ongoing contribution to the local, regional and State economies from well-established mining operations

- increase the gross regional product by a projected approximately $2.1 billion in net present value terms, over the life of the Project

- increase the NSW gross State product (including the Hunter region) by approximately $3.0 billion in net present value terms over the life of the Project

- a net benefit of $414 million to NSW over the life of the Project in present value terms

- royalty revenue stream flowing to the NSW government estimated to be $369 million over the life of the Project

- significant export earnings for Australia.

The Department of Trade and Investment, Division of Resources and Energy (DRE) has confirmed in a letter dated 29 June 2015 that the resource is considered a significant coal resource, stating:

> *The Division considered the coal deposit a significant coal resource which will continue to bring economic benefits to the State and the region. The Division supports the proposed Project as a responsible utilisation of the State's valuable coal resources and supports the project proceeding through the State's comprehensive development assessment and approval process.*

World energy demand is predicted to increase significantly over the next 20-30 years. Meeting this increased energy demand into the future will require a mix of energy sources, however, thermal coal is expected to be a key component of this energy mix into the foreseeable future (International Energy Agency 2012). While coal demand has slowed, global coal consumption is projected to increase by 0.8 per cent per year until 2020 (IEA 2015) and there is continuing demand for high quality coal.

The Project is well positioned to contribute to meeting this expected demand in the short to medium term and will maximise coal recovery from within existing mining areas, whilst optimising the use of existing infrastructure and minimising the environmental impact associated with meeting this demand.

3.2 Project Overview

3.2.1 Key Features of the Project

The Project proposes open cut coal mining for a period of 23 years, with mining in a new open cut mining area at United combined with ongoing mining at the existing, approved Wambo Open Cut mine under a modified mine plan that includes a minor extension to the extraction boundary and a depth increase to maximise coal recovery. The Project requires a number of changes to the layout of existing mining, public and private infrastructure within the Project Area. The key aspects of the Project are shown on **Figure 1.5** and a summary of the key Project details is provided in **Table 3.1**. A more detailed description of the Project is provided in the following sections.

Table 3.1 Summary of Key Project Details

Key Project Components/Aspects	Proposed Operations
Key feature of the Project	The operation of a multi-seam open cut mining operation integrating the existing and approved Wambo Open Cut under a modified mine plan and the proposed United Open Cut (refer to **Figure 3.1**)
Total Economically Recoverable Reserve	Approximately 176 Mt of ROM coal recovered from the two open cut mining operations, made up of: • approximately 110 Mt of ROM coal from the United Open Cut • approximately 66 Mt of ROM coal in total from the Wambo Open Cut, including an additional 40 Mt accessed from the increased depth of mining
Extraction Rates	Up to 10 Mtpa ROM coal
Life of Mine	Approximately 23 years from the date of Project approval
Operating Hours	24 hours per day, 7 days per week
Number of Employees	Up to approximately 500 total operational positions (at peak production)
Mining Methods	Open cut mining using a truck and excavator/shovel fleet
Extent of Mining Areas	Refer to **Figure 3.1** for the proposed extent of open cut mining The Project proposes to modify the Wambo Open Cut boundary to maximise resource recovery. The modification to the approved Wambo Open Cut boundary will result in a minor surface adjustment of approximately 3.8 hectares of additional disturbance. The modification also includes accessing deeper seams within the existing Wambo Open Cut.

Key Project Components/Aspects	Proposed Operations
Infrastructure	Initial use and upgrades of existing United Mine Infrastructure Area prior to its decommissioning and demolition/removal due to the progression of the United Open Cut Construction of temporary facilities during the construction phase of the Project Ongoing use, expansion and upgrade of the Wambo Mining Infrastructure Area Use of existing Wambo CHPP and train loading facility within their currently approved annual capacities of 14.7 Mtpa ROM coal and 15 Mtpa product coal respectively
Tailings and Rejects Strategy	Decommissioning and capping of existing tailings storage facilities located in areas proposed for overburden emplacement and ongoing use of existing tailings storage facilities and storages established in other mine voids as required Coarse rejects from coal preparation to be transported by truck to the open cut overburden areas for emplacement and subsequent covering by overburden material. Coarse rejects will continue to be co-disposed within the open cut overburden areas for the life of operations
External Coal Transport	Product coal will continue to be transported off site via train from the existing Wambo train loading facility. Product coal transport rates proposed to increase from a maximum of six to eight trains per day. No change to total approved 15 Mtpa product coal tonnage transported by train.
Roads	Realignment of a 2 kilometre section of the Golden Highway to accommodate the proposed United Open Cut The main entrance to the Project will be via the existing entrance to Wambo. The existing United access road will be used in the initial phase of the Project for construction and ancillary services with limited ongoing use as a property access point
Power and Communications Infrastructure	An existing 330 kV transmission line which traverses the proposed United Open Cut mining area is proposed to be relocated as part of the Project (refer to **Figure 1.5**). Several other 66 kV and 11kV power lines will also require relocation to outside of proposed mining areas Some existing telecommunications and associated infrastructure are located adjacent to the existing alignment of the Golden Highway and will also require relocation as part of the Project
Water Management	Construction of mine water management controls including dams Use of the previously mined United underground voids for water storage

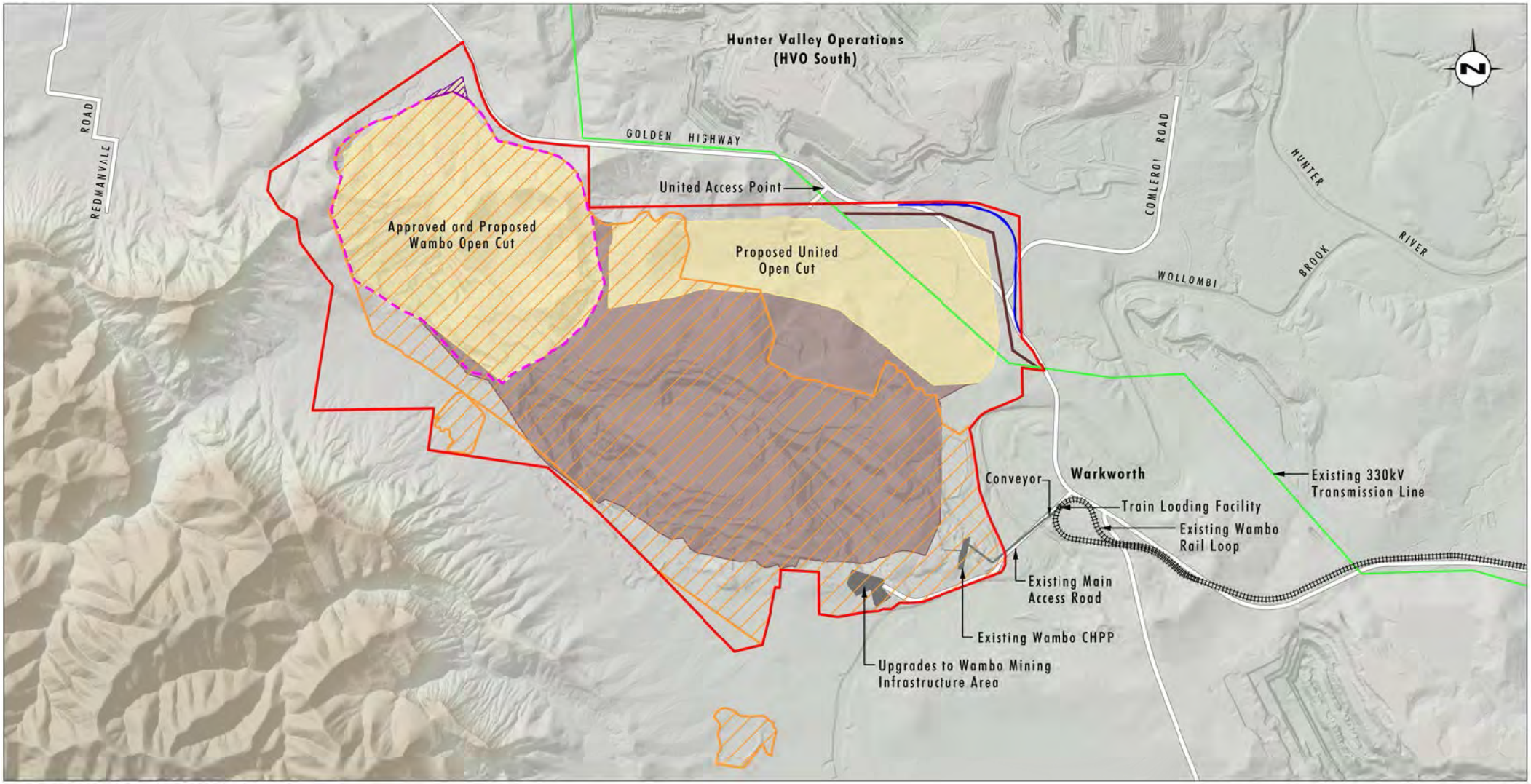


Image Source: United LiDAR (2015)
Data Source: Glencore (2015)

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Legend

- Project Area
- Proposed Conceptual Extraction Area
- Active Mining Area
- Approved Wambo Surface Development Area
- Approved Wambo Open Cut
- Proposed Wambo Open Cut Extension Area
- Proposed Golden Highway Realignment
- Existing 330kV Transmission Line
- Proposed Relocated 330kV Transmission Line

FIGURE 3.1

Proposed Conceptual Extent of Mining

The detailed Project planning and stakeholder engagement processes assisted United to develop the key objectives of the Project. These key objectives are as follows:

- conduct mining in an environmentally responsible manner to minimise Project specific and cumulative environmental and social impacts
- develop the coal resources within existing and proposed new mining leases with a long term focus on
    - maximising efficiency and coal resource recovery
    - optimising the use of existing infrastructure
    - minimising additional mining disturbance footprint by maximising the use of existing disturbed areas and utilising the available capacity of existing infrastructure
- maintaining and extending the employment opportunities for the existing mining workforce and creating additional employment opportunities
- developing comprehensive mitigation and management strategies to mitigate and offset predicted impacts associated with the Project
- co-existing with the local community
- establishing a final landform that is safe, stable and sustainable.

3.2.2 Interaction with Wambo

As discussed in **Section 1.2**, Wambo (subsidiary of Peabody) currently operates the Wambo Open Cut and underground operations along with the Wambo CHPP and train loading facility. Under the Joint Venture, United (or another Glencore related company) will operate all future open cut mining in the Project Area following receiving the required State and Federal approvals for the Project. The Wambo Open Cut will operate under its existing approvals until the point at which mining operations comprising the Project have commenced, at which point it is appropriate for such operations to be regulated by a new development consent for the Project.

The Project will use available approved capacity in Wambo's existing CHPP and train loading facilities and as noted in **Table 3.1**, seeks approval for continued use of these existing facilities for the life of the Project. Wambo will continue to operate these facilities in accordance with the approved throughput provided by its current approvals (and continued as part of this Project), with the Joint Venture delivering ROM coal to these facilities for coal washing, handling and loading coal onto trains for transportation. These facilities will continue to be managed and operated under Wambo's existing development consent.

The Wambo underground operations do not form part of the Project or the Joint Venture and will continue to be owned and managed by Wambo. The Wambo underground operations will continue to use the Wambo CHPP and train loading facility.

3.2.3 Key Features of the Proposed Harmonisation Modification

As discussed in **Section 1.1**, in addition to seeking approval for integrated mining of the United Open Cut and Wambo Open Cut and associated activities, a modification to the current Wambo development consents is also proposed for alignment with the Project. This will include modifications to both the Wambo mine development consent (covering the mine, CHPP and associated activities) and the Wambo train loading facility development consent. For the purposes of this EIS, these modifications are hereafter referred to as the Harmonisation Modification.

The existing development consents for the Wambo mine (DA 305-7-2003) and Wambo train loading infrastructure (DA 177-8-2004) will remain in place and will be modified to harmonise approved operations with the Project. This includes extending the life of these consents so that the existing mining infrastructure (including but not limited to the Wambo offices, MIA, CHPP, train loading facility, water management infrastructure, and other ancillary infrastructure) can continue to be operated for the life of the Project at currently approved capacities (where capacity is relevant). The existing Wambo underground mining operations will not be modified as part of this application.

It is intended that the Wambo Open Cut will continue to operate under the existing conditions of the Wambo mine development consent until such time as mining operations commence under a development consent which is granted for the Project.

This will provide for ongoing operation of the Wambo Open Cut under its existing approvals until mining operations comprising the Project have commenced, at which point it is appropriate for these operations to be regulated by a new development consent for the Project. It is noted that some construction activities may be undertaken under the new development consent prior to United commencing mining operations for the Project. United will notify DPE of the date on which mining under the new development consent commences in order to provide clarity as to the date from which operations at the Wambo Open Cut will be regulated by the new development consent for the Project.

The modifications proposed for the Wambo mine development consent (DA 305-7-2003) include:

- extension of life of the existing and approved Wambo infrastructure for the life of the Project, including
    - the Wambo CHPP (refer to **Section 3.6**)
    - the MIA and sites offices (refer to **Section 3.8.2**)
    - explosives magazine and hydrocarbon storage facilities (refer to **Section 3.8.3**)
    - access roads and internal haul roads (refer to **Section 3.9.4**)
    - water management system (refer to **Sections 3.9.3.1** and **6.8.1**)
    - tailings and reject management facilities (refer to **Section 3.6.2**)
- upgrades to the existing Wambo washbays, workshop capacity, fuel farm and stores areas (refer to **Section 3.8.2**)
- upgrades to the administration, car parking and bathhouse facilities in the existing Wambo MIA (refer to **Section 3.8.2**)
- upgrades or modifications to ancillary infrastructure and services including power and telecommunication infrastructure (refer to **Sections 3.9.2** to **3.9.4**)

- placement of tailings including within the Project's open cut voids and capping with overburden and coarse rejects for the life of the Project (refer to **Section 3.6.2**)

- allowance for the Wambo CHPP to receive coal from the United Open Cut (and modified Wambo Open Cut) for processing and stockpiling prior to being transported from the Wambo train loading facility

- upgrades to increase the capacity of the ROM receival facility for the open cut operations

- ongoing exchange of water between the United and Wambo operations to allow for integration of the water management systems (refer to **Section 3.9.3.1**).

The modification proposed for the Wambo train loading facility development consent (DA 177-8-2004) includes:

- extension of life of all of the coal handling and train loading facilities including the rail spur, rail loop, coal reclaim area, product coal conveyor, train load-out bin and refuelling infrastructure for the life of the Project (refer to **Section 3.6.1**) and ongoing receipt of coal from both Wambo and United

- an increase to the number of trains utilising the train loading facility, including the refuelling infrastructure, from a maximum six trains to a maximum of eight trains per day for the life of the Project (refer to **Section 3.6.1**). No change is proposed to the existing approved total annual movements as no change in maximum capacity is proposed.

3.2.4 Geology and Resource Description

The Project Area is located in the central coal-producing region of the Hunter Coalfield. The many seams of this coalfield were formed in the Permian period and are similar in age to the Illawarra Coal Measures south and west of Sydney, and the Newcastle and Tomago Coal Measures of the Newcastle/Maitland area.

The strata in the Hunter Coalfield generally dip to the west-southwest under the prominent sandstone escarpments of the Sydney Basin. A series of folds, superimposed upon the regional dip, form large north-south trending anticline, syncline and monocline structures. The coal seams within the Project Area form part of the Late Permian Wittingham Measures of the Singleton Super Group.

The Wittingham Coal Measures are divided into two important coal bearing sub groups, the lower Vane Subgroup and the overlying Jerrys Plains Subgroup. The Project proposes to extract coal from the Jerrys Plains Subgroup.

In the northeastern corner of CCL775, the Jerrys Plains Subgroup strata dips toward the southwest at 3 degrees. The uppermost seams of the Jerrys Plains Subgroup (Whybrow, Redbank, Wambo, Whynot) that are mined in the Wambo Open Cut operations, subcrop to the south and west of the proposed United Open Cut mining area and have limited representation in the United Open Cut.

Figure 3.2 shows the typical stratigraphy within the Project Area.

The United mining leases and exploration licence are held on behalf of United by the CFMEU. United's surface mining lease area within CCL775 is the focus for open cut coal extraction. The extent of CCL775 and surrounding lease and licence areas are illustrated on **Figure 1.3**.

The Wambo mining leases and exploration licences are held by Wambo with the exception of A444 which is held jointly by Wambo and United (through the CFMEU). The existing Wambo Open Cut operates within these leases. The proposed Wambo Open Cut will continue to operate within these mining leases but will

also require access to exploration licence A444, with a new mining lease being required for the depth extension below ML1572.

Certain areas of the resource within the Project Area are currently stratified between United and Wambo (that is, access to seams within the same area is differentiated by depth), dividing access to seams within the existing mining tenements. This is illustrated in **Figure 3.2** and is summarised below:

- Area 1 – United holds a mining lease from the surface to 5 metres above the Bayswater seam. Land in this area is predominantly owned by the CFMEU as a result of its existing interest in United.
- Area 2 – United has access to seams from below the Whynot seam to 5 metres above the Bayswater seam under CCL775. As a result of a lease swap between United and Wambo in the 1990s, Wambo holds mining lease CCL374 from the surface down to and including the Whynot seam within this area. Wambo has mined the majority of the seams in this lease and the area is currently being used by Wambo for overburden emplacement and rehabilitation activities.

United and Wambo also jointly hold A444 (refer to **Figure 3.2**). Coal resources within A444 are currently shared on a strata title basis on the same terms as noted in Area 2 above.

As a result of the Joint Venture, the complex stratified restrictions and surface boundary constraints for mineral rights are removed, with United and Wambo each having a beneficial interest of 50 per cent of the combined resources. It is this combining of the resources that makes the Project feasible.

The coal resources proposed to be recovered by the Project are those that are economically recoverable by open cut mining methods and are estimated at approximately 176 Mt ROM (including both the United and Wambo Open Cut mining area).

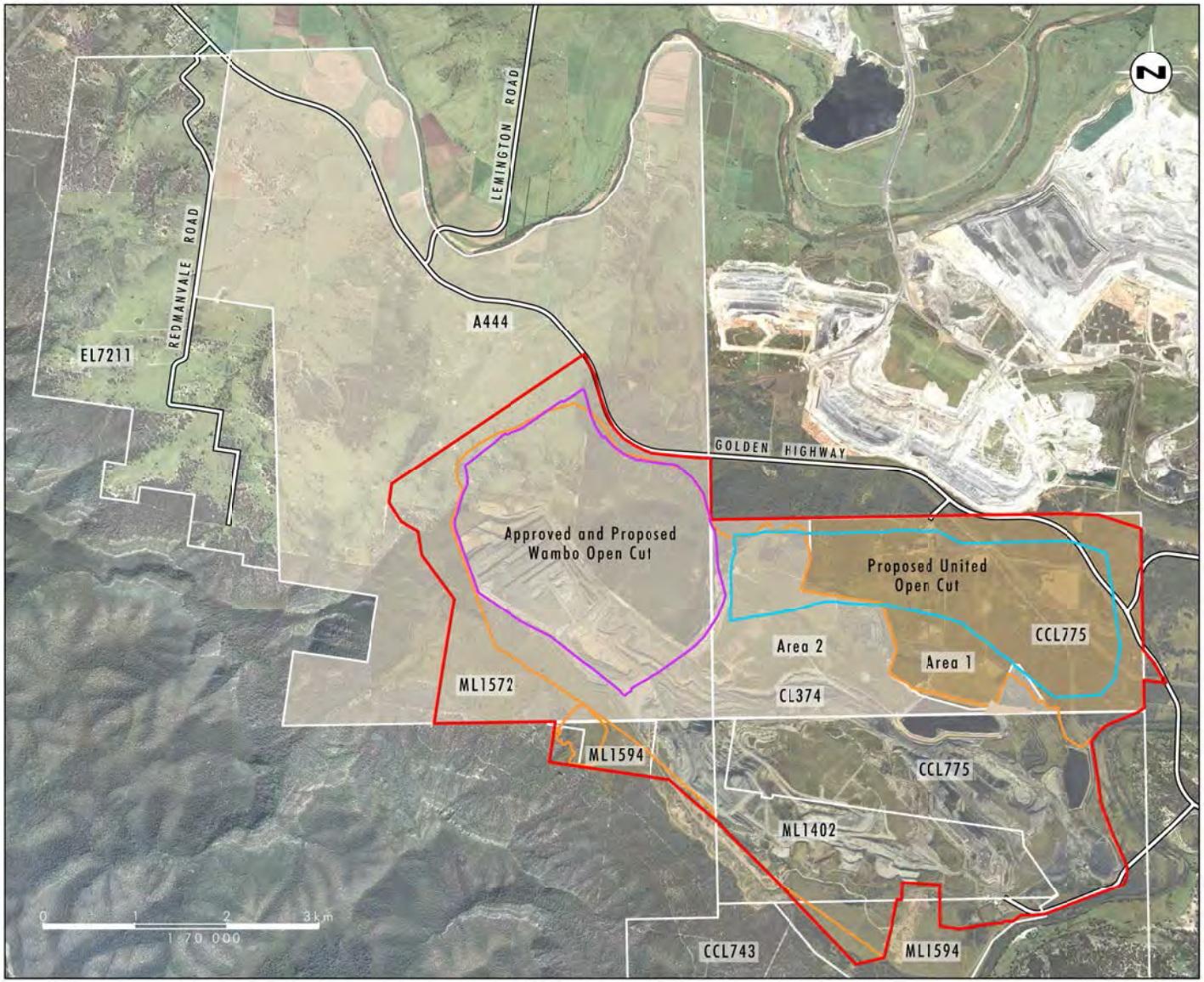
3.2.4.1 Exploration History

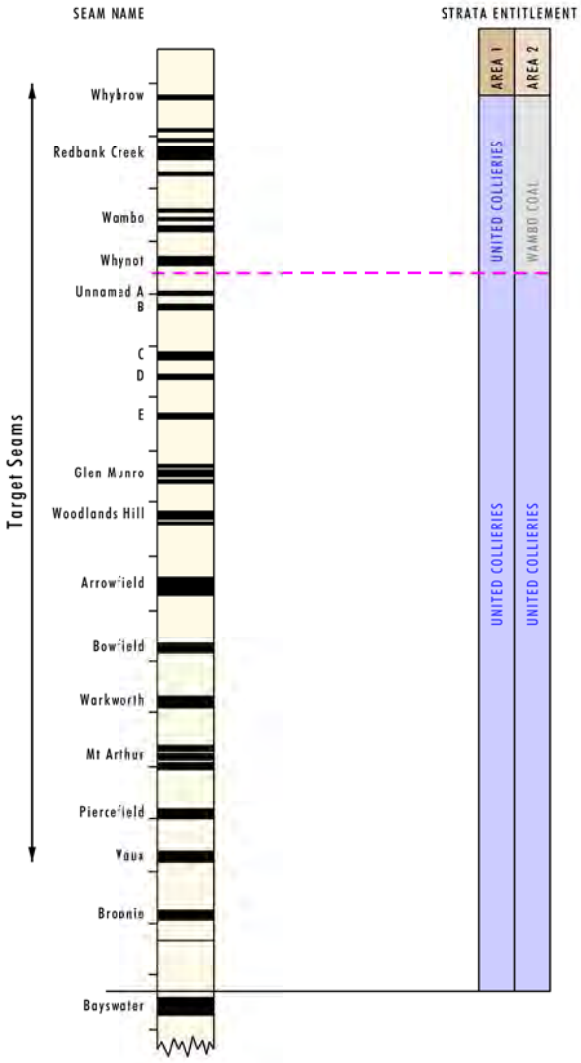
In addition to the extensive knowledge gained of the geology of the area through the existing mining operations at United and Wambo, detailed exploration programs have been undertaken by both companies to identify the resources suitable for mining. To date over 3200 boreholes have been drilled, geophysical surveys (seismic, gravity and downhole geophysical) have been undertaken and in-depth geological modelling completed. This detailed exploration work and past mining records result in the geometry and structure of the coal deposits in the proposed mining areas being well understood.

3.2.4.2 Coal Resource

The existing Wambo Open Cut extracts coal from the Wittingham Coal Measures including the Whybrow, Redbank Creek, Wambo and Whynot seams (refer to **Figure 3.2**). The proposed depth of mining extension in the Wambo Open Cut would allow access to additional seams down to the base of the Warkworth seam. The United Open Cut will allow for mining from the Whybrow seam down to the base of the Vaux seam (refer to **Figure 3.2**).

The exploration program undertaken to date has identified an additional coal resource of approximately 150 Mt within the target coal seams, within the proposed mining areas bringing the total targeted future coal resource to be recovered as part of the Project to 176 Mt. The high quality of the coal to be mined will allow a range of coal types to be produced including export quality thermal and semi-soft coal which can be used for power generation and steel manufacturing.





Legend

- Project Area
- Approved Wambo Surface Development Area
- Proposed Conceptual Wambo Open Cut
- Proposed United Conceptual Open Cut

Source: AAM (2012), United (2015)

File Name (A4): R06/3509_260.dgn
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FIGURE 3.2

Typical Stratigraphic Section and Strata Entitlement

Based on current proposed mine scheduling, this resource, coupled with the existing approved resource, would enable open cut mining operations to continue for approximately 23 years from the commencement of mining.

3.2.4.3 Geochemistry

Analysis was undertaken by Geoterra Pty Ltd (Geoterra) to assess the acid rock drainage (ARD) potential of the materials to be mined. The study indicated that the vast bulk of overburden, interburden and floor materials represented by the samples tested are unlikely to be acid producing or release significant salinity and will be acid consuming. This is consistent with the current experience within the Project Area, however, the Geoterra laboratory results did identify some small areas of potential acid forming (PAF) material present within the Project Area (1 out of 87 samples collected) and the development of a management approach for this PAF material is therefore discussed in **Section 6.13**.

3.3 Key Project Design Considerations

The Project has been designed to maximise resource recovery and operational efficiencies between the proposed United Open Cut and the existing Wambo Open Cut whilst aiming to minimise environmental and social impacts. In terms of minimising environmental and social impacts, changes to the Project through the design and assessment phase have significantly reduced the number of noise impacted residences (through design changes such as bunding and noise controls), reduced dust generation (e.g. through commitments to temporary rehabilitation areas and a high level of active dust control) and reduced visual, landform and water impacts through development of a more natural final landform. The Project design also includes a range of environmental and social management and mitigation measures, including measures relating to cultural heritage values and community sustainability, which have been included as part of the Project to minimise impacts (refer to **Section 8.0**).

The stratified lease arrangement across the United and Wambo mining titles is complex and places significant constraints on both operations. Several standalone mine plan options have been considered by both United and Wambo in order to realise resource recovery across the two operations. This has included consideration of both open cut and underground mining methods separately operated by both parties. The Joint Venture arrangement provides an opportunity for the adjoining mining operations to integrate operations to efficiently extract the mineable resources as a single mining operation.

The Project will allow for significant operational efficiencies and improved resource utilisation. The Project Area, in particular the United Open Cut in CCL775 (refer to **Figure 1.3**), is constrained due to the proximity of neighbouring mining operations, natural features (e.g. Wollombi Brook) and public infrastructure. As a standalone mine, the United Open Cut would have been heavily constrained, limiting mining methods, resource recovery and the ability of the mine to generate a suitable final landform.

The Project proposes to utilise spare capacity within the existing Wambo CHPP and train loading facilities. Due to the constrained nature of the United Open Cut area, the modification or construction of new infrastructure facilities would have sterilised coal resources under a standalone option, or if constructed on adjoining land, would have resulted in significantly increased environmental impacts through increased land disturbance and cumulative amenity impacts. By entering into the Joint Venture, a number of the constraints have been removed, resulting in a more efficient and economic development with improved environmental outcomes. In addition, the full utilisation of the approved capacity within the existing Wambo CHPP and train loading facilities provides an improved environmental and community outcome by avoiding duplication of such facilities.

A significant advantage derived from forming the Joint Venture and integrating the United and Wambo Open Cut operations is providing an improved final landform outcome. As discussed above, Wambo and United are both constrained by existing operations, stratified tenement allocation, infrastructure and natural features. As single entities, the overburden emplacement areas would be significantly restricted and would have resulted in the need for higher emplacement areas for the United Open Cut which would have been more challenging to accommodate in designing an appropriate final landform. If overburden emplacement was restricted to the United site, the overburden dump would have been developed with no ability to provide a natural landform outcome and would have resulted in the sterilisation of resources. The integrated approach will result in an improved final landform, most notably at United, and has allowed for a significantly improved conceptual final landform design (refer to **Section 3.4.4**).

An integrated environmental management approach will be adopted for the two open cut operations, including integrated mine design and management to minimise dust, noise, blasting and visual impacts, improve water management and enhance the ability to respond to any issues or community concerns that arise with both open cut areas being managed by the same operator.

Once the key elements of the Joint Venture arrangement were established, United implemented a detailed Project design, stakeholder engagement and environmental and social assessment process. This process allowed stakeholders views and the findings of the technical studies to inform the Project design and thereby further minimising impacts. As discussed above, this has included a range of impact avoidance measures being incorporated into the Project design including measures to minimise noise through mine design (e.g. addition of haul road bunding and haul road placement behind topographic barriers), minimise dust generation (e.g. temporary rehabilitation to reduce wind blown dust), minimise the disturbance footprint (e.g. avoidance of impacts on the critically endangered weeping myall community), efficiently manage water resources (e.g. water sharing with Wambo), create an improved final landform and address a range of issues raised by Project stakeholders including blasting and visual impacts.

Through this iterative design process the potential environmental impacts of the Project have been minimised. Further details of how potential impacts have been reduced by United through the Project design process are discussed in **Section 3.4**.

3.4 Project Alternatives

Detailed concept and pre-feasibility studies have been completed for the Project, considering mining options, layouts, overburden emplacements and infrastructure arrangements to optimise the Project's final design. During each of these studies, environmental and community impacts were key considerations that informed the Project design.

The key issues considered in assessing the viability and feasibility of various alternatives and developing the final Project design were as follows:

- minimising noise, dust and visual impacts on the surrounding community over the life of the Project
- financial viability
- minimising impacts on biodiversity and water resources
- minimising social impacts
- the future final landform.

Prior to formal stakeholder consultation on the Project, various alternatives were considered based on options to maximise the use of existing infrastructure and maximise economic resource recovery whilst minimising environmental and community impacts.

A fundamental objective in the Project's pre-feasibility mine planning stage was to identify potential alternatives for mining the identified coal resources at United that were viable within the existing mining lease areas. Various combinations of open cut and underground mining layouts were considered as part of Project planning to optimise the Project's environmental and economic outcomes.

Quantitative air quality and noise modelling was undertaken on some early Project options, including standalone and potential Joint Venture options. Technical, environmental, social and economic evaluations of various alternatives led to the development of a preliminary Project definition.

The following sections outline the evolution of the Project design and discuss the various mine designs and features that were considered and ultimately found either not to be feasible, or desirable, or able to form part of, the Project design.

3.4.1 Alternative Mine Plans

United has undertaken detailed studies which considered alternative mining options. Utilising existing infrastructure where possible, minimising environmental and community impacts and maximising economic resource recovery have been the key sustainable development considerations in the evaluation of these alternatives. As discussed in **Section 3.3**, changes to the Project through the design and assessment phase have significantly reduced the impacts of the Project including reducing the disturbance footprint (and consequential impacts on cultural heritage, biodiversity and land resources), providing an improved final landform outcome, reducing noise and dust impacts, reduced visual impacts, reduced water impacts and reduced social impacts.

During early stages of Project conceptualisation and pre-feasibility alternative mining methods and recovery options were explored. This included both open cut and underground mining options.

Underground mining options were excluded due to issues associated with mining below an open cut operation which would have impacted on safety and stability matters along with other issues concerning geology, geotechnics and gas which made underground mining uneconomic. As a consequence of the stratified mining leases present within the Wambo and United mining areas, designing multi-seam underground operations independently was not feasible.

A key alternative to the Project was to develop the United Open Cut as a standalone open cut mining operation. A standalone operation had significant shortcomings compared to the integrated mining operation provided by the Joint Venture. Without the Joint Venture, infrastructure and overburden emplacement areas would have competed with mining areas in CCL775, significantly reducing coal recovery. Further to this, more land outside CCL775 would have been required for infrastructure, significantly increasing the disturbance footprint for the Project and the consequential impacts on cultural heritage, biodiversity, land resources and water. Further discussion of these alternatives is provided below.

Due to land and lease ownership restrictions within the United Open Cut area and the proximity of constraints surrounding this area, all other open cut designs were excluded due to economic considerations. The early Project conceptualisation process considered alternative mining direction and final void locations of the United Open Cut. For example, an alternative mining direction starting in the northwest was investigated and would have resulted in the final void being located in close proximity to the Wollombi Brook. This was less desirable as it would have required more overburden being placed in emplacement areas outside of the mine void footprint resulting in higher out of pit overburden

emplacement areas and a much larger final void. In addition, the proximity of the final void adjacent to Wollombi Brook may have resulted in potential connectivity interaction between the final void and Wollombi Brook.

During consideration of a standalone United Open Cut, alternative overburden emplacement designs were considered. The designs included restricting emplacement to within the United surface holdings. This was less desirable as it would have resulted in a final landform with steeper slopes that would not blend in well with the surrounding landscape. It would have also resulted in sterilisation of coal resources below overburden emplacement areas. Another option considered the reinstatement of Redbank Creek along an alignment close to the original location. This option would have required two independent overburden emplacements areas separated by the creek alignment. These separated emplacement areas would have resulted in a less desirable final landform with higher emplacement areas that would not blend in well with the surrounding landscape.

To further illustrate the consideration of alternatives as part of the mine planning process, **Table 3.2** provides details of a selection of the alternative mine plans considered prior to United finalising the conceptual mine plan for the Project.

Table 3.2 Selection of Alternative Mine Plans Considered

Mine Plan Alternative	Key Features	Key Reasons Not Selected
Option 1 – United north mine	• Key features shown on **Figure 3.3**. • Mining on United land and land owned by Coal and Allied to the north. • No mining on Wambo land by United. Limited overburden emplacement on common United/ Wambo boundary. • Recovery of 75.2 Mt ROM. • Disturbance of approximately 860 ha. • Required construction of a new CHPP, MIA and train loading facility (i.e. no access to Wambo facilities). • Mine life of 15 years.	• Larger disturbance footprint than Project (approximately 860 ha verses 714 ha) for substantially reduced coal recovery (75.2 Mt verses 150 Mt (consisting of 110 Mt in the United Open Cut and 40 Mt additional ROM coal in the Wambo open cut)). • Poor final landform outcome as landform not integrated across Wambo and United sites. • Three final voids (2 at Wambo and 1 at United). • High capital cost due to new mining infrastructure required with lower coal recovery. Inefficient use of existing Wambo mining infrastructure which would have spare capacity. • Impacts on Wollombi Brook (required new rail line crossing over Brook). • Reduced mine life and therefore reduced employment and other economic benefits.

Mine Plan Alternative	Key Features	Key Reasons Not Selected
Option 2 – United land only mine	• Key features shown on **Figure 3.4**. • Mining and overburden emplacement on United land only. • Recovery of 34 Mt ROM. • Disturbance of 560 ha. • Use of existing United CHPP and facilities. • Use of Wambo train loading facility. • Mine life of 7 years.	• Substantially reduced coal recovery (34 Mt verses 150 Mt). • Poor final landform outcome as landform not integrated across Wambo and United sites. • Three final voids (2 at Wambo and 1 at United) • Inefficient use of existing Wambo mining infrastructure which would have spare capacity. • Sterilisation of coal resource due to need to maintain United CHPP, infrastructure area and out-of-pit emplacement areas over coal resources. • Substantially reduced mine life and therefore substantially reduced employment and other economic benefits.
Option 3 – No relocation of Golden Highway	• Key features shown on **Figure 3.5**. • Mining in both United and Wambo Open Cuts. • Golden Highway not relocated with a small pit developed on the eastern side of highway accessed by bridge or tunnel. • Recovery of 90 Mt ROM. • Disturbance of 623 ha. • Use of Wambo facilities. • Mine life of 21 years.	• Reduced coal recovery compared to the Project (90 Mt verses 110 Mt in the United Open Cut – no change to Wambo Open Cut). • Significant cost to develop bridge or tunnel required to cross the Golden Highway. • Poorer final landform outcome as operations and landforms not integrated. • Four final voids (2 at Wambo and 2 at United – one void located on eastern side of highway) • Slightly reduced mine life and therefore reduced employment and other economic benefits.

Mine Plan Alternative	Key Features	Key Reasons Not Selected
Option 4 – More 'constructed looking' final landform	• Same key features as the Project however with a more traditional looking 'blocky' or flat top final landform that was not sympathetic with the surrounding natural landform. • This landform was the original output of the mine planning process. It was subsequently modified to have a more natural appearance following community consultation. • Refer to **Figure 3.6**.	• Improved final landform outcome with more natural appearance. • More stable and hence sustainable design that allows for more natural drainage features to minimise ongoing maintenance of rehabilitated land. • Reduced visual impacts by designing the landform to blend in with the surrounding landforms.

In regard to the avoidance of impacts on biodiversity, Option 1 would have resulted in approximately 148 hectares of further disturbance to biodiversity than the Project due to the need to develop stand-alone coal processing facilities, mine infrastructure and transportation infrastructure. Due to not proceeding with Option 1, the following potential key impacts on biodiversity were avoided:

- a predicted further impact on approximately 115 hectares of *Hunter Valley Eucalypt Forest and Woodland CEEC*
- impact a small area of potential *Warkworth Sands Woodland in the Sydney Basin Bioregion EEC* occurring to the southeast of the Project Area
- impacts to Wollombi Brook required for a new rail line crossing, including impacts on a small area of *Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions EEC* and potential impacts on the stands of river red gum (*Eucalyptus camaldulensis*) occurring along Wollombi Brook
- avoidance of impacts on habitat for a range of threatened and non-threatened fauna species across the approximate 148 hectare avoidance area.

The formation of the Joint Venture and integration of the two open cut mining areas provides significant resource recovery and mining efficiency, in addition to commercial and improved final landform benefits, and was therefore identified as the preferred approach.

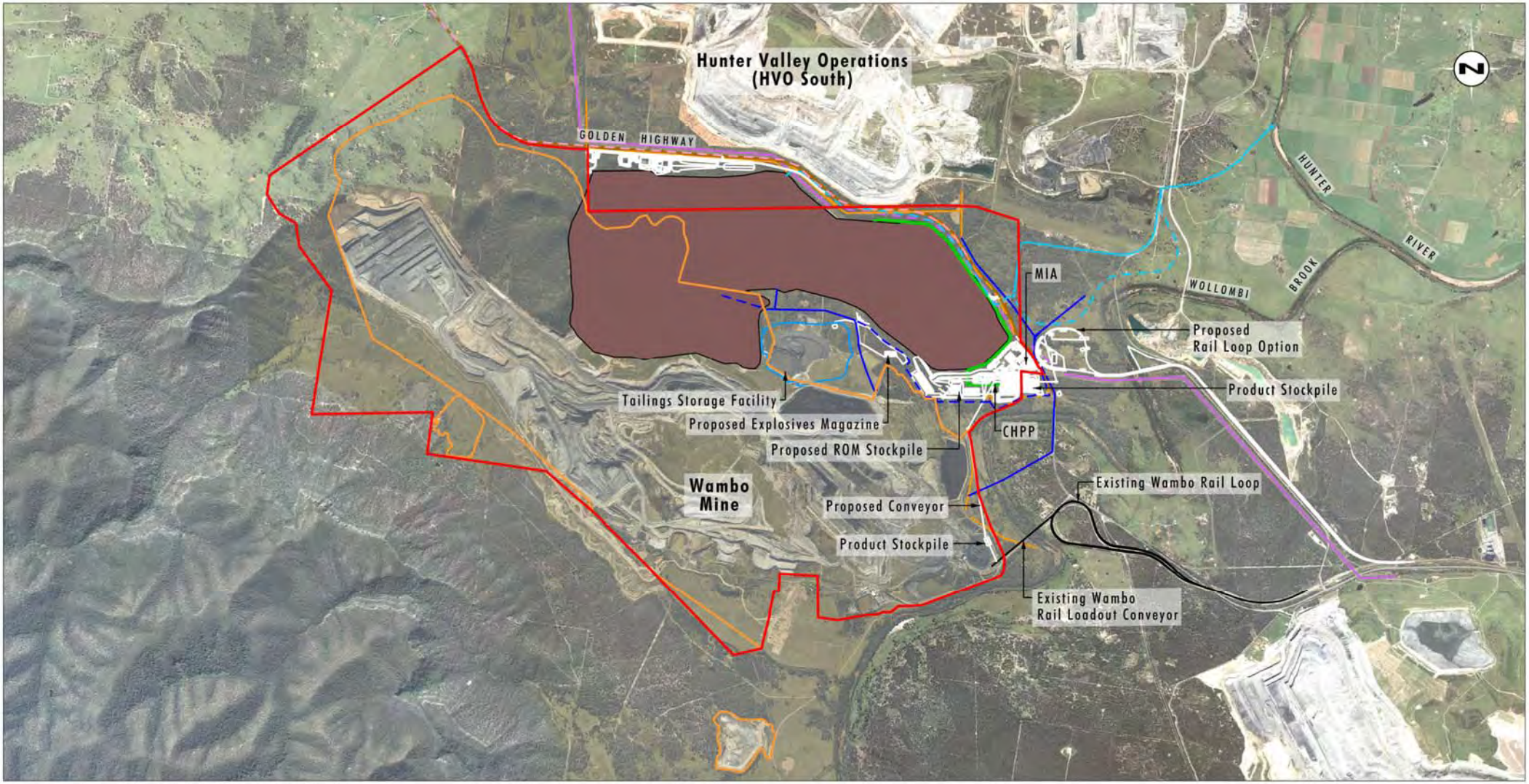


Image Source: AAM (2012), United (2015)
Data Source: United (2010)

Legend

- Project Area Boundary
- Approved Wambo Surface Development Area
- Existing Infrastructure
- Proposed Infrastructure
- Proposed Mining Extent
- Existing 330kV Transmission Line
- 330kV Transmission Line Relocation
- Existing 11kV Transmission Line
- 11kV Transmission Line Relocation
- Existing 66kV Transmission Line
- 66kV Transmission Line Relocation
- Existing Pipeline from River

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FIGURE 3.3

Indicative Project Concept Design - Option 1

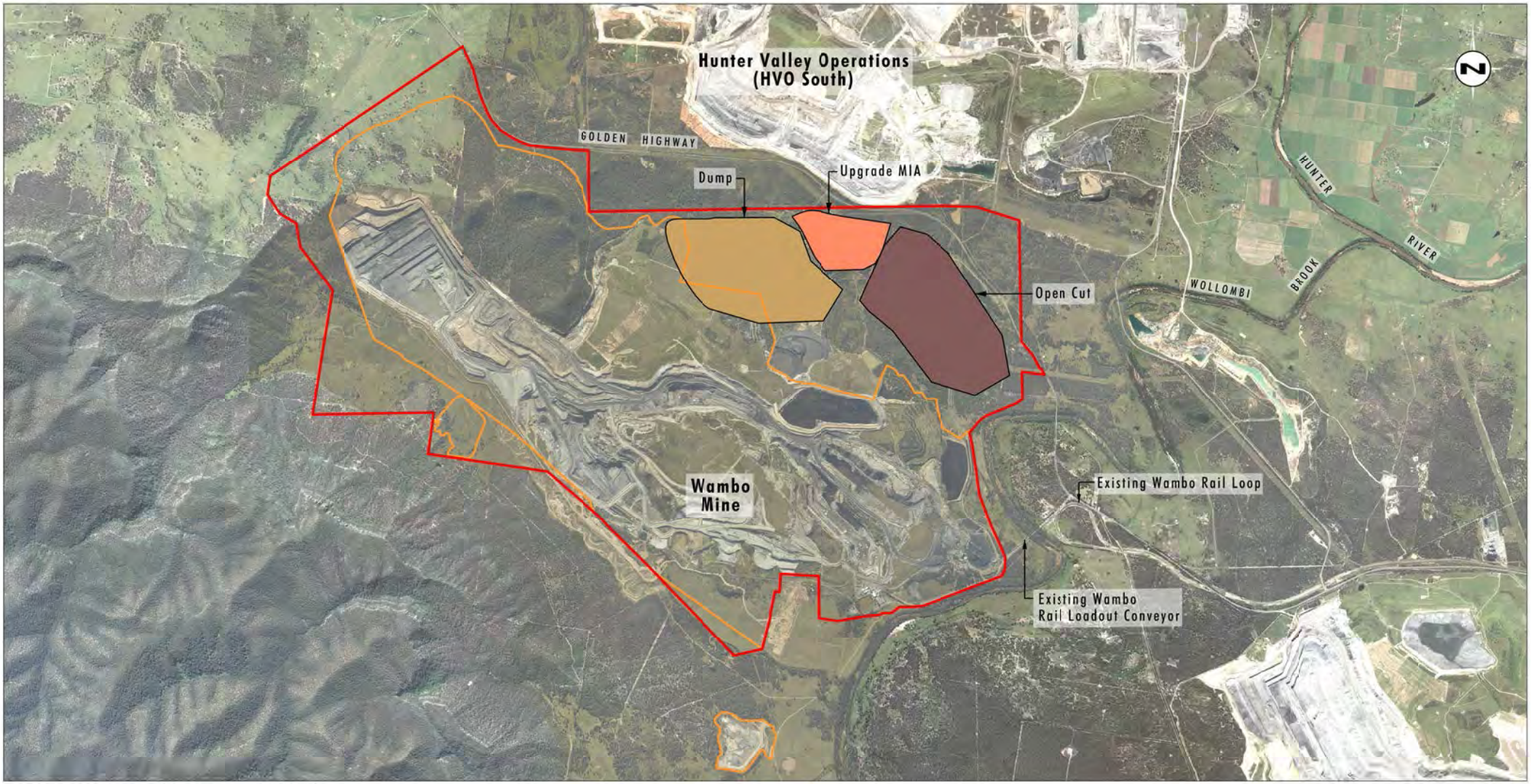


Image Source: AAM (2012), United (2015)
Data Source: United (2010)

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1:60 000

Legend

- Project Area Boundary
- Approved Wambo Surface Development Area

FIGURE 3.4

Indicative Project Concept Design - Option 2

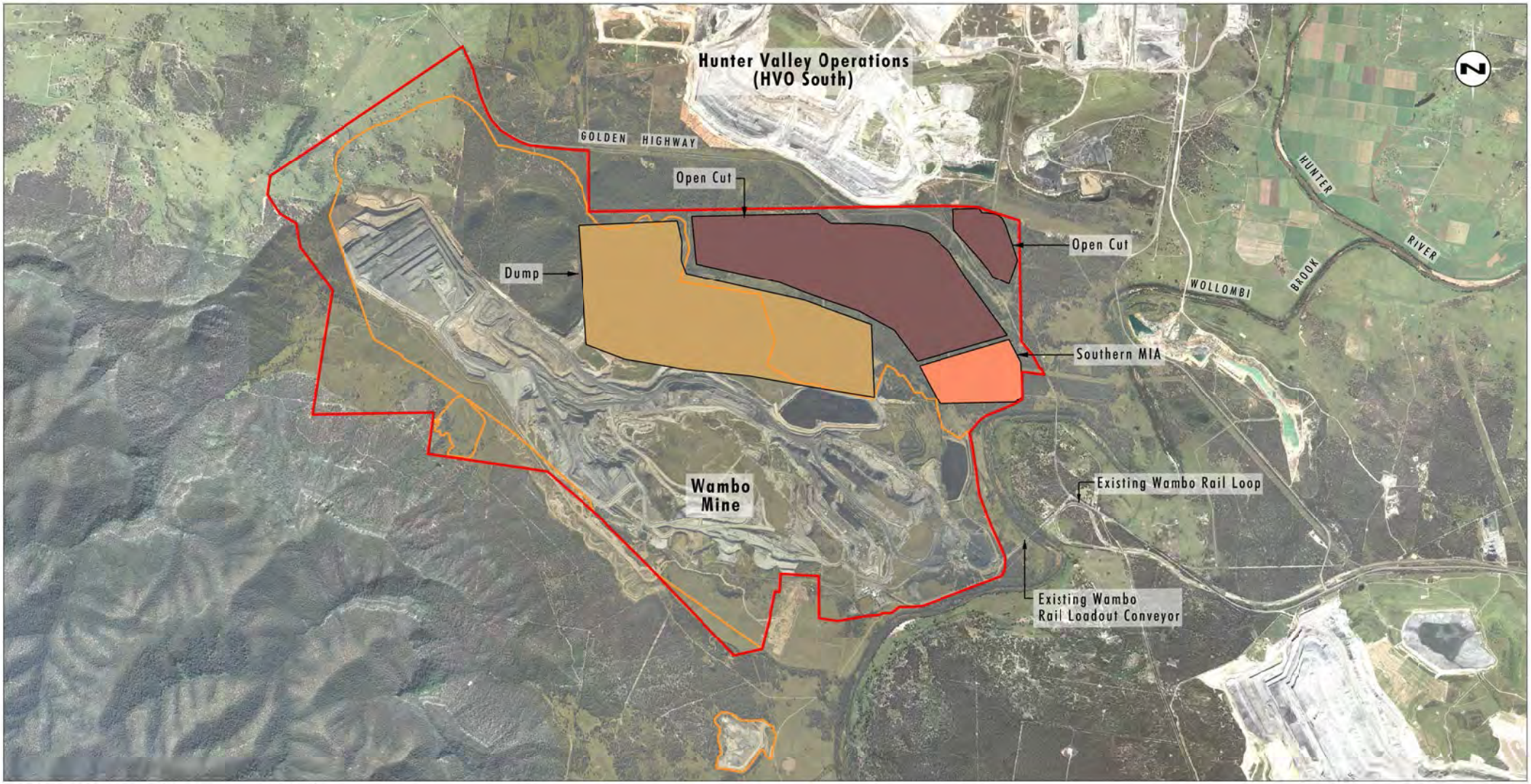


Image Source: AAM (2012), United (2015)
Data Source: United (2010)

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1:60 000

Legend

- Project Area Boundary
- Approved Wambo Surface Development Area

FIGURE 3.5

Indicative Project Concept Design - Option 3

umwelt

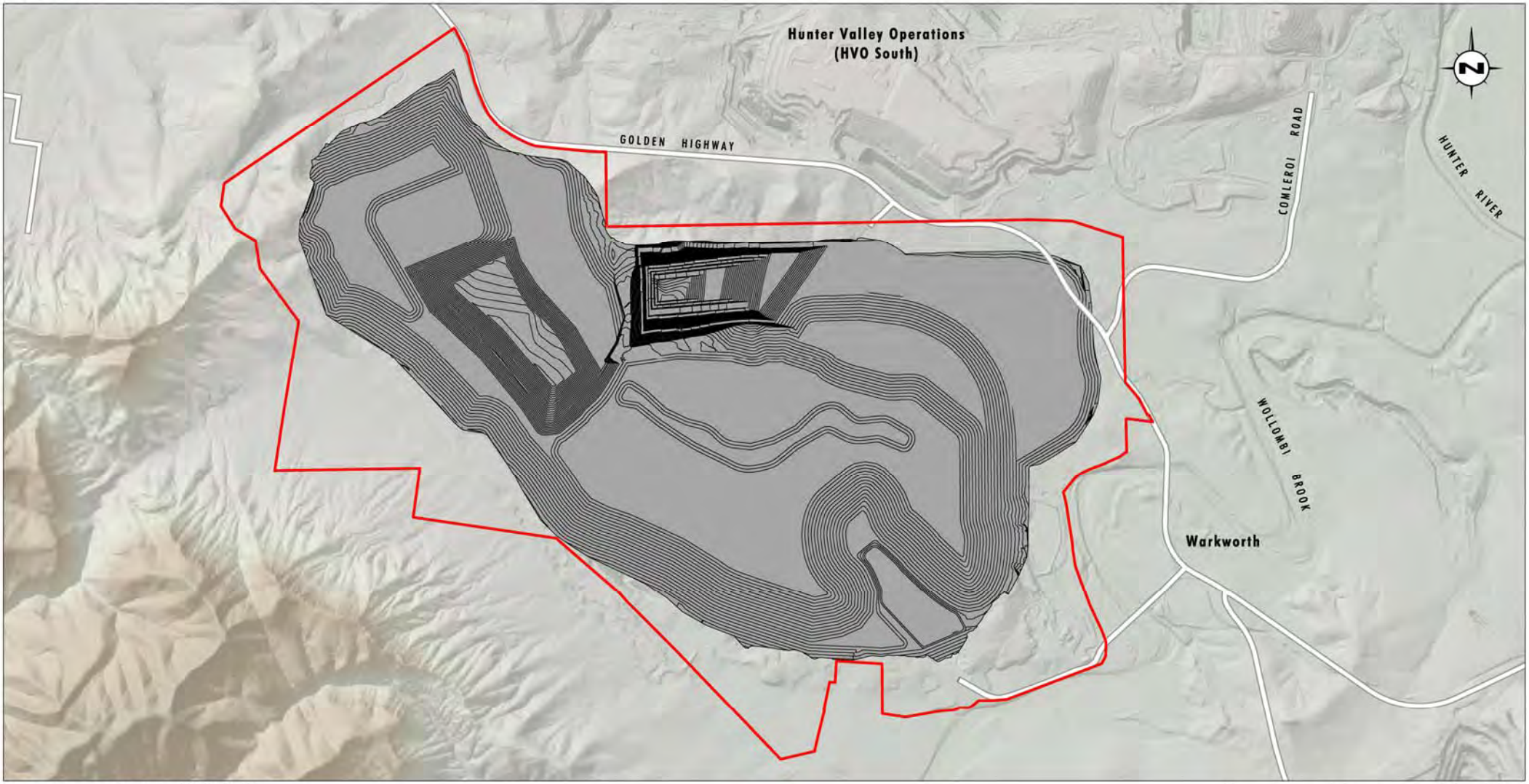


Image Source: United LiDAR (2015)
Data Source: Glencore (2015)
Note: Contour Interval 5m

0 1.0 2.0 2.5km
1:50 000

Legend

Project Area

FIGURE 3.6

Indicative Project Concept Design - Option 4

3.4.2 Alternative Coal Processing and Transport Options

The Project aims to utilise capacity within existing infrastructure and approved limits. As discussed, the main alternative to the Project as proposed was to develop the United Open Cut as a standalone mining operation and building standalone coal processing and transport infrastructure.

Alternative coal processing options included construction of a new on-site CHPP and associated facilities. On-site processing at United was less desirable due to:

- the available capacity at the Wambo mine facilities
- the potential for additional noise impacts
- physical site constraints
- sterilisation of coal resources
- high cost
- duplication and inefficient use of the proposed infrastructure at United, with sufficient available capacity for the Project available at the Wambo CHPP.

Alternative coal transport options, including construction of a dedicated rail loop at United, were considered in early Project conceptualisation. A dedicated rail loop was less desirable due to:

- impacts on significant ecological communities
- sterilisation of coal resources
- potential additional noise impacts
- duplication and inefficient use of the proposed infrastructure at United, with sufficient available capacity for the Project available at the Wambo train loading facility.

3.4.3 Alternative Infrastructure Locations

As detailed in **Section 3.8**, the mining of the United Open Cut will necessitate the realignment of the Golden Highway and relocation of sections of 330 kV and 66 kV transmission line. The designs for these realignments focused on developing the shortest alignments whilst meeting relevant design guidelines and satisfying the needs of the infrastructure owners. Consultation on the proposed realignments included a range of key stakeholders including RMS, Singleton Council, TransGrid, Ausgrid and Telstra.

As discussed in **Section 3.4.1**, alternative options to the relocation of the Golden Highway included the option of not relocating it and reducing the mine footprint. This option was considered less desirable as it would have resulted in constrained mining conditions and resource sterilisation. The proposed realignment maximises the potential United Open Cut mining area and therefore maximises resource recovery.

Options for the relocation of the 330 kV transmission line were also considered. The primary alternative considered was an option where the line would be relocated to the very northeastern corner of the United mining lease area. This option was dismissed as it would encroach on the take-off and landing alignments for Glider Club, located to the northeast of the Project Area. Consultation with the Glider Club discussed the proximity of their runway to the proposed alignment of the 330 kV transmission line and considered the appropriate setback to minimise impact on the ongoing use of the Glider Club. Similar to the Golden Highway realignment, if the existing 330 kV line is not relocated it would result in constrained mining conditions and resource sterilisation. This option was considered less desirable. The alignment was then further modified in consultation with TransGrid to meet its design requirements, including the angle at which the relocated section joins the existing line.

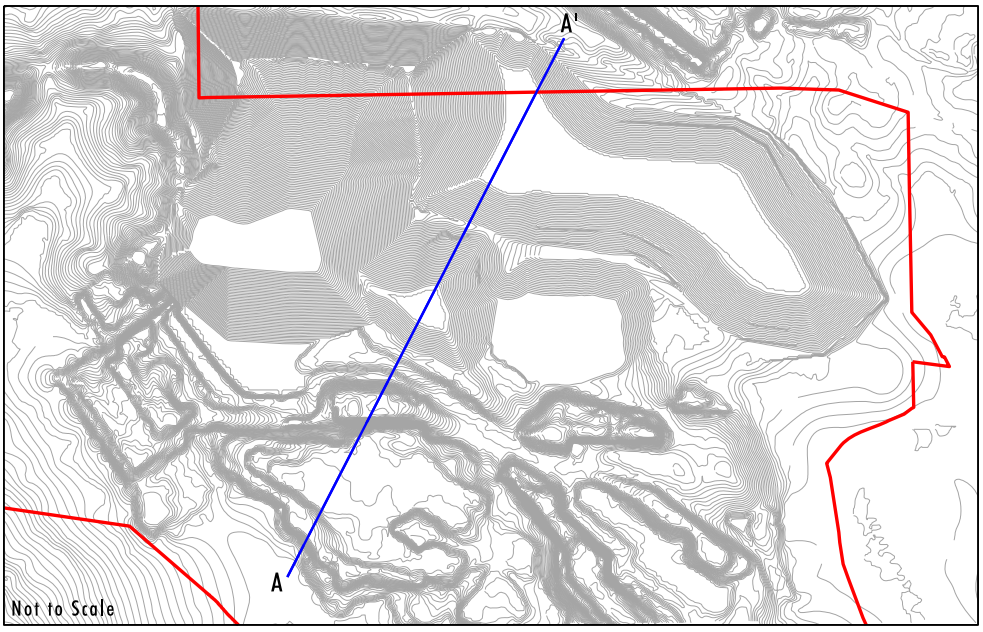
Site access arrangements with alternative access locations were considered as part of the Project design. All other options were excluded due to inadequate sight distances, impacts on mine design, the sterilisation of coal resources and the ability to maximise resource efficiency by using the existing infrastructure.

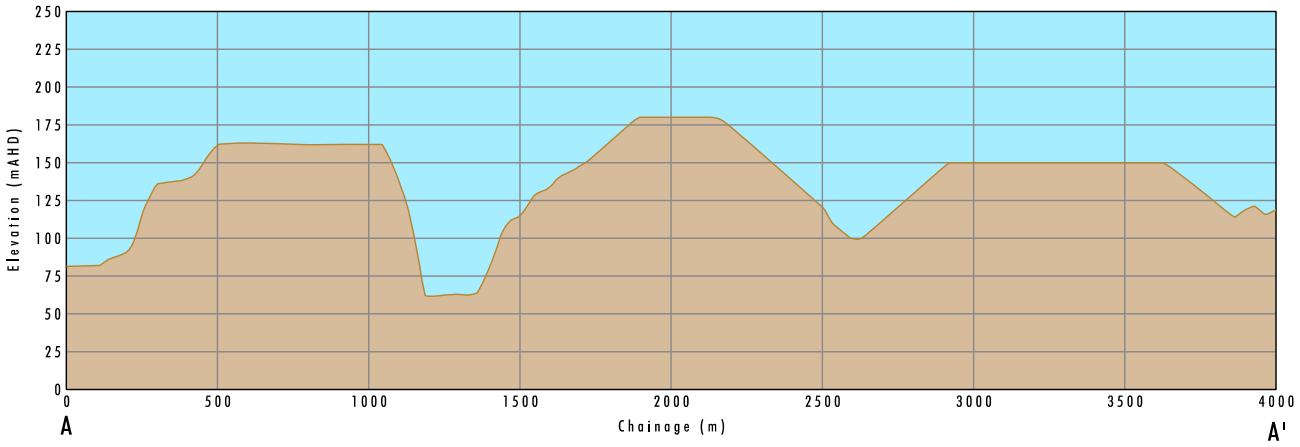
3.4.4 Final Landform and Final Void Options

As discussed in **Section 3.4.1**, several different mine plan options were considered for the Project. A key determining factor in the selection of the final Project mine plan was providing an improved final landform outcome across the United and Wambo mining areas. As discussed in **Table 3.2**, some of the options considered resulted in an additional final void, while others resulted in poor final landform outcomes. In particular, some of the final landform options considered resulted in a higher emplacement area at United with little assimilation of this landform with the approved final landform at Wambo. This resulted in a lack of landform integration across the United and Wambo mining areas and a subsequent landform that was unnatural looking and did not blend in well with the surrounding landscape as illustrated in **Figure 3.7**. As discussed in **Section 1.0**, the provision of an integrated, more natural looking final landform across the United and Wambo mining areas is one of the key benefits of the Project.

Once the concept mine plan for the Project was determined, further work was undertaken to improve the appearance and function of the final landform by modifying the more traditional 'blocky' or flat top design that was an outcome of the initial mine planning process with a more natural looking landform following the design principles discussed in **Section 6.13**. **Figure 3.8** shows the differences between the initial concept 'blocky' final landform, the Project concept final landform and an indicative example of a more 'natural looking' and functioning final landform which is the type of landform proposed to be developed as part of the Project. As discussed in **Section 6.13**, rehabilitation of the mining area will be progressively undertaken to achieve an overall more natural landform outcome.

Detailed consideration was also given to the final void outcomes for the Project. The existing Wambo Open Cut mine plan is approved to retain two final voids (refer to **Figure 3.9**). The Project adds another mining area and potential void at the United Open Cut, however, the Project has been designed to restrict the number of final voids to two, reducing the number of voids at Wambo to one. The retention of a void within each open cut mining area at completion of the Project was determined by United to be necessary from a Project viability perspective following the consideration of a range of final void options as part of the mine design process. A selection of the key final void options considered is provided in **Table 3.3**.





Previous Indicative Conceptual Final Landform Option Cross Section

0 50 100 200m
Vertical Scale 1:5000

0 0.25 0.5 1.0km
Horizontal Scale 1:25 000

Legend
- Project Area
- Transect Location

FIGURE 3.7

Previous Indicative Conceptual Final Landform Option

Image Source: AAM (2012), United (2015)
Data Source: Glencore (2014)

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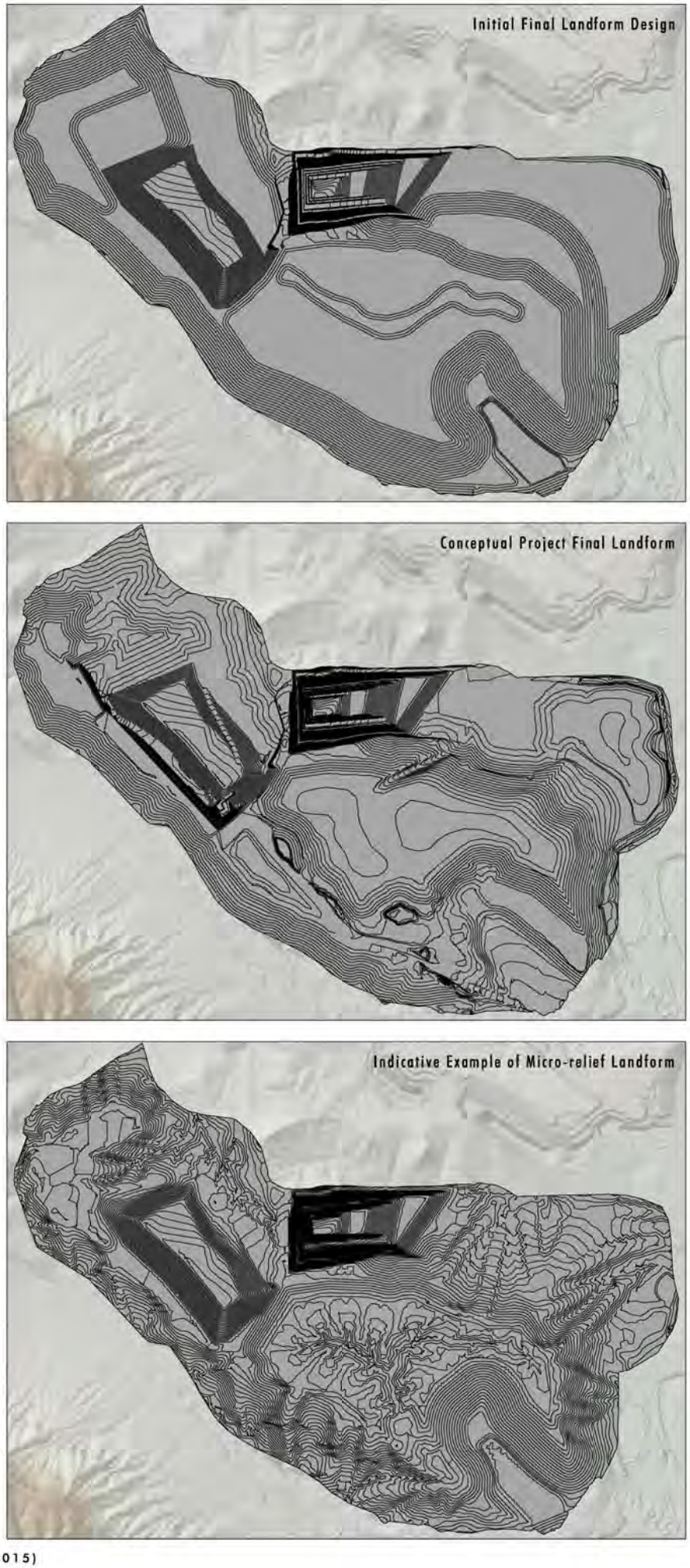


FIGURE 3.8

Refinement of Project Conceptual Final Landform

Image Source: United (2015)
Data Source: United (2015)

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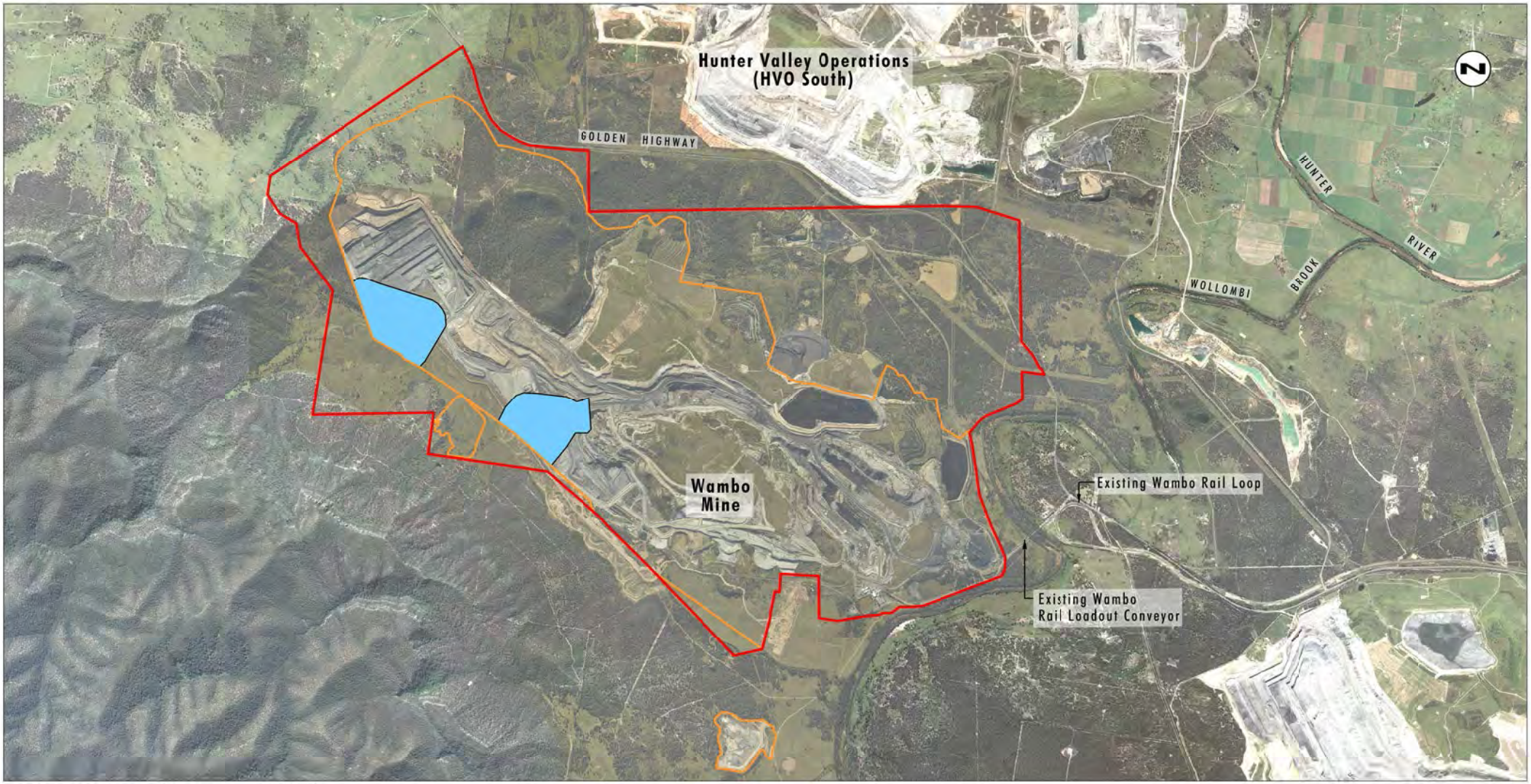


Image Source: AAM (2012), United (2015)
Data Source: United (2010)

0 1.0 2.0 3.0km
1:60 000

Legend

- Project Area Boundary
- Approved Wambo Surface Development Area
- Approved Wambo Final Void

FIGURE 3.9

Approved Wambo Final Void Locations

Table 3.3 Final Void Options

Final Void Option	Description	Determination
Three final voids	Retain the two approved final voids at Wambo with an additional final void at United. Refer to **Figure 3.10**.	Not selected – Mine planning determined that it was feasible to design the Project to reduce the number of final voids to two which was considered a better outcome.
Two final voids with United void near Wollombi Brook	Two final voids, one at Wambo and one at United. United final void located at the southernmost end of the mining area near Wollombi Brook.	Not selected – Concern about risk of long-term stability due to proximity and potential connectivity to Wollombi Brook. This proximity may result in increased risk of highwall slumping.
Back filling one final void	Rehandling material from the overburden emplacement areas back into a void.	Not selected – It was determined that this activity would incur prohibitive costs such that it would affect the overall viability of the Project.
Two final voids, with United void at western end of proposed open cut	Two final voids, one at Wambo and one at United. Mining in United undertaken from east to west with final void furthest away from Wollombi Brook.	Selected – Mine planning provides for an integrated final landform and final voids located in appropriate positions for rehabilitation and long term landform stability.

Based on these considerations, it was determined by United that the Project could be designed to reduce the number of voids from three to two, but that designing the final landform to result in one or no final voids was not feasible.

The indicative final voids, final landform and land use were presented to DRE and Singleton Council and were the subject of a community workshop. The feedback from these stakeholder engagement processes influenced the final landform considerations and the closure commitments discussed in **Section 6.13**. This included feedback on aspects such as:

- the balance between biodiversity offset requirements, woodland areas and land for agricultural purposes as part of the final land use and revegetation plan
- the desire to minimise the number and size of the final voids, where practicable
- the desire for the incorporation of natural landform design principles into the design of the final landform for the Project.

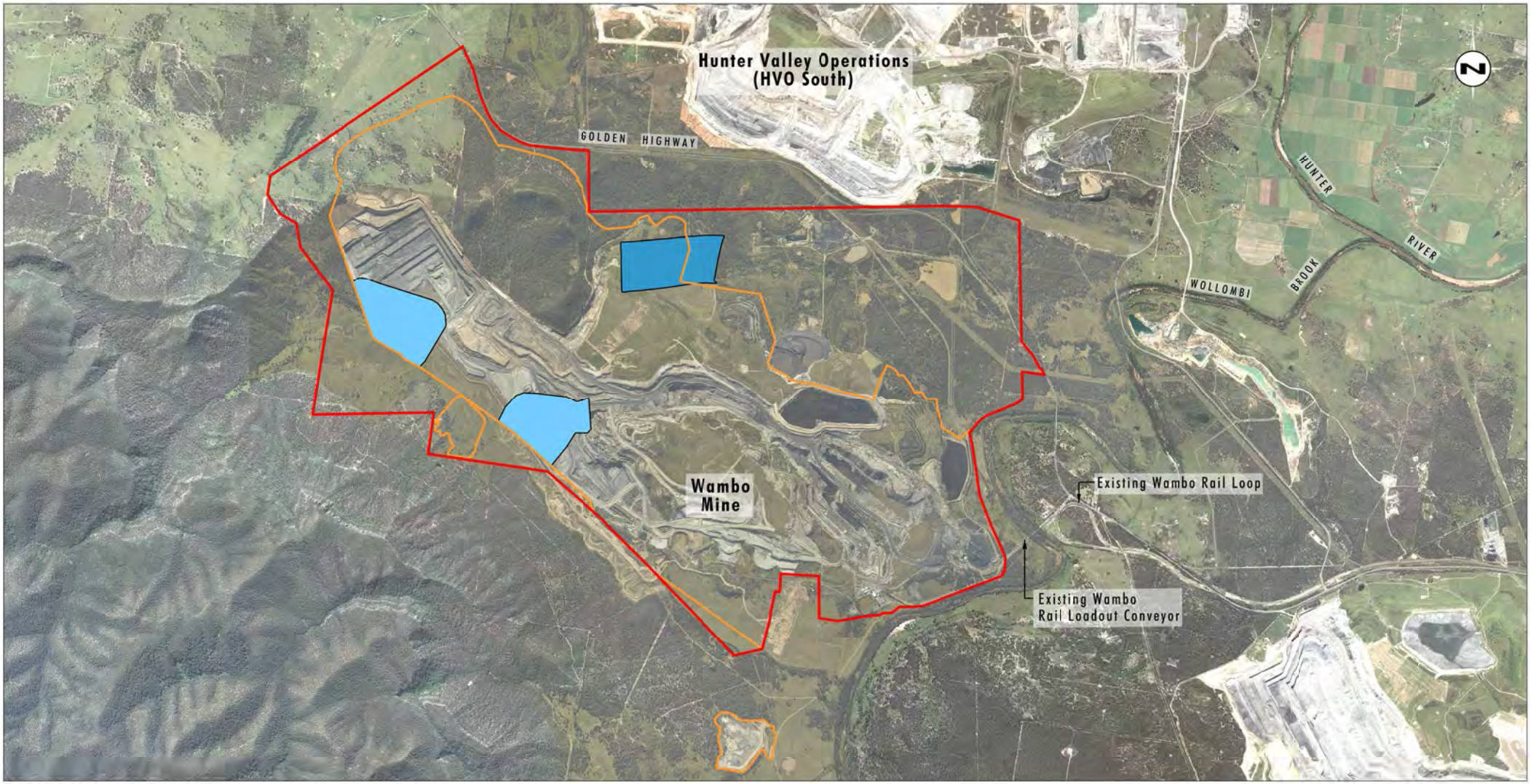


Image Source: AAM (2012), United (2015)
Data Source: United (2010)

0 1.0 2.0 3.0km
1:60 000

Legend

- Project Area Boundary
- Approved Wambo Surface Development Area
- Approved Wambo Final Void
- Indicative Final Void

FIGURE 3.10

Indicative Final Void Location - Option 1

The above aspects have all been addressed in the design of the final landform and rehabilitation strategy for the Project. Further details on the development of the final landform, management of rehabilitation and design of the final voids are discussed in **Section 6.13**.

3.4.5 Alternative of not proceeding with the Project

The option of not proceeding with the Project would mean the closure of the Wambo Open Cut in either 2017 or 2020 and also no further operations at United. Whilst rehabilitation and closure works would continue for some years following the cessation of mining, such operations would be at a much lower intensity than the current mining operations within the Wambo Open Cut and there would be a significant reduction in employee numbers. The employment opportunities for up to approximately 250 Wambo Open Cut employees would be lost as would the significant flow on effect to the local, regional and state economy.

The Project will extract approximately 176 Mt of ROM coal during the life of the Project. The impacts of supplying this coal from within an existing mining area are significantly reduced when compared to supply from a new 'greenfields' mine development. The extraction of this ROM coal now, while there is existing mining equipment operating at the site and available mining infrastructure, is substantially more efficient than seeking to mine the resource at some future date following closure of the existing operations. Not proceeding with the Project will make it considerably more expensive to extract the coal in the future, with commensurate reductions to taxation and royalty revenue. Such future operations may not be commercially viable as the current benefits of being able to utilise existing Wambo infrastructure may not be available if the Project does not proceed.

Proceeding with the Project will provide a range of economic and social benefits at local, regional and State levels. These benefits would not be realised should the Project not proceed. Not progressing with the Project would have potential benefits to the local community and environment in terms of avoiding some of the impacts from mining. However, these potential benefits need to be balanced against the significant economic benefits of the Project.

As outlined in **Section 9.3**, the Project has been assessed against the principles of ecologically sustainable development as required by the EP&A Act. This assessment has indicated that the Project is consistent with the principles of ecologically sustainable development. As outlined in **Section 6.21**, the Project would inject approximately $2.1 billion into the Hunter Valley regional economy and approximately $3.0 billion into the State economy.

With the implementation of appropriate management, mitigation and offset measures as outlined in **Section 6.0**, the assessment in this EIS has concluded that the Project would result in a net benefit to the NSW community. United therefore considers that not proceeding with the Project is not an appropriate alternative.

3.5 Proposed Mining Operations

3.5.1 Conceptual Mine Plan

As discussed in earlier sections the Project will involve open cut mining in two mining areas, the existing approved Wambo Open Cut and the proposed United Open Cut (refer to **Figure 1.5**). The Project includes a minor surface extension to, and deepening of, the approved Wambo Open Cut to recover additional resources.

The Project is seeking approval for open cut mining at a maximum combined extraction rate of 10 Mtpa of ROM coal, using truck and excavator/shovel methods for a period of approximately 23 years from granting of development consent.

The conceptual staged mine plans are shown on **Figures 3.11** to **3.16**. Refinements to the conceptual mine plans may occur as a result of geological anomalies or Project optimisation over the life of the Project.

In the United Open Cut, mining is planned to commence in the south eastern end of the proposed mining area and proceed in a north westerly direction (refer to **Figure 3.11**). By approximately Year 5 of the operation, the pit will reach the existing United mine infrastructure area and CHPP, which will be decommissioned and dismantled and the area mined through as the open cut pit proceeds further west (refer to **Figure 3.12**). The mine plan also includes mining through an area in the Arrowfield Seam that was formerly subject to underground mining as part of the United underground mining operations. Mining through these old workings will be undertaken in accordance with a plan that will address potential issues associated with strata stability, water, gas and spontaneous combustion in accordance with safe open cut mining practices.

The approved Wambo Open Cut is currently progressing in a north westerly direction until it reaches the limit of its current approval (refer to **Figure 2.2**) from which point it will turn and progress in a south easterly direction. Under the Project, mining within the Wambo Open Cut will be undertaken at a reduced rate than currently approved, to more appropriately integrate with the mining of the United Open Cut.

There will be some minor changes to the disturbance footprint of the Wambo Open Cut mining area as part of the Project, including an extension to part of the northern boundary of the mining area and some other minor realignments as shown on **Figure 3.11**. This change is primarily designed to enable the Wambo Open Cut access to coal seams below its approved mining area which are currently held by United. Access to the coal seams below held by United has been made available as a consequence of the Joint Venture. The realignment and mining of deeper seams will maximise resource recovery within the Wambo Open Cut. The proposed Wambo Open Cut will reach a depth of approximately -105 mAHD, which is approximately 75 metres lower than the lowest point of previously approved open cut mining at Wambo of -30 mAHD. The United Open Cut will reach a depth of approximately -155 mAHD.

United is also seeking consent to undertake highwall or auger mining within the conceptual mine plan areas as an alternative method to truck and shovel mining.

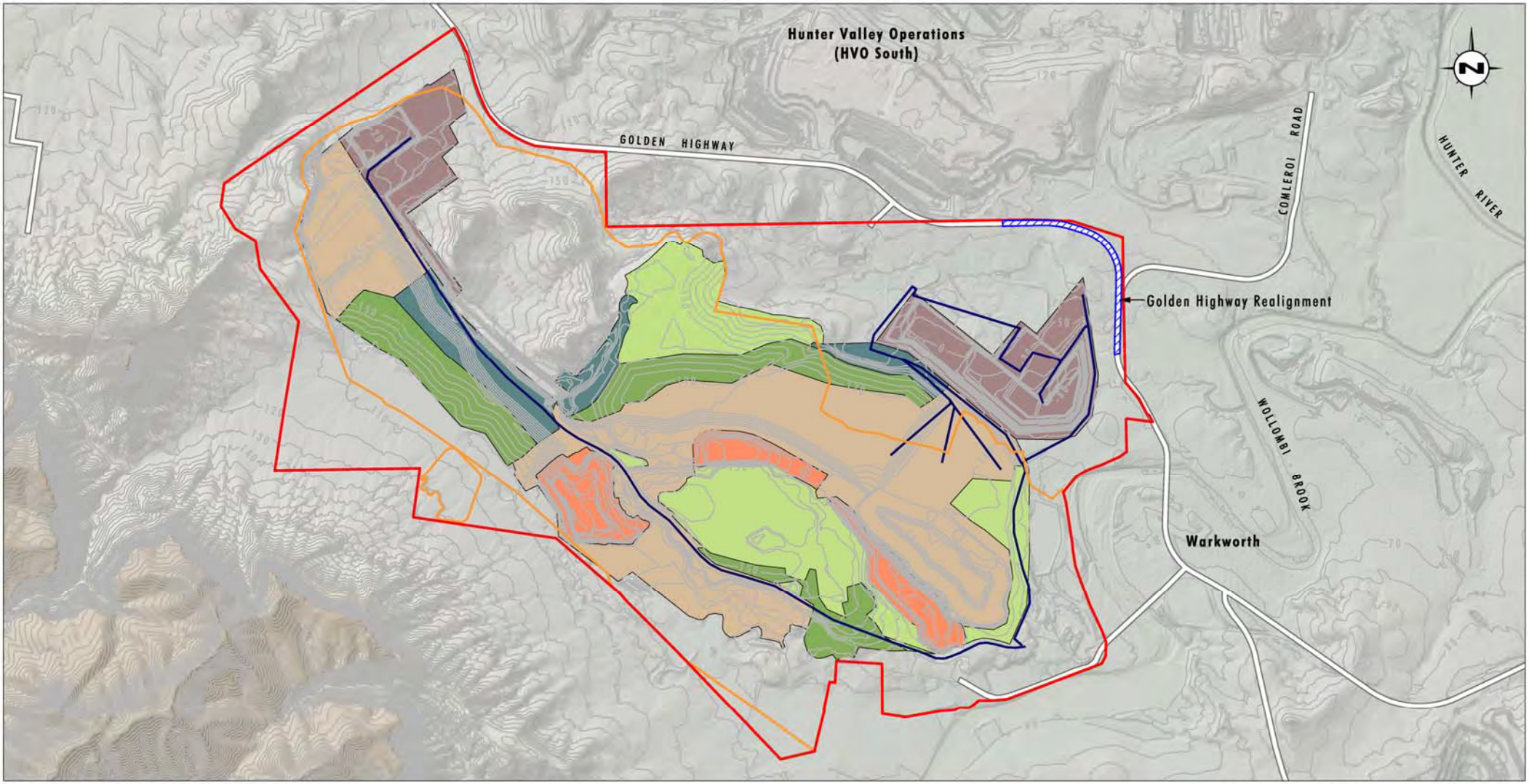


Image Source: United LiDAR (2015)
Data Source: Glencore (2015)
Note: Contour Interval 10m

0 1.0 2.0 2.5km
1:50 000

Legend

- Project Area
- Approved Wambo Surface Development Area
- Active Dumping Area
- Active Mining Area
- Proposed Rehabilitation
- Existing Rehabilitation
- Temporary Rehabilitation
- Tailings Emplacement
- Haul Road

FIGURE 3.11

Conceptual Mine Plan Year 2

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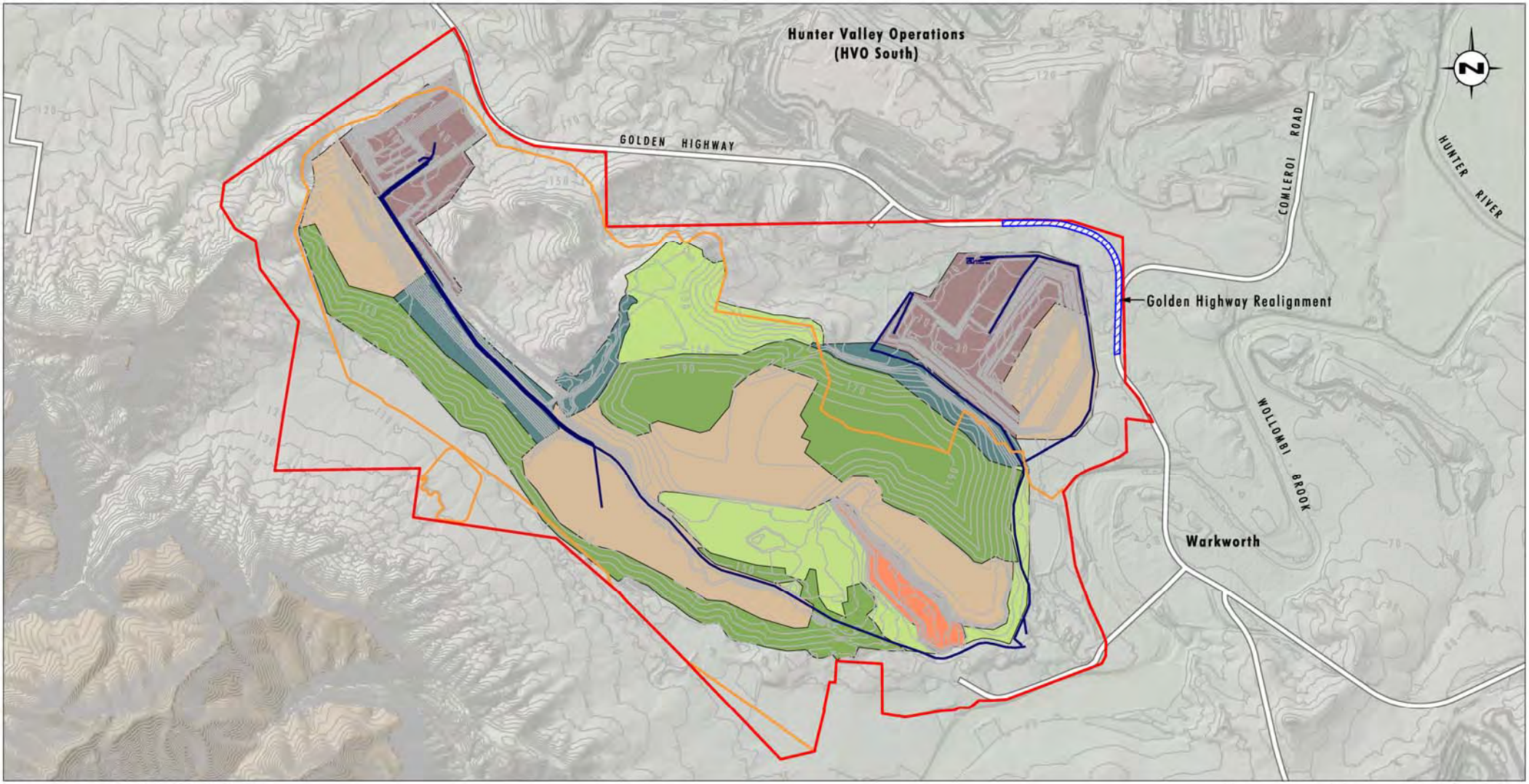


Image Source: United LiDAR (2015)
Data Source: Glencore (2015)
Note: Contour Interval 10m

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1:50 000

Legend

- Project Area
- Approved Wambo Surface Development Area
- Active Dumping Area
- Active Mining Area
- Proposed Rehabilitation
- Existing Rehabilitation
- Temporary Rehabilitation
- Tailings Emplacement
- Haul Road

FIGURE 3.12

Conceptual Mine Plan
Year 6

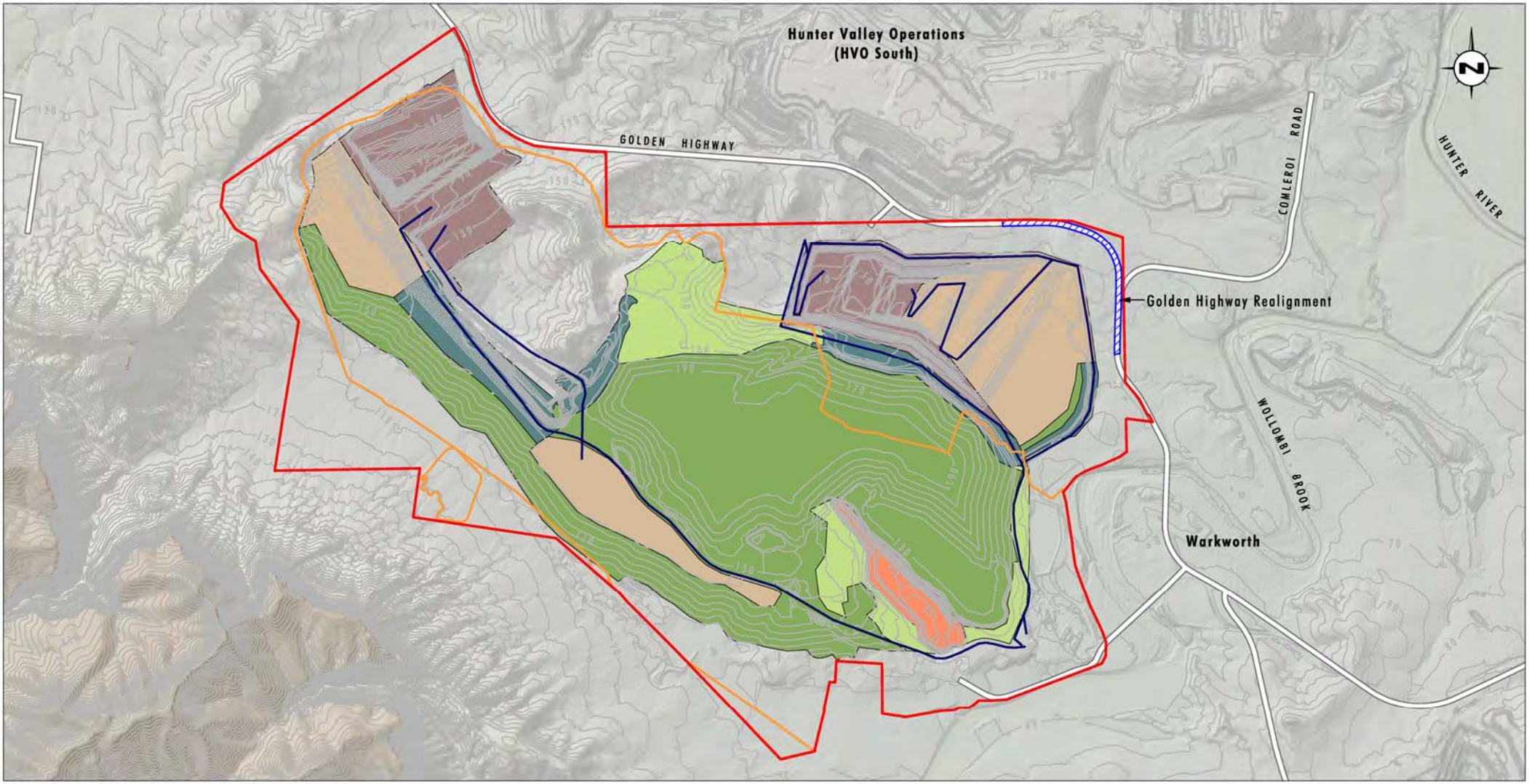


Image Source: United LiDAR (2015)
Data Source: Glencore (2015)
Note: Contour Interval 10m

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1:50 000

Legend

- Project Area
- Approved Wambo Surface Development Area
- Active Dumping Area
- Active Mining Area
- Proposed Rehabilitation
- Existing Rehabilitation
- Temporary Rehabilitation
- Tailings Emplacement
- Haul Road

FIGURE 3.13

Conceptual Mine Plan
Year 11

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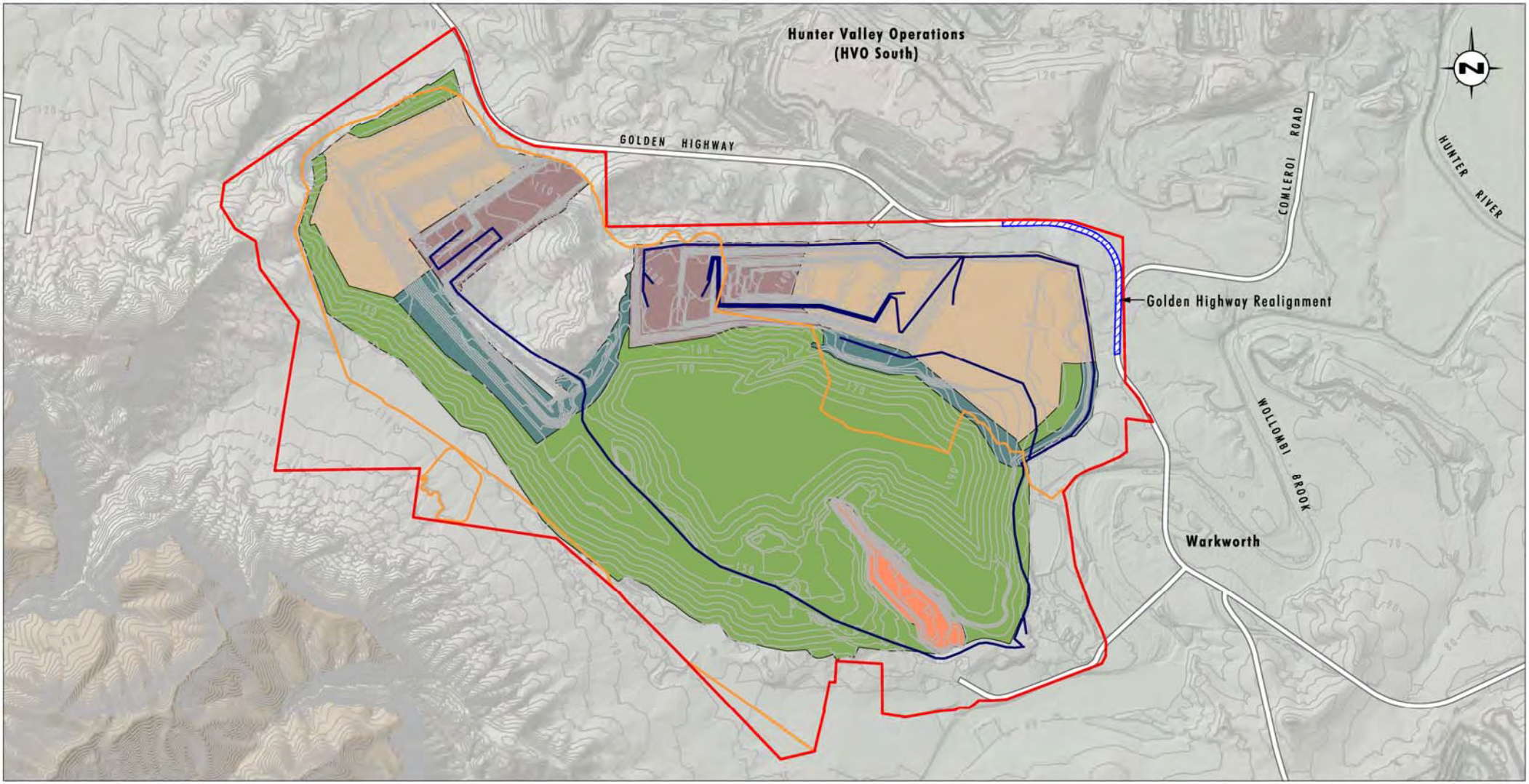


Image Source: United LiDAR (2015)
Data Source: Glencore (2015)
Note: Contour Interval 10m

0 1.0 2.0 2.5km
1:50 000

Legend

- Project Area
- Approved Wambo Surface Development Area
- Active Dumping Area
- Active Mining Area
- Proposed Rehabilitation
- Temporary Rehabilitation
- Tailings Emplacement

FIGURE 3.14

Conceptual Mine Plan
Year 16

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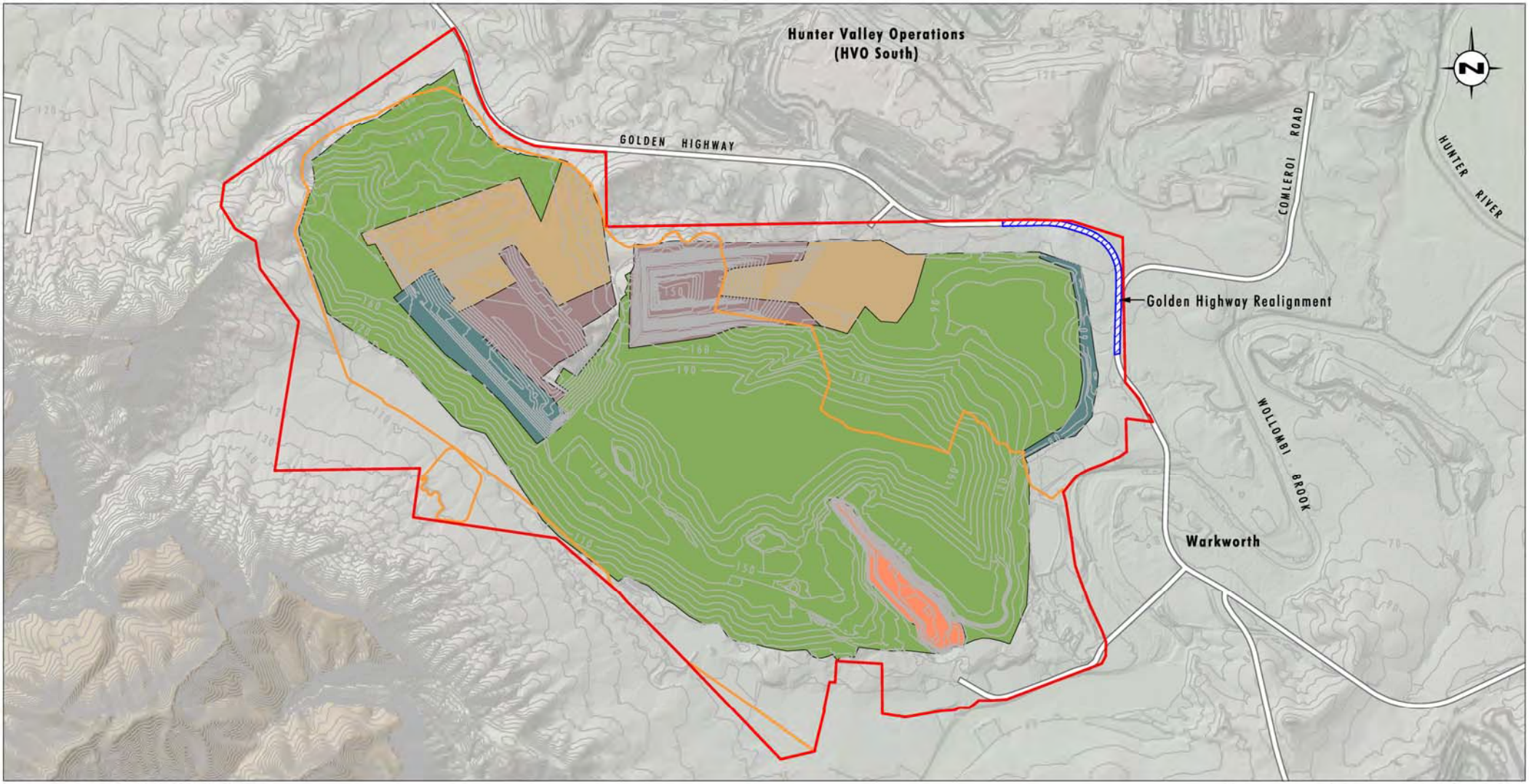


Image Source: United LiDAR (2015)
Data Source: Glencore (2015)
Note: Contour Interval 10m

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Legend

- Project Area
- Approved Wambo Surface Development Area
- Active Dumping Area
- Active Mining Area
- Rehabilitation
- Temporary Rehabilitation
- Tailings Emplacement

FIGURE 3.15

Conceptual Mine Plan
End of Mining

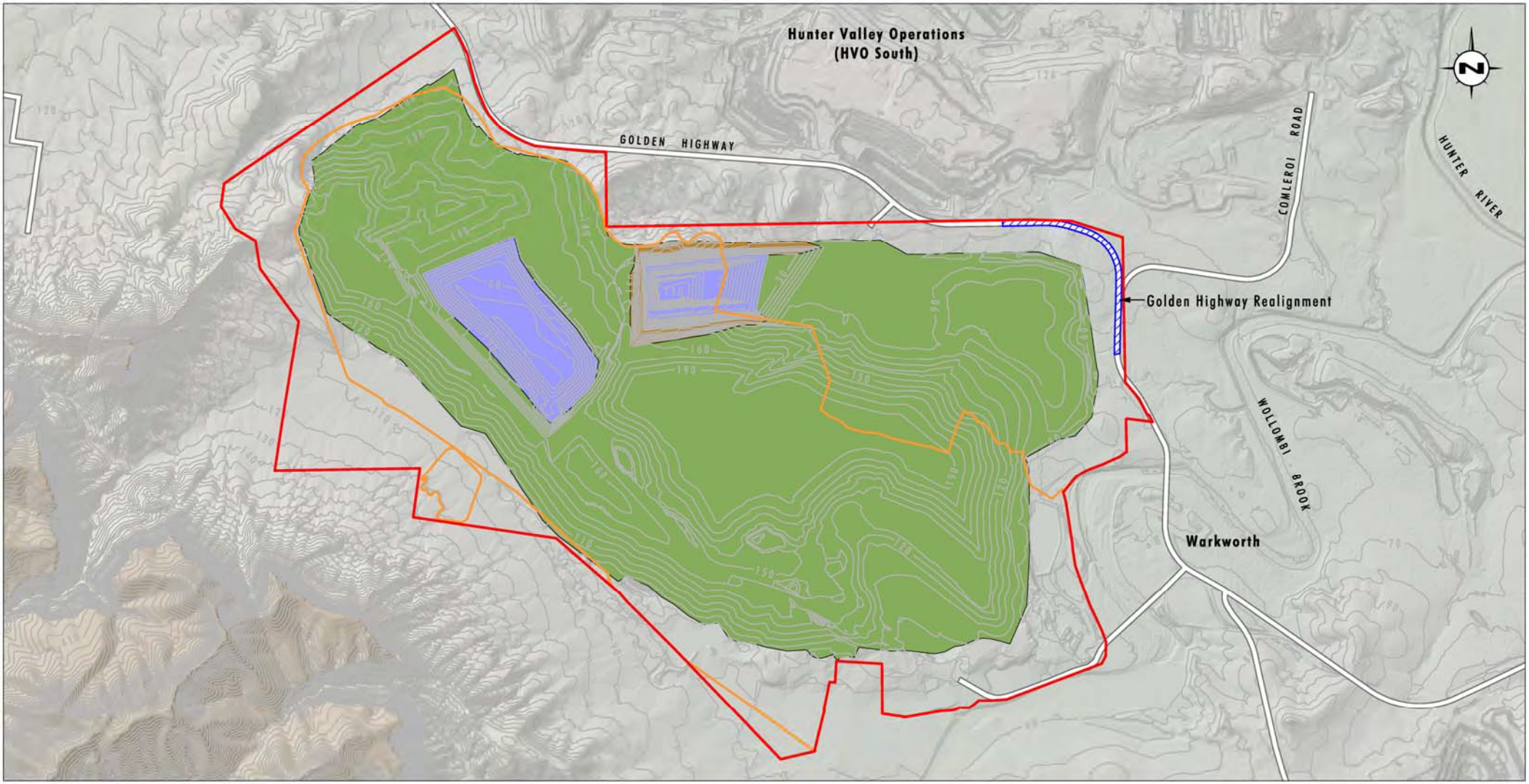


Image Source: United LiDAR (2015)
Data Source: Glencore (2015)
Note: Contour Interval 10m

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Legend

- Project Area
- Approved Wambo Surface Development Area
- Rehabilitation
- Final Void
- Highwall

FIGURE 3.16

Conceptual Mine Plan
Final Landform

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The mine plan incorporates a range of measures to limit potential environmental impacts with some key measures including:

- placement of haul roads behind topographic barriers to reduce noise
- use of haul road bunds in strategic locations to reduce noise
- design of haul roads to maximise efficiency of equipment, reducing the distance travelled (and consequently dust generation and energy use/greenhouse gas emissions) and noise generation from haul trucks
- designing the mine, where practicable, to provide shielded operating locations for use during adverse meteorological conditions
- design for timely progression of rehabilitation to minimise dust generation and minimise visual impacts
- use of temporary rehabilitation to limit windblown dust generation
- measures to divert clean water around the mining area and effectively manage water within the mining area.

The above measures are a selection of some of the measures incorporated into the Project design to reduce impacts with further discussion of the range of measures adopted for the Project provided throughout **Section 6.0**.

The overburden emplacement areas resulting from the two open cut mining areas will be combined to provide an integrated final landform across the Project mining area. In the early phases of mining in the United Open Cut overburden from the pit will be emplaced over previous open cut mining areas at Wambo. After approximately Year 6, overburden will be placed back into the United Open Cut void as mining progresses.

As shown on **Figures 3.11** to **3.16**, the areas disturbed by mining will be progressively rehabilitated throughout the life of the mine to achieve a suitable final landform. The conceptual final landform for the Project is provided in **Figure 3.16**. Further details on rehabilitation and final landform are provided in **Sections 3.5.4** and **6.13**.

The concept plans which form the basis of this assessment have been developed in consideration of current mining techniques and technologies and are based on United's current understanding of the local geology. Mining operations are, however, dynamic and the specific mine plan layout and sequence shown in the indicative mine plans may be subject to change due to economic conditions, technological advances, operational needs or as further geological data is gathered.

3.5.2 Mining Fleet

The mining fleet will initially include the continued use of the current Wambo mining fleet which will be progressively replaced over the life of the Project. Additional equipment will also be required and the Project will utilise truck and excavator/shovel mining methods. This method is suited to the progressive backfilling and rehabilitation of pit areas behind the active working areas as the mining activities advance, as shown in **Figures 3.11** to **3.16**.

Trucks will be utilised to haul overburden excavated by the shovels/excavators to emplacement areas and will also haul extracted coal to the Wambo CHPP ROM coal stockpile for subsequent delivery to the Wambo CHPP. Trucks used for hauling coal to the Wambo ROM stockpiles will also be used to transport coarse and thickened reject material from the CHPP to overburden emplacement areas. The typical mining fleet that will be used over the life of the Project is outlined in **Table 3.4**, however, this indicative equipment list is subject to change to meet the needs of the mining operations and in response to technological advances in mining equipment which may alter the composition of the fleet. The make-up of the mining fleet will vary from time to time throughout the life of the Project.

Table 3.4 Indicative Typical Mining and Key Ancillary Equipment

Equipment Type	Indicative No.	Key Ancillary Equipment	Indicative No.
Excavator/Shovel	8	Drill	5
Rear dump truck	36	Grader	4
Dozers (including both tracked and rubber tyred)	25	Water cart	4
Loaders	1	Fuel and service truck	2

Note: The table outlines the indicative numbers of equipment for the maximum production scenario based on the indicative mine plan shown in **Figures 3.11** to **3.16**. There may be variation in numbers, size and types of equipment used to suit operational needs, provided that the relevant production limits and environmental impact criteria are maintained.

3.5.3 Mining Process

The proposed general sequence of mining is outlined in the following sections.

3.5.3.1 Pre-strip Operations

Pre-strip operations include the removal of vegetation and topsoil ahead of the active mining operation and overburden emplacement for later use in the rehabilitation of disturbed areas. Pre-strip operations will also be carried out prior to the construction of infrastructure. Establishment of the required water management system infrastructure is also a key component of pre-strip operations.

Following the removal of vegetation, topsoil will be stripped and either stored in topsoil stockpiles for later use or placed directly on reshaped overburden for rehabilitation purposes. Topsoil management is discussed further in **Section 6.13** with procedures to minimise impacts associated with vegetation clearing discussed further in **Sections 6.9**.

3.5.3.2 Overburden Removal and Management

Once the mining area is cleared of vegetation and topsoil, the material lying above or between the target coal seams, known as overburden and interburden respectively (hereafter overburden), is broken up through drilling and blasting to enable it to be removed. The top layer of overburden close to the surface is generally weathered material that may not require blasting and may be able to be removed without blasting.

The blasted overburden will then be loaded by shovels and excavators into trucks for transportation to the overburden emplacement areas.

Overburden will be emplaced over the existing open cut mining areas at Wambo to provide a more integrated landform and also emplaced back into the Wambo and United Open Cuts, filling some of the previously mined areas. The sequence of mining and development of emplacement areas has been designed to allow early and progressive final rehabilitation as shown on **Figures 3.11** to **3.16**. The overburden emplacement area over the former Wambo mining areas and within the Wambo Open Cut will be developed progressively to a typical height of approximately 190 mAHD, with some more elevated emplacement being included at the southern end of the emplacement area so that stockpiled material can be later used to cap the Homestead and Main Homestead tailings storage facilities (refer to **Figure 3.17**).

The approved conceptual final landform at Wambo consisted of a single, broad ridgeline with a southeast to northwest alignment reaching approximately 160 mAHD flanked on the western side by two final voids. Under the Project, the Wambo final landform will be modified to provide an integrated landform which will result in changes to the previously approved final landform heights. The United Open Cut emplacement area will progressively backfill the void behind the active mining area and be developed to a typical height of approximately 160 mAHD. Emplacement activities will be managed to create a variable vertical profile and shape that provides a more natural looking and functioning final landform. Further discussion of the proposed approach to emplacement landform development is provided in **Section 6.13**.

The location of overburden emplacement activities will be generally dependent on the source of the overburden, haul distances and weather conditions, and will be actively managed to minimise noise, dust and visual impacts. Glencore, the manager of United has successfully implemented such active management systems at its existing Hunter Valley mining operations resulting in significantly reduced noise, dust and amenity impacts. Glencore's environmental standards and protocols will be implemented by United as part of the Project.

The overburden emplacement areas will be progressively shaped and rehabilitated to minimise visual impacts and dust generation, and prevent erosion. The rehabilitation of the emplacement areas is discussed in further detail in **Section 6.13**.

3.5.3.3 Blasting

Overburden will generally be blasted prior to removal. In addition, where thickness is sufficient, coal seams may also be blasted prior to extraction.

United will undertake blasting in accordance with a detailed design process that considers operational, geological and environmental constraints. Blasts will be designed such that potential impacts on surrounding features, such as infrastructure, residences, sensitive land uses and sensitive locations in the vicinity of the proposed mining operations are appropriately managed in compliance with relevant criteria. All blasts will be monitored with future blast designs being revised in light of monitoring results and any changed geological conditions. Consistent with existing requirements at Wambo, blasting will occur between 9.00 am and 5.00 pm Monday to Saturday unless otherwise approved by the EPA. Blasting will be limited to a maximum of 15 blasts per week and three blasts per day, with an allowance for additional blasts where there are low vibration blasts or misfires. The management of vibration and overpressure impacts associated with blasting is discussed in **Section 6.7**.

Blasts will also be designed to minimise the likely occurrence of blast fume generation. The management of potential blast fume impacts is discussed in **Section 6.7**. Where necessary, precautionary measures, such as the temporary closure of roads, will be implemented to ensure public safety is not put at risk as a result of blasting operations. This will include periodic closures of the Golden Highway which will be managed in consultation with RMS and with other nearby mining operations (in particular Coal and Allied's HVO mine) to minimise disruption to traffic as much as practicable. Further discussion of blasting road closure management is provided in **Section 6.7**.

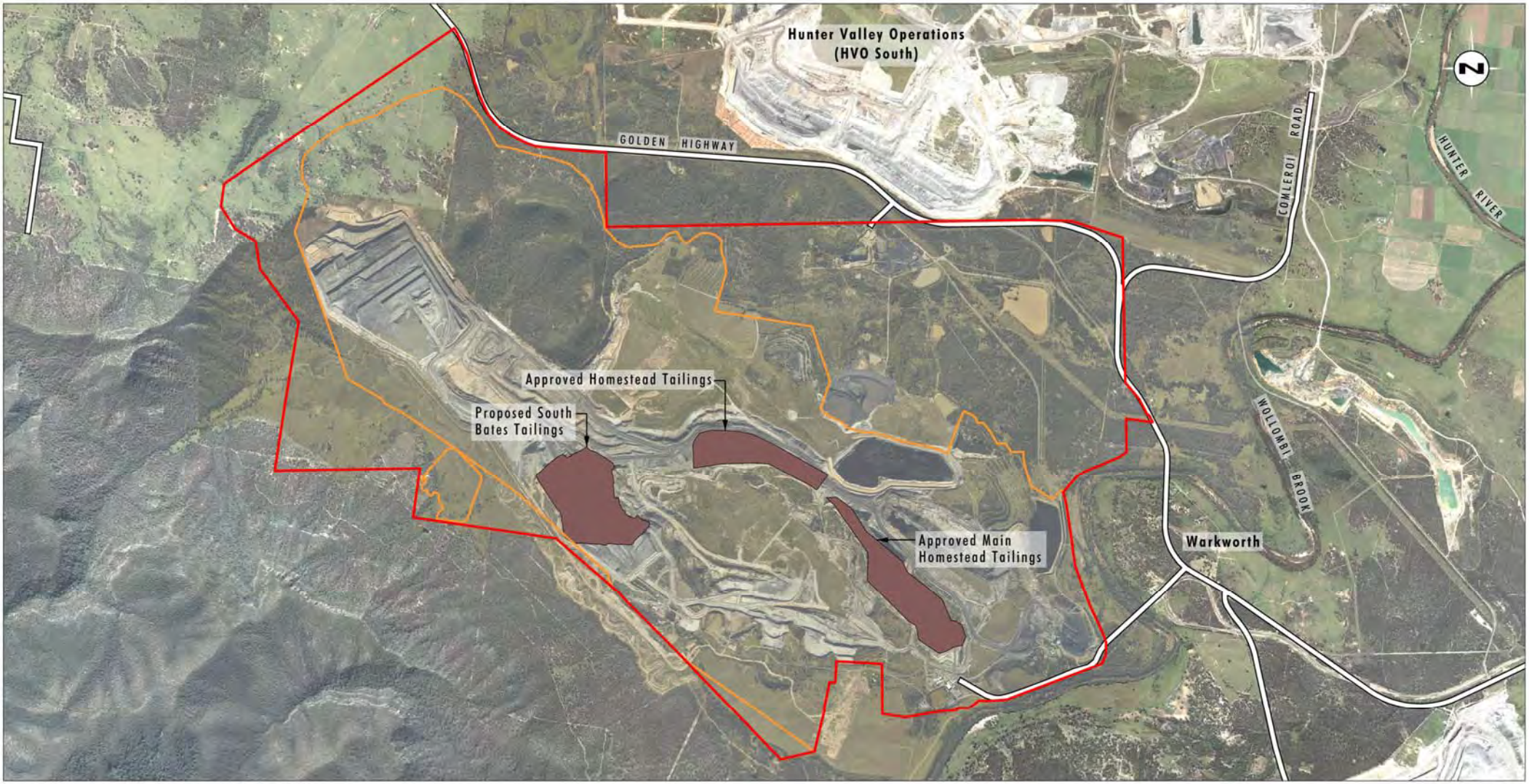


Image Source: AAM (2012), United (2015)
Data Source: Glencore (2015)

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Legend

- Project Area
- Approved Wambo Surface Development Area
- Approved and Proposed Tailings Storage Facilities

FIGURE 3.17

Conceptual Tailings Storage Facilities

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3.5.3.4 Coal Removal

Approximately 176 Mt of ROM coal will be removed during the life of the Project; of which approximately 27 Mt is already approved to be mined from the Wambo Open Cut. The United Open Cut will produce approximately 110 Mt of ROM coal. The Wambo Open Cut will produce approximately 66 Mt of ROM coal of which approximately 40 Mt will be accessed by the extension and depth of mining modifications.

Exposed coal will typically be mined by hydraulic excavators, shovels or front end loaders and loaded into trucks for transportation via internal haul roads to the Wambo CHPP ROM coal stockpile.

3.5.4 Proposed Rehabilitation and Closure

United will be responsible for rehabilitation and closure of the Project components that are under United's management (that is, the open cut operations). Wambo will remain responsible for the rehabilitation and closure of those components under Wambo control, that is, the CHPP, Wambo MIA, Wambo train loading facility and Wambo underground.

3.5.4.1 Temporary Rehabilitation

Disturbed areas which will not form part of the active open cut mining operations for extended periods will be seeded with groundcover to reduce potential wind erosion and associated dust emissions. Indicative temporary rehabilitation areas are shown on the indicative stage plans provided in **Figures 3.11** to **3.16**. Glencore has successfully implemented such temporary rehabilitation measures at its other Hunter Valley mines, reducing visual impacts, dust generation and erosion.

3.5.4.2 Rehabilitation of Disturbed Areas

Areas disturbed as part of the Project will need to be progressively rehabilitated following mining activities. The indicative progression of Project rehabilitation is provided in **Figures 3.11** to **3.16**.

Rehabilitation of disturbed land is designed with the objective of returning much of the Project Area to woodland habitat generally consistent with ecological communities that would have historically occurred in the area, combined with pastoral grassland areas that will provide future opportunity for appropriately managed grazing. Rehabilitation to achieve this objective will generally take the form of direct seeding of endemic tree, shrub and/or grass species into a growing medium established using soil removed during pre-stripping operations and/or imported material and, where conditions permit, by seeding directly into overburden. Tree and shrub seedlings may also be used either instead of, or in addition to, direct seeding where direct seeding alone is deemed unsuitable or past experience has produced suboptimal results. 'Cover crops' of exotic grasses and non-local shrub species may also be used where considered appropriate to provide protection for emerging shrub and tree seedlings, in areas proposed for pastoral grassland, for rapid establishment of erosion and sediment control and to minimise dust. Further details on the approach to rehabilitation are discussed in **Section 6.13**.

3.5.4.3 Decommissioning of Infrastructure Areas

As part of the mine closure process, infrastructure which is not able to be utilised by subsequent approved land uses will be removed following the principles discussed within **Section 6.13.5**. Soils within and surrounding former infrastructure areas will be assessed for potential contamination. Any contamination present will be remediated and contaminated material will be treated or appropriately disposed of. As with other disturbed areas, former infrastructure areas will be revegetated unless proposed for other land uses.

3.5.4.4 Decommissioning of Waterbodies

As part of the mine closure process, dams forming part of the mine water management system will be removed unless they are to be utilised for habitat purposes, are associated with long-term stability and water management, or are beneficial to subsequent land uses (e.g. stock dams). Removal of sediment from mine water dams will occur as required as part of the closure and rehabilitation processes regardless of the suitability of the dams for other purposes.

As discussed in **Section 3.4.4**, two final voids will remain as part of the final landform and will become waterbodies (refer to **Figure 3.16**). This outcome is consistent with the approved final landform for the Wambo Open Cut, however, the location of the voids will change as a result of the Project. It is predicted that the voids will partially fill with water and be a long term hydraulic sink. The catchment size of the final voids has been minimised where practicable. Further details on water recovery in the voids are contained in **Section 6.8**.

Further details regarding the rehabilitation and closure processes that will be implemented for disturbed areas are provided in **Section 6.13**.

3.6 Proposed Coal Handling and Processing

The Project will utilise the existing Wambo CHPP and coal handling infrastructure (such as conveyors, stockpiles and train loading facilities) for the washing, storage and transport of coal. No change is proposed to the currently approved operating capacity of the Wambo CHPP and Wambo train loading facility of up to 14.7 Mtpa ROM coal feed and 15 Mtpa of product coal, respectively. Both infrastructure facilities will continue to operate seven days a week, 24 hours per day. ROM coal from the Project will be hauled via internal haul roads to the CHPP.

The use of the Wambo CHPP is currently approved until 2025 under the Wambo mine development consent. As discussed in **Section 2.2.3**, Wambo is seeking a modification to increase the life of the CHPP until 2032. In order to allow for continued use of the CHPP, the Project includes seeking approval for continued use of the CHPP for the life of the Project.

ROM coal can be placed directly into the ROM bin or placed onto a 250,000 tonne capacity ROM coal stockpile. ROM coal is crushed and washed at the CHPP. A product coal stockpile with an approximate capacity of 500,000 tonnes is used to stockpile product coal, prior to reclaim and loading to trains for transport off site.

Changes are proposed to the existing ROM receival facility for open cut coal to upgrade the capacity of this existing system. This will include an upgrade of the existing open cut ROM dump station and associated facilities which transfer coal to the ROM coal stockpile. Minor changes to the ROM stockpile configuration are also sought to allow for increased flexibility including segregation of open cut and underground coal.

There are no other changes proposed to the Wambo CHPP as part of the Project.

3.6.1 Product Coal Transportation

Export coal processed from the Project will to be transported to the Port of Newcastle via the existing Wambo train loading facility and rail spur onto the Main Northern Line. There are no proposed changes to the existing train loading system infrastructure.

The use of the Wambo train loading facility is currently approved until 2025 under the Wambo train loading facility development consent. In order to allow for continued use of the train loading facility the Project, via the harmonisation modification, includes seeking approval for continued use of the train loading facility for the life of the Project.

The Project also seeks approval to increase maximum daily train movements from 6 to 8 to match the available time slots on the rail network. This approval is being sought via the harmonisation modification. As the approved maximum capacity of the train loading facility will remain unchanged, there will be no change to maximum annual train movements.

3.6.2 Proposed Rejects and Tailings Management

The Project proposes to utilise existing and approved tailings storage facilities at Wambo, including the approved Homestead and Main Homestead tailings storage facilities (refer to **Figure 3.17**). In addition, the Project will utilise the South Bates void for tailings storage once available. The indicative volumes of the three tailings storage facilities are provided in **Table 3.5**. Other mine voids or suitable locations within the open cut mining footprint may be used as tailings storage over the life of the Project if feasible.

Table 3.5 Indicative Tailings Storage Facility Volumes

Tailings Storage Facility	Indicative Volume
Homestead (also known as Inpit)	13.6 GL
Main Homestead (also known as Homestead Void)	19.5 GL
South Bates	21.5 GL

These facilities have sufficient capacity for the expected tailings generation over the life of the Project, as well as to cater for tailings generation from the Wambo underground operations. The timing of use of various tailings storage facilities will vary over the life of the Project based on operational needs and to facilitate the eventual effective capping and rehabilitation of these areas. That is, the facilities may be used concurrently as opposed to sequentially to meet operational needs or to improve progressive drying and manageability.

All tailings storage facilities take time to dry sufficiently to allow them to be capped by emplacement of overburden. To provide sufficient time for the Homestead and Main Homestead tailings storage facilities to dry prior to capping, it is proposed to initially emplace overburden adjacent to the storage facilities in an elevated bund, prior to later using this material to cap the storage facilities.

The previous mining operations at United utilised a tailings storage facility located on the southwest boundary of CCL775. This existing tailings storage facility will be decommissioned and capped as part of the Project.

Coarse rejects from coal preparation will be transported by truck to the open cut overburden emplacement areas for emplacement and subsequent covering by overburden material.

3.7 Proposed Exploration and Monitoring Boreholes

Exploration drilling will continue to be undertaken within the mining lease areas (including CCL775, the portion of A444 within the Project Area which will be converted to a ML for the Project and ML1572) to obtain further information regarding the resources to be mined as well as define geological and geotechnical information relevant to the mining and construction activities that will be undertaken. Additional drill holes to install groundwater and gas monitoring bores may also be required.

Construction, sealing and abandonment of boreholes will be in accordance with relevant standards and guidelines published by the DRE and in force at the time.

Where required, monitoring bores will be licensed under the *Water Management Act 2000* or the *Water Act 1912*, depending on the aquifers being intersected and monitored.

Surface disturbance associated with exploration and groundwater monitoring will be minimised when it occurs outside of the additional disturbance area for the Project. All exploration and groundwater monitoring boreholes will be undertaken in accordance with relevant requirements and standards under the *Water Act 1912* and *Water Management Act 2000*.

3.8 Proposed Infrastructure

3.8.1 Use of Existing Infrastructure

As shown on **Figures 2.1** and **2.2**, a range of existing mine infrastructure is located within the Project Area owned by either United or Wambo. The Project has been designed to maximise the use of existing infrastructure such as existing coal handling and processing infrastructure (refer to **Section 3.6**), MIAs, roads, conveyors, stockpile areas, rail loading facilities, power supply, fences and other mine infrastructure. This infrastructure will be retained and used where practicable. Existing roads servicing both the Wambo and United mines will be utilised for access to and within the Project Area. Some existing internal service roads may require widening to accommodate the movement of machinery or the installation of equipment.

The Project will operate beyond the expiry dates of the existing development consents that currently permit these facilities to be used and approval is sought as part of this Project, including the harmonisation modification, for ongoing use of the existing surface facilities and infrastructure in the Project Area for the life of the Project. This includes the proposed upgrade of some existing infrastructure to provide for ongoing utilisation and integration with the Project as discussed in the following sections.

United also has an existing water pipeline which it uses to transfer water abstracted from the Hunter River under licence to the site. This existing pipeline will be used for the Project.

3.8.2 Mine Infrastructure Area

The Project will require modification of the existing approved surface facilities at Wambo and United, including upgrades and installation of new facilities to accommodate the proposed mining fleet and increased workforce numbers. The general and indicative layout for the proposed Wambo MIA modification is shown in **Figure 3.18**. The new or modified infrastructure required for the Project will include:

- temporary workshop facilities during Project construction phase

- upgrades to and expansion of the existing Wambo washbays, workshop capacity, fuel farm and stores areas and associated facilities

- upgrades and expansion of the administration, car parking and bathhouse facilities in the existing Wambo MIA and associated facilities

- other upgrades or modifications to ancillary infrastructure and services including power and water reticulation systems.

These new or modified facilities will be constructed within the MIA Development Area shown on **Figure 3.18**.

A key focus is locating new or modified infrastructure within the existing disturbance footprints for both sites where practicable, to minimise additional surface disturbance.

3.8.3 Magazine and Ammonium Nitrate Emulsion Storage

Wambo has an existing explosives magazine and ammonium nitrate emulsion (ANE) storage tank on site (refer to **Figure 3.19**).

Both structures are readily relocatable with minimal site establishment works. Due to the hazardous nature of the materials housed in the structures, management controls including fencing and separation distances are required to minimise the risk of explosion and manage related workplace and public safety risks.

The location of these facilities will change throughout the life of the Project as the Wambo Open Cut and United Open Cut progress. A detailed hazard assessment has been undertaken (refer to **Section 6.16**) which has identified the minimum separation distance that the magazine and ANE storage tank must be located from publicly accessible areas or non-Joint Venture owned land. Based on the existing licensed storage capacity for each structure, this separation distance is 1300 metres for the ANE storage tank and 320 metres for the magazine. As mining progresses, these structures will be relocated to areas within the Project Area which meet these buffer zone requirements and which have regard to operational and workplace safety issues.

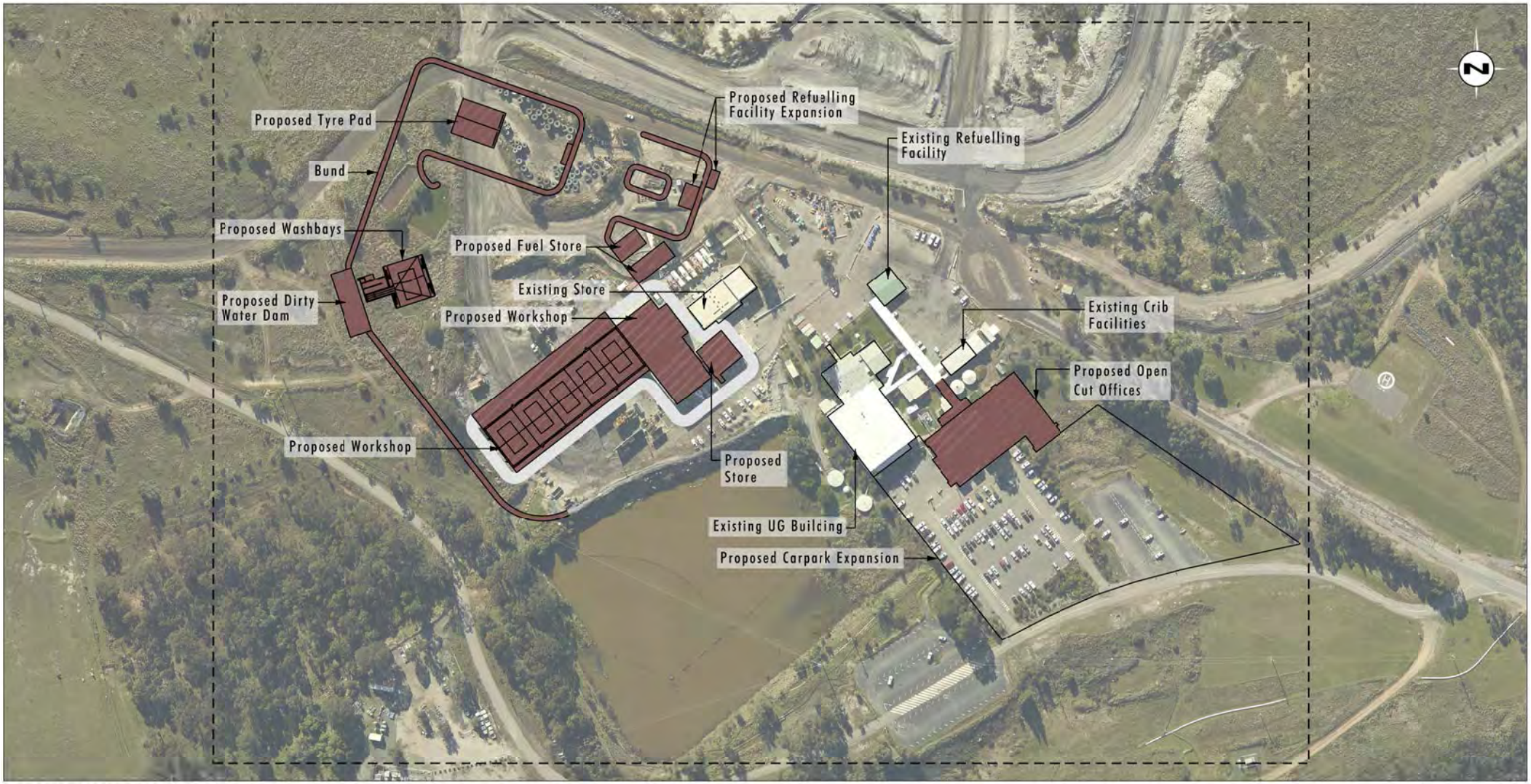


Image Source: United (2015)
Data Source: United (2015)

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- Proposed Additional Infrastructure
- Wambo MIA Development Area

FIGURE 3.18

Conceptual Proposed Wambo Mining Infrastructure Area Modifications

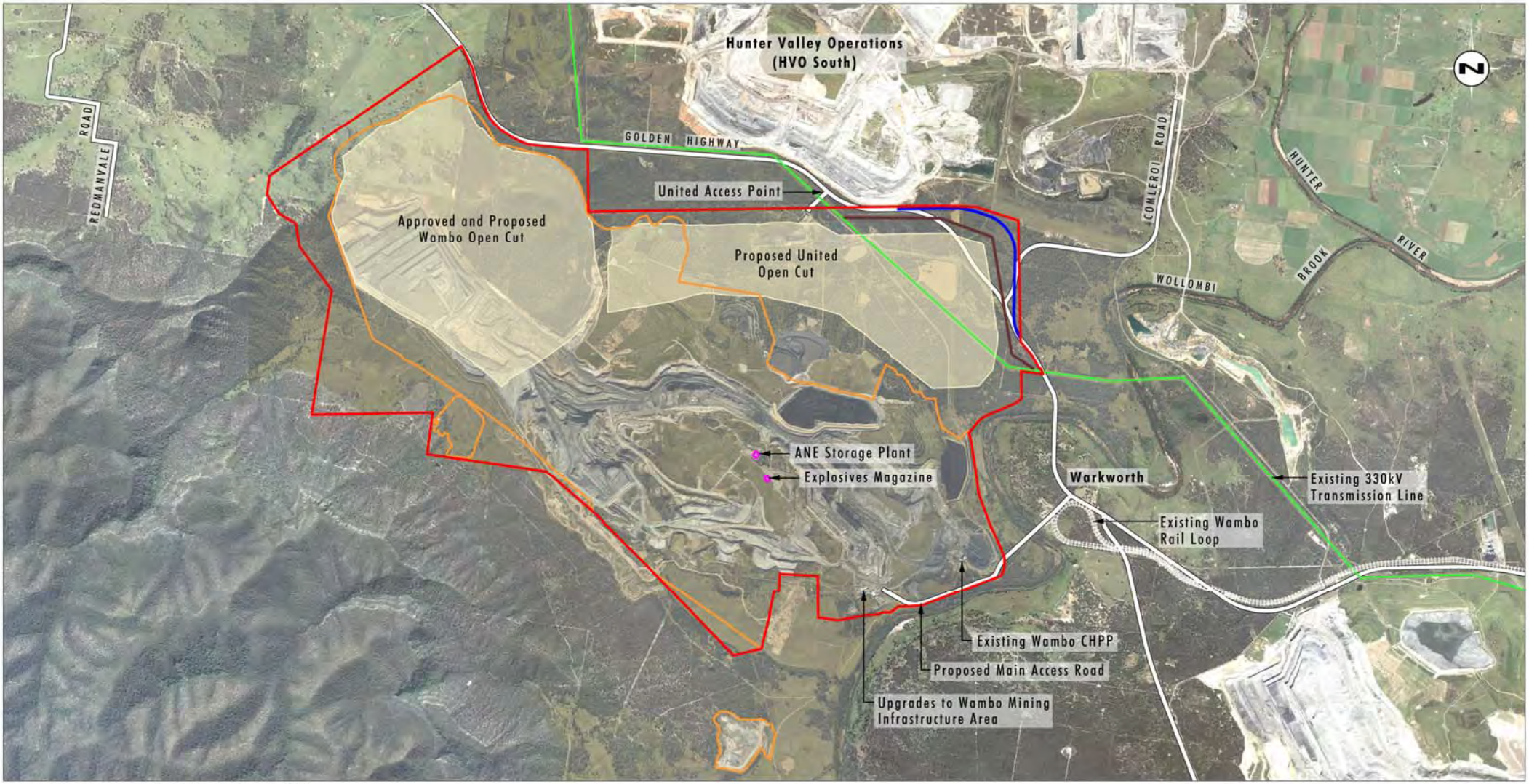


Image Source: AAM (2012), United (2015)
Data Source: Glencore (2014)

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1:60 000

Legend

- Project Area
- Proposed Conceptual Extraction Area
- Approved Wambo Surface Development Area
- Proposed Golden Highway Realignment
- Existing 330kV Transmission Line
- Proposed Relocated 330kV Transmission Line
- Hazardous Materials Storage Location

FIGURE 3.19

Existing Explosives Magazine and ANE Storage

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3.9 Proposed Associated Infrastructure

3.9.1 Proposed Golden Highway Realignment

The proposed United Open Cut will require the realignment of an approximately 2 kilometres section of the Golden Highway. The realignment is proposed to maximise resource recovery from the pit and provide improved mining conditions and will be undertaken by United in consultation with the Roads and Maritime Service (RMS). It is proposed that the Golden Highway will be diverted east around the open cut mine in the location shown on **Figure 3.20**. The realignment of the highway will also necessitate realignment of the Comleroi Road intersection with the Golden Highway.

The proposed diversion will have minimal impact on travel distances (approximately 800 metres longer) whilst retaining the current road speed limit of 100 km/h. The change in travel time associated with the increased length of the Golden Highway of approximately 800 metres is approximately 30 seconds. The realigned road will be designed and constructed to Austroads and RMS requirements and will include two 3.5 metre wide lanes with 2.0 metre shoulders. United has commenced discussions regarding the proposed realignment and design requirements with RMS. United has also consulted with Singleton Council regarding the relocated intersection of the Golden Highway and Comleroi Road (a Council road) and with TransGrid, Ausgrid and Telstra regarding the realignment and its interaction with existing services.

Based on consultation with RMS, the conceptual design includes a road corridor with sufficient width for a potential future duplication, if required.

The realigned section of the Golden Highway will be fully constructed, other than the junction with the existing Golden Highway, prior to it being commissioned to minimise disruptions to traffic.

3.9.2 Electricity and Telecommunications Infrastructure

The Project will require the relocation, construction and decommissioning of sections of 330 kV transmission lines and several other transmission lines (including 66 kV and 11 kV transmission lines) within the Project Area. These relocations will be undertaken by United in consultation with the infrastructure owners.

There will also be changes to the electrical distribution network in and around the Project Area to meet the needs of the Project and associated infrastructure.

330 kV Transmission Lines

Due to the proposed United Open Cut, a section of 330 kV transmission line is required to be realigned at the commencement of the Project. The realignment has been designed in consultation with TransGrid, the owners of the transmission line, with the relocated transmission lines being of similar design to the existing lines.

The alignment of the existing 330 kV transmission line and the proposed 330 kV transmission line relocation is shown on **Figure 3.21**.

The total length of the proposed transmission line realignment will be approximately 3.2 kilometres and will be designed to meet the requirements of TransGrid.

The towers associated with the section of line being decommissioned will be dismantled as it is located within the proposed United Open Cut area.

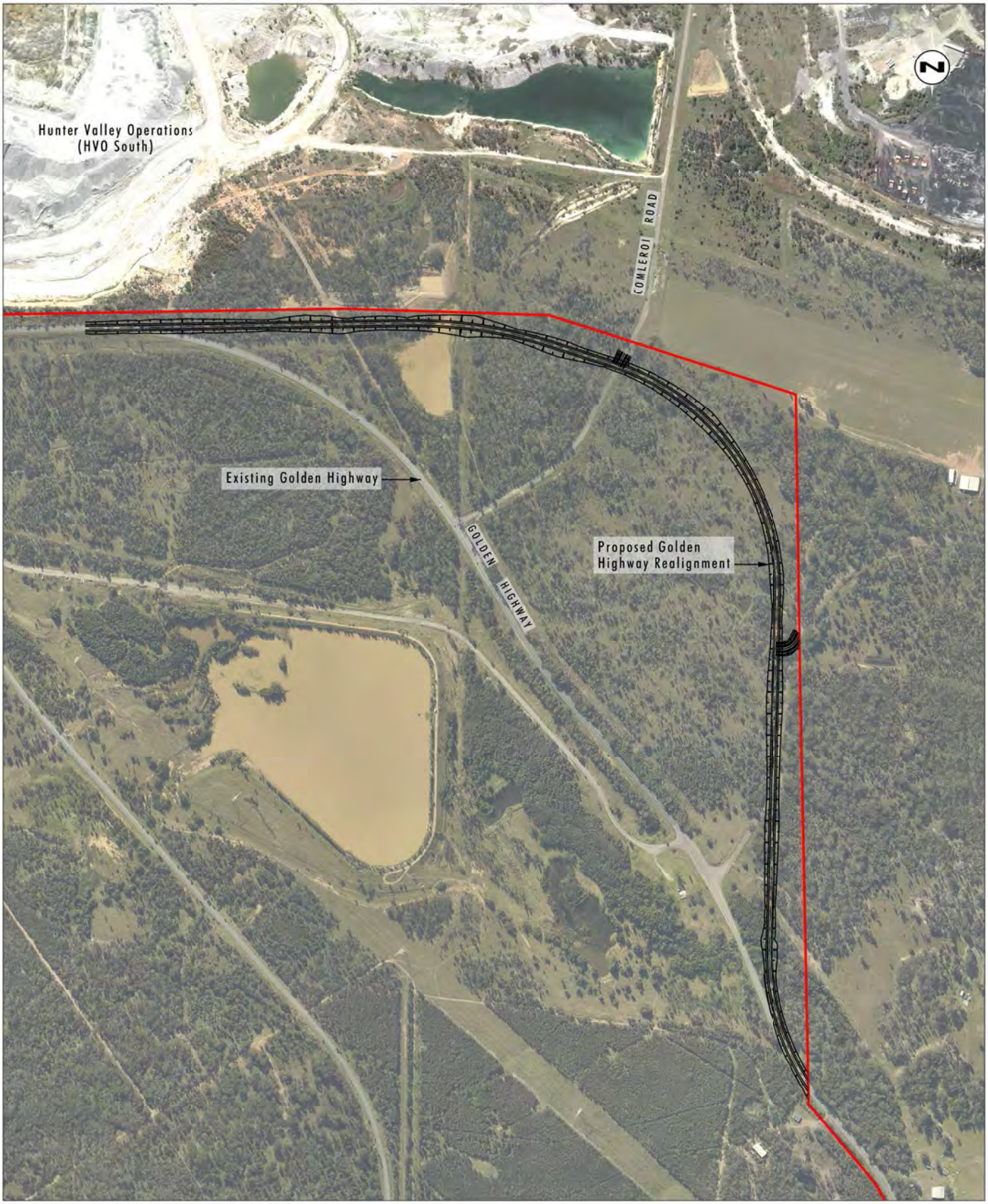


Image Source: AAM (2012), United (2015)
Base Data Source: Glencore (2015)

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Legend

- Project Area
- Proposed Golden Highway Realignment

FIGURE 3.20

Conceptual Golden Highway Realignment

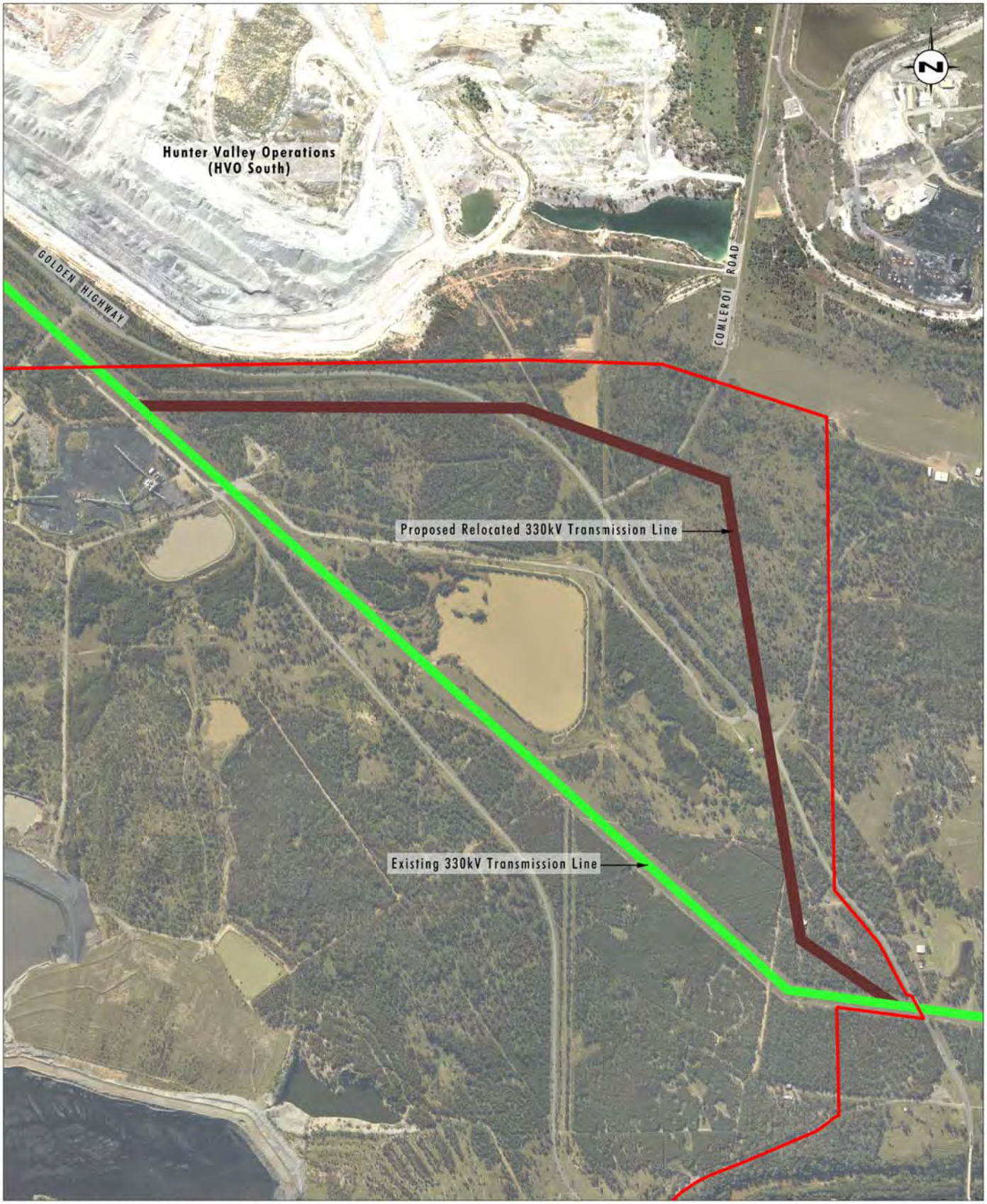


Image Source: AAM (2012), United (2015)
Base Data Source: Glencore (2015)

0 250 500 750m
1:15 000

Legend

- Project Area
- Existing 330kV Transmission Line
- Proposed Relocated 330kV Transmission Line

FIGURE 3.21

Conceptual Alignment of 330kV Transmission Line Relocation

66 kV and 11 kV Transmission Lines

Existing 66 kV and 11 kV transmission lines running through the Project Area provide power to United, Wambo and private users. The 66 kV transmission line forms part of the local power supply network ring main, providing network contingency in the event of a break in transmission on other parts of the regional network.

Some of these lines will need to be relocated and Ausgrid has been, and will continue to be, consulted as the Project progresses in this regard. The relocation of these lines will take place at various stages through the life of the Project and the required relocations will occur prior to decommissioning of the existing line for continuity of supply to other users.

The indicative location of alignments for new and relocated 66 kV powerlines is shown in **Figure 3.22**, however, the final alignment will be subject to detailed design in consultation with asset owners.

An existing substation at United will be removed as part of the Project, with a second substation at Wambo to be retained. The substation which will be removed may need to be replaced depending on the outcomes of the detailed electrical transmission design process. If required, this replacement substation will be located within the additional disturbance area for the Project or within the approved Wambo Surface Development Area.

Telecommunications Infrastructure

Some existing telecommunications and associated infrastructure are located adjacent to the existing alignment of the Golden Highway and will also require relocation as part of the Project. These services are predominantly owned by Telstra.

Discussions have been undertaken with the owners and operators of this infrastructure regarding the design requirements for the infrastructure being relocated and the timing of relocation. The relocated infrastructure will be commissioned in a manner that causes the least disruption to end users and the infrastructure operators. United will continue to engage with the owners and operators of this infrastructure during the detailed design and construction process to minimise the risk of service disruptions.

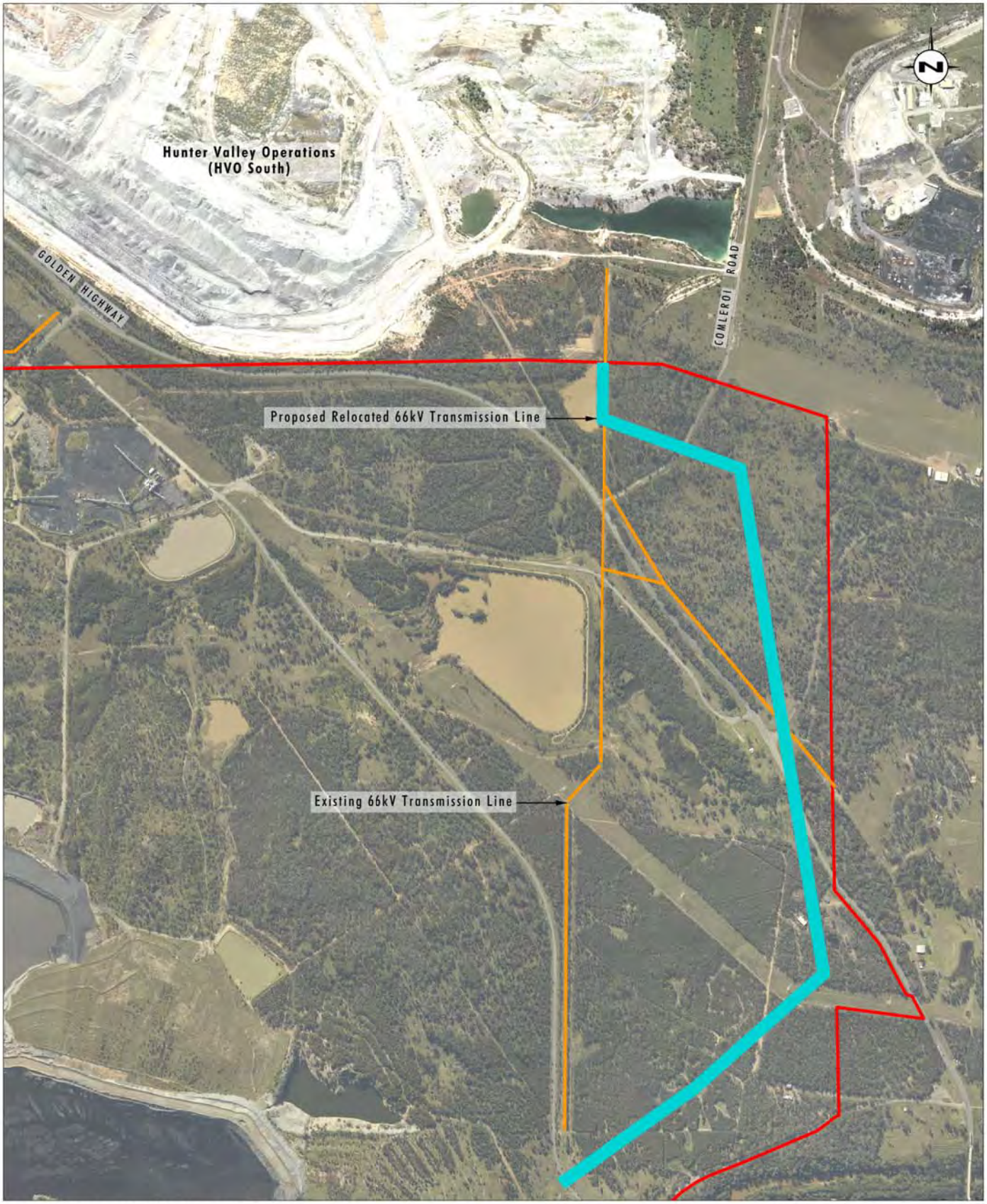


Image Source: AAM (2012), United (2015)
Base Data Source: Glencore (2015)

0 250 500 750m
1:15 000

Legend

- Project Area
- Existing 66kV Transmission Line
- Proposed Relocated 66kV Transmission Line

FIGURE 3.22

Conceptual Alignment of 66kV Distribution Network

3.9.3 Other Site Infrastructure and Activities

3.9.3.1 Water Management Infrastructure

The water management system for the Project will be integrated with the existing water management systems of the United and Wambo mines, with water managed across the combined United and Wambo mining complex. The Project will involve construction of new water management structures and will result in changes to some of the existing water management systems including the removal of some of the existing water storage facilities and changes to existing water management structures and infrastructure. A key objective of the Joint Venture water management strategy is to allow for water sharing between the two operations to maximise water recycling, minimise external water demand and water discharge, and to provide operational flexibility.

The water management strategy for the Project includes controls to separate clean water and mine water, seeking to prevent the contamination of clean water by mining activities and managing compliance with statutory obligations.

The Project proposes to utilise the existing United underground mine workings as a water storage facility along with other water storage options across the Project Area including the approved Montrose Storage Dam (not yet constructed), if required. While United was operational, United pumped water from the underground workings via a dewatering borehole located in the southern portion of the Project Area (refer to **Figure 2.1**). This dewatering bore will be used and relocated as necessary throughout the life of the Project to facilitate extraction of water from the underground workings for reuse.

United and Wambo also transfer water to and from HVO from time to time. Approval is sought as part of the Project to continue such water transfers as required, subject to commercial agreements.

As discussed above, a number of new dams and other water management structures will be required for the Project, which also integrates with the Wambo site water management systems. The final number and arrangement of these structures will be determined as part of the detailed design process as the Project progresses. These dams will be designed in accordance with relevant guidelines (refer to **Section 6.8**). The conceptual layout of the water management system for the Project is discussed in **Section 6.8.1**.

Flood modelling of Wollombi Brook (refer to **Section 6.8.1**) indicates that the inundation extent of the 1 per cent annual exceedance probability (AEP) flood event (sometimes referred to as the 1 in 100 year event) includes an area of the footprint of the United Open Cut. To protect the United Open Cut from flooding impacts and provide safety for mining operations personnel, it is proposed to construct a flood levee. The flood levee will be designed to provide flood protection to the United Open Cut for at least the 0.1 per cent AEP flood event. The indicative extent of the proposed flood levee is shown on **Figure 3.23**.

Further detail regarding the site water management system is contained in **Section 6.8.1**.

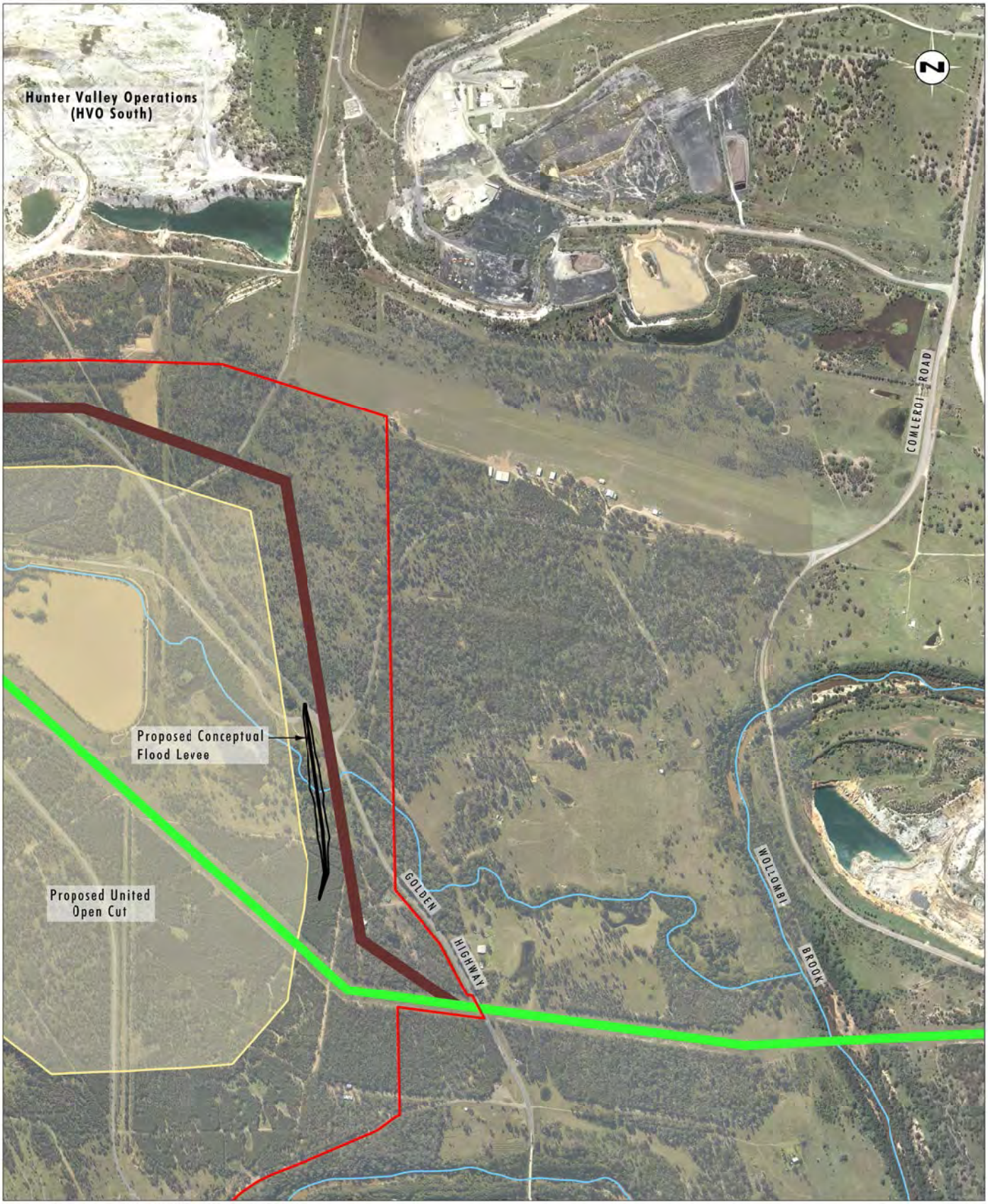


Image Source: AAM (2012), United (2015)
Base Data Source: Glencore (2015)

0 250 500 750m
1:15 000

Legend

- Project Area
- Proposed Conceptual Extraction Area
- Proposed Conceptual Flood Levee
- Existing 330kV Transmission Line
- Proposed Relocated 330kV Transmission Line

FIGURE 3.23

Indicative Flood Levee

3.9.3.2 Other Ancillary Infrastructure

Various ancillary infrastructure associated with the operation of an open cut mine will be required including access tracks, fences and gates, fire trails, telecommunications, water pipelines, communications systems and other infrastructure. The specific locations will be determined as part of the detailed mine planning process for each stage and will be detailed as part of the Mining Operations Plan (MOP)/Rehabilitation and Environmental Management Plan (REMP) process over the life of the Project. All infrastructure will be located within the identified disturbance areas for the Project (refer to **Section 3.11**), or if not possible, will be subject to appropriate due diligence processes to avoid adverse environmental impacts and, if required, subject to future approvals.

3.9.3.3 Onsite Waste Disposal

As part of the Project, used tyres and inert waste will be disposed of in open cut mining areas. This may include tyres and inert waste from both the Project (e.g. inert waste from the demolition of the existing United underground surface facilities prior to open cut mining in this area) and from Wambo. All such waste disposal activities will be undertaken in accordance with an EPL with wastes classified in accordance with EPA waste classification guidelines.

3.9.4 Mine Access

United currently has two site access roads from the Golden Highway, the existing main site access road and the former coal haulage truck access road (refer to **Figure 3.24**). The main entrance for the Project will be via the current entrance to Wambo. The existing United access roads will be used in the initial phase for construction and ancillary services with limited ongoing use as a property access point. Wambo has a secondary access point off the Golden Highway. This access is utilised in emergency situations or if the main access is unavailable (e.g. accident or flooding). The secondary Wambo access will remain available for use in such situations.

No change to the location or configuration of current site access roads is proposed as a result of the Project.

3.10 Construction Activities

The Project has been designed to maximise the use of existing infrastructure, however, as outlined in the previous sections some new or relocated infrastructure will be required. Most changes to infrastructure are currently planned to occur by approximately Year 3 of the Project, to allow mining in the United Open Cut to proceed in a timely manner. The upgrades to mine infrastructure may occur throughout the life of the Project.

Construction of the re-aligned section of the Golden Highway will generally occur during standard construction hours of 7.00 am to 6.00 pm, Monday to Friday and 8.00 am to 1.00 pm on Saturday. Construction activities may also be required outside these times, but will be managed to meet the relevant construction noise criteria.

Construction of the other infrastructure including the 330 kV transmission line realignment, the construction of water management system components as well as general mine infrastructure works will be undertaken 24 hours per day, 7 days per week as required. Some works, such as the installation of utility infrastructure, need to be undertaken at specific times to minimise the disruption to utility users. The construction work undertaken outside the standard construction hours will be managed to provide for compliance with Project noise criteria unless otherwise agreed with affected landholders.



Image Source: AAM (2012), United (2015)
Data Source: Glencore (2014)

0 1.0 2.0 2.5km
1:50 000

Legend
- Project Area
- Existing Traffic Access Locations

FIGURE 3.24

Existing Wambo and United Mine Access

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The construction workforce on site at any one time will vary depending on the timing of construction of the various components of the Project. The average construction workforce over the first two years of the Project when the majority of the construction activity is planned to take place will be approximately 100 people with a peak construction workforce currently predicted in Year 2 of approximately 120 people. Approximately 200 construction positions of various durations will be created over the first two years of the Project.

Construction laydown areas and construction workforce offices and facilities will be located within the Project Area. The location of these facilities will be dependent on final designs and on the timing of construction, however, these facilities will be located within the additional disturbance area of the Project (refer to **Section 3.11**).

As discussed in **Section 3.9.4**, the existing United and Wambo access points will be used for the Project. During the construction phase, however, it may also be necessary to use some temporary construction access points for specific construction activities (e.g. transmission line construction, construction of dams etc.). The management of temporary construction access points will occur via a construction traffic management plan. The construction road traffic management plan will be developed in consultation with Singleton Council and RMS prior to the commencement of construction activities. The plan will identify the measures to be implemented to manage potential construction related traffic impacts, including any temporary construction access points (refer to **Section 6.15**).

Lighting associated with night time construction works will be managed in compliance with *AS4282-1997 Control of the obtrusive effects of outdoor lighting*.

3.11 Project Disturbance Area

Most activities associated with the construction or carrying out of the Project involve some degree of surface disturbance although much of the affected land has been previously disturbed by existing or historical activities, or is currently approved for disturbance. The approved Wambo Surface Development Area shown on **Figure 3.25** is currently approved for disturbance and ongoing surface disturbance works will occur within the area over the life of the Project. As this area has previously been assessed and approved for disturbance (under both NSW and Commonwealth legislation), and as much of it has been or will be disturbed prior to the determination of the Project, no further assessment of the disturbance of this area is required as part of this EIS. The ongoing management of disturbance activities in this area will be undertaken in accordance with the approved management controls under the Wambo mine development consent.

Where possible, as part of the implementation of the Project, activities will be undertaken in a manner that limits the amount of physical ground disturbance. However, this is not always possible, nor is it possible to accurately identify every area within the Project Area that will remain intact or will be disturbed. **Figure 3.25** identifies the areas within the Project Area that have been identified as potentially being disturbed as a result of the Project. Due to the difficulty in accurately defining the precise location of access tracks, infrastructure alignments and water management infrastructure and impact areas associated with the development of Project components over the life of the Project, buffers around areas that are known to be, or are likely to be, disturbed as a result of the Project, have been applied so that the maximum potential footprint of the Project has been identified and assessed.

Components of the Project Area have been disturbed by previous United and Wambo mining operations or, as discussed above, are approved to be disturbed by Wambo's mining operations. The total conceptual additional disturbance area (hereafter referred to as the additional disturbance area) is shown on **Figure 3.25**.

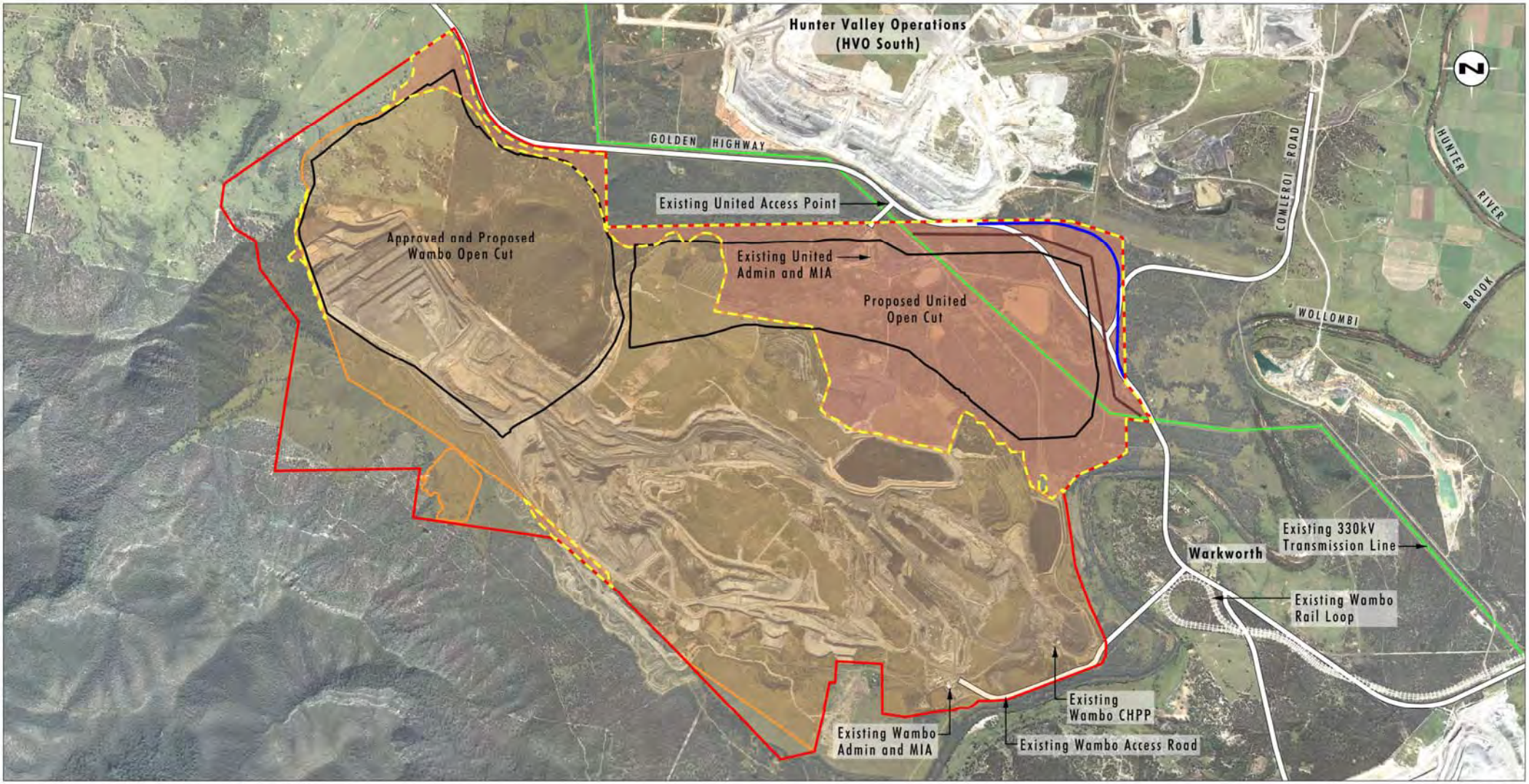


Image Source: AAM (2012), United (2015)
Data Source: Glencore (2014)

0 1.0 2.0 2.5km
1:50 000

Legend

- Project Area
- Conceptual Additional Disturbance Area
- Approved Wambo Surface Development Area
- Proposed Conceptual Extraction Area
- Conceptual Golden Highway Realignment
- Existing 330kV Transmission Line
- Conceptual Relocated 330kV Transmission Line

FIGURE 3.25

Conceptual Additional Disturbance Area

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3.12 Operations Workforce and Hours of Operation

Once at full operation, the Project will provide employment for a total workforce of up to approximately 500 positions during peak production, including up to approximately 250 additional operational positions. The Joint Venture's workforce will include existing Enterprise Agreement employees at the Wambo Open Cut operation and it is anticipated that additional mine worker positions will be created as the Project operations are developed. Without the Project the existing employment for the approximately 250 Wambo Open Cut personnel would cease in 2017 (or 2020, pending approval of Modification 12 of the Wambo mine development consent). The proposed operational workforce will peak at up to approximately 500 in the first seven years of the Project before reducing to up to approximately 450 for the remainder of the Project life.

Mining operations will be undertaken 24 hours per day, seven days per week. Consistent with existing Wambo operations, blasting will be restricted to 9.00 am to 5.00 pm Monday to Saturday except where approved otherwise by the EPA.

Section 4.0

Planning Considerations

4.0 Planning Considerations

The Project requires approval under both Commonwealth and NSW legislation with the primary planning and environmental approvals required including:

- approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) for those activities that are not within the scope of the existing Wambo EPBC Act approval (principally, approval is required for the United Open Cut and public infrastructure relocations, refer to **Section 4.1.1**)

- granting of a new development consent under Part 4 of the NSW EP&A Act to provide for the proposed open cut mining operations, public infrastructure relocations and associated activities (refer to **Section 4.2.1**)

- a modification to the existing Wambo mine development consent (DA 305-7-2003) to extend the operating life of the CHPP to match the life of the Project and upgrade and continued use of existing mining infrastructure (refer to **Section 4.2.1**)

- a modification to the existing Wambo Train Loading Facility development consent (DA 177-8-2004) to extend the life of the facility to match the life of the Project (refer to **Section 4.2.1**).

This EIS provides the required environmental, social and economic impact assessments required to accompany the applications for the above planning and other environmental approvals for NSW and Commonwealth consent authorities to assess and determine the:

- Project State Significant Development application

- modification applications for both DA 305-7-2003 and DA 177-8-2004

- Controlled Action approval under the EPBC Act.

This section discusses the application of the various State and Commonwealth environment and planning legislation and policies that are relevant to the Project.

4.1 Commonwealth Legislation

The EPBC Act is the primary environmental and planning regulatory instrument relevant to the Project at a Commonwealth level. The operation of the EPBC Act and its application to the Project is discussed in **Section 4.1.1** below.

The *Native Title Act 1993* is not directly relevant to the approval process for the Project, however, it does have implications for the grant of mining leases under the *Mining Act 1992* where there is potentially land in respect of which native title has not been extinguished within the lease application area. The implications (if any) of the *Native Title Act* on the grant of any mining lease necessary for the Project will be dealt with as part of the mining lease application process.

4.1.1 Environment Protection and Biodiversity Conservation Act 1999

Under the EPBC Act the approval of the Commonwealth Minister for the Environment is required for any action that may have a significant impact on a matter of national environmental significance. The matters of national environmental significance are:

- World Heritage properties
- National heritage places
- wetlands of international importance (listed under the Ramsar Convention)
- threatened species and ecological communities listed under the EPBC Act
- migratory species protected under international agreements
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mines)
- a water resource, in relation to coal seam gas development and large coal mining development
- Commonwealth land.

Approval under Part 9 of the EPBC Act is required for actions that may result in a significant impact on any of the above matters, unless approved under a Strategic Assessment prepared in accordance with Part 10 of the EPBC Act. Both Part 9 and Part 10 are relevant to the approvals path for the Project as discussed below. Part 10 is relevant due to the proposal to assess the ecological impacts of the Project under the Upper Hunter Strategic Assessment, while the remaining relevant matters of national environmental significance (including impacts on water resources) are to be considered under Part 9 of the EPBC Act.

The Project does not interact with any Commonwealth land, Commonwealth marine areas, the Great Barrier Reef Marine Park and is not a nuclear action. The remaining potentially relevant matters have been considered in regard to the Project as discussed in the following sections.

As noted in **Section 2.2.2**, Wambo has an existing approval granted under the EPBC Act (EPBC 2003/1138). This approval covers the approved Wambo mine including the open cut, underground, and surface facilities, including train loading facilities. EPBC 2003/1138 covers the following key elements:

- development and operation of the Wambo underground mine
- construction and operation of a rail spur, rail loop, coal reclaim area, product coal conveyor and train load-out bin
- continued development of open cut mining operations (including limited auger mining beyond open cut mining limits) within existing Wambo mining and coal leases and into new mining lease application areas (MLA 1 and MLA 2)
- upgrade of the existing CHPP to facilitate increased coal production

- development of a water control system including a water control structure across North Wambo Creek at the northwestern limit of the open cut operation and an associated channel

- closure of Pinegrove Road and development of new access and internal haul roads

- relocation of the administration area, site offices, existing explosive magazine and construction of additional hydrocarbon storage facilities.

The current application for approval under the EPBC Act therefore relates to those elements of the Project that are not already approved under the current Wambo EPBC Approval (EPBC 2003/1138).

Part 9 Assessment Process

Those aspects of the Project requiring approval under the EPBC Act were referred to DoE in October 2015 to determine whether or not it was a controlled action, thereby requiring approval of the Commonwealth Minister for the Environment. As the Upper Hunter Strategic Assessment is not yet finalised (refer to further detail in the following section), all potentially relevant matters were addressed in the referral including biodiversity impacts.

On 7 December 2015, the Project was determined to be a Controlled Action requiring approval under the EPBC Act from the Commonwealth Minister for the Environment due to its potential impact on the following matters of national environmental significance:

- Central Hunter Valley Eucalypt Forest and Woodland (a Critically Endangered Ecological Community (CEEC) listed under the EPBC Act)

- regent honeyeater (a threatened species listed in the EPBC Act)

- swift parrot (a threatened species listed in the EPBC Act)

- spotted-tailed quoll (a threatened species listed in the EPBC Act)

- a water resource.

A copy of the determination of the Project as a Controlled Action is provided in **Appendix 3**. The assessment path for the Project is under the bilateral agreement between the Commonwealth and NSW Governments and DoE has issued its assessment requirements which have been incorporated into the SEARs for the Project (refer to **Section 4.2.1.2**). This EIS addresses the assessment requirements, with a summary of the assessment findings related to matters of national environmental significance included in **Section 7.0**.

It is noted that once the Upper Hunter Strategic Assessment is finalised and in place (assuming this occurs prior the determination of the Project), it is intended to withdraw the referral of the biodiversity impacts as these would be instead assessed under Part 10 of the EPBC Act as discussed below. The impacts of the Project on water resources will require approval under Part 9.

Part 10 Assessment Process

The Commonwealth and NSW Governments have entered into an agreement under section 146 of the EPBC Act to undertake a strategic assessment of a Biodiversity Plan for Coal Mining in the Upper Hunter Valley, NSW. This assessment is referred to as the Upper Hunter Strategic Assessment (UHSA). The UHSA is being undertaken in accordance with the relevant provisions of the EPBC Act and the EP&A Act.

The Upper Hunter Valley has been identified for a strategic assessment because there are a number of prospective and existing mining and exploration areas for which applications to mine, or to expand existing mines, are expected over the next two decades. There has been extensive historical land clearing in the region for a variety of land uses and the Commonwealth and NSW Governments have identified benefit in taking a proactive approach to identifying priority biodiversity conservation outcomes in advance of inevitable project-by-project applications for future coal mining.

As discussed above, while the biodiversity impacts of the Project were referred under the EPBC Act, it is intended to pursue the UHSA pathway for the Project (to the extent permitted by the timing of finalisation of the UHSA process). The UHSA process was planned to be completed by the NSW and Commonwealth Governments by the date of this report but it is currently ongoing and not yet finalised. To allow projects to be assessed while the UHSA is being finalised, the NSW and Commonwealth Governments developed the UHSA Interim Policy (DP&I 2012). This Project has been assessed following the process outlined in the Interim Policy.

4.2 NSW Legislation and Policies

There are a substantial number of legislative instruments in NSW which regulate the environmental impact of development. The primary instrument is the EP&A Act which regulates the planning and environmental assessment and approval process for development in NSW. The Application of the EP&A Act and subordinate legislation to the Project is discussed in **Sections 4.2.1** and **4.2.2**. The operation of other environmental legislation in regard to the Project is discussed in **Section 4.2.3** and in **Section 6.0** in relation to specific Project impacts where relevant.

Section 4.2.4 discusses the key strategic policies that have relevance to the design and operation of the Project and which have been considered in the environmental assessment of the Project. In addition to the policies discussed in **Section 4.2.4**, there are a large number of impact specific guidance documents and policies that have been considered as part of the environmental assessment of the Project, these are identified and discussed in the relevant impact assessment sections in **Section 6.0**.

4.2.1 Environmental Planning and Assessment Act 1979

The EP&A Act is the primary legislation governing environmental planning and assessment for NSW.

The objectives of the EP&A Act are set out in Section 6 of the Act and are:

(a) to encourage:

(i) the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment;

(ii) the promotion and co-ordination of the orderly and economic use and development of land;

(iii) the protection, provision and co-ordination of communication and utility services;

(iv) the provision of land for public purposes;

(v) the provision and co-ordination of community services and facilities;

(vi) the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats;

(vii) ecologically sustainable development; and

(viii) the provision and maintenance of affordable housing;

(b) to promote the sharing of the responsibility for environmental planning between the different levels of government in the State; and

(c) to provide increased opportunity for public involvement and participation in environmental planning and assessment.

In order to meet these objectives, the EP&A Act prescribes a number of approval and assessment pathways for new development and modifications to existing development. These pathways are determined by environmental planning instruments such as local environmental plans and State Environmental Planning Policies.

4.2.1.1 Approval Pathway

State Significant Development

The State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP) prescribes development for the purposes of 'coal mining' as a being State Significant Development. Development consent under Division 4.1 of Part 4 of the EP&A Act is required before coal mining can be carried out.

The Minister for Planning is the consent authority for State Significant Development. However, based on current ministerial delegations in place, the Development Application will be determined by the Planning Assessment Commission under delegation from the Minister for Planning.

Harmonisation Modification

As discussed in **Section 1.4**, modifications are required to aspects of the existing development consents for Wambo mine (DA 305-7-2003) and the Wambo train loading facility (DA 177-8-2004) to harmonise or align these approvals with the Project.

Because of the effect of Clause 8J(8) of the EP&A Act, these consents are 'transitional Part 3A' projects as defined in Clause 2(1)(a) of Schedule 6 of the EP&A Act. Clause 12 of Schedule 6A of the EP&A Act provides that Section 75W of Part 3A of the EP&A Act continues to apply to modifications of development consents referred to in Clause 8J(8) of the EP&A Regulation. Clause 8J (8) of the EP&A Regulation states:

(8) For the purposes only of modification, the following development consents are taken to be approvals under Part 3A of the Act and section 75W of the Act applies to any modification of such a consent:

(c) a development consent granted by the Minister under Part 4 of the Act (relating to State significant development) before 1 August 2005 or under clause 89 of Schedule 6 to the Act,

...

The components of the Project that require the proposed modifications are discussed in **Section 3.2.3**. In summary these are:

- extension of life of the existing and approved Wambo infrastructure and facilities (including the CHPP and train loading facility) for the life of the Project
- changes and upgrades to some of the existing Wambo infrastructure and facilities and ancillary infrastructure
- placement of tailings including within the Project's open cut voids and capping with overburden and coarse rejects for the life of the Project
- allowance for the Wambo CHPP to receive coal from the United Open Cut (and modified Wambo Open Cut) for processing and stockpiling prior to being transported from the Wambo train loading facility
- ongoing exchange of water between the United and Wambo operations to allow for integration of the water management systems
- an increase to the number of trains utilising the train loading facility from a maximum six trains to a maximum of eight trains per day for the life of the Project.

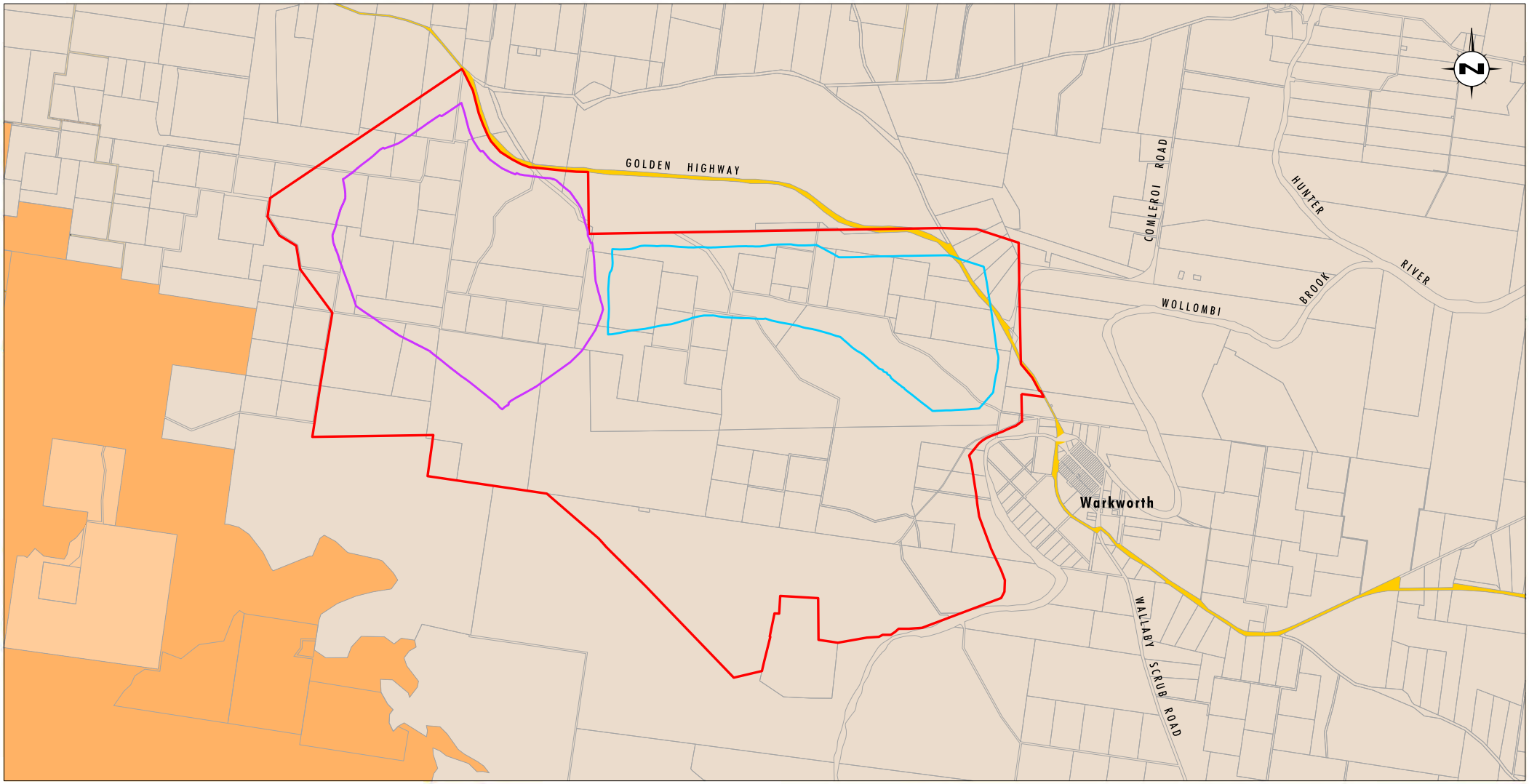
The existing Wambo underground mining operations are not proposed to be modified as part of the Project.

Permissibility

The Project Area is zoned RU1 Primary Production and SP2 Infrastructure under the provisions of the *Singleton Local Environmental Plan 2013* (LEP) (refer to **Figure 4.1**). Open cut mining is permissible with development consent in RU1 Primary Production but is prohibited within land zoned SP2 Infrastructure. The land zoned SP2 Infrastructure is associated with the current alignment of the Golden Highway which is proposed to be realigned as part of the Project (refer to **Section 3.9.1**).

Clause 7(1)(b)(i) of the State Environmental Planning Policy (Mining, Petroleum and Extractive Industries 2007 (Mining SEPP) provides that mining is permissible with development consent on land where development for the purpose of agriculture is also permissible under the provisions of an environmental planning instrument. Extensive agriculture is a permissible land use within land zoned SP2 Infrastructure. Clause 5(3) of the Mining SEPP provides that the Mining SEPP will prevail where there is any inconsistency between the provisions in the Mining SEPP and the provisions in any other environmental planning instrument (such as the Singleton LEP) (subject to limited exceptions not relevant here). The effect of clause 7(1)(b)(i), in conjunction with the operation of clause 5(3) of the Mining SEPP, is that notwithstanding any prohibition in the Singleton LEP, development for the purpose of open cut mining may be carried out with development consent in the Project Area.

As the development is permissible with consent, the Minister (or delegate) can approve the carrying out of the Project.



Data Source: LPMA (2009), Department of Natural Resources (2005)

0 1.0 2.0 3.0km
1:60 000

Legend

- Project Area
- Proposed Conceptual United Open Cut Pit
- Proposed Conceptual Wambo Open Cut Realignment

Zone:

- E1 National Parks and Nature Reserves
- E2 Environmental Conservation
- RU1 Primary Production
- SP2 Infrastructure

FIGURE 4.1

Land Zoning Map

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4.2.1.2 Assessment Requirements

As State Significant Development the Project is subject to the general assessment requirements under Part 4 of the EP&A Act as amended by the requirements under Part 4 Division 4.1 of that Act. The requirements are discussed below.

Section 79C Matters for Consideration

Under Part 4, the consent authority, in this case the Minister or their delegate must have regard to the matters set out in section 79C of the EP&A Act. The matters for consideration by the consent authority and where they have been addressed in this EIS are provided in **Table 4.1**.

Table 4.1 Section 79C Matters for Consideration

Matters for Consideration	Relevant EIS Section
(a) The provisions of: **Any environmental planning instrument**	**Section 4.2.2**
Any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Secretary has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved)	**Section 4.2.2**
Any development control plan	Not applicable due to operation of Clause 11 of SRD SEPP.
Any planning agreement that has been entered into under section 93F, or any draft planning agreement that a developer has offered to enter into under section 93F	Not applicable. Planning agreement not yet entered into however discussions with Singleton Council have commenced.
The regulations (to the extent that they prescribe matters for the purposes of this paragraph)	**Section 4.2.1**
Any coastal zone management plan (within the meaning of the Coastal Protection Act 1979) that applies to the land to which the development application relates	Not applicable. Project not subject to any coastal management plan.
(b) The likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality	**Section 6.0** and **Appendices 4** to **19**
(c) The suitability of the site for the development	**Sections 6.2** and **9.2**
(d) Any submissions made in accordance with this Act or the regulations	Comments to be received on the EIS during the public exhibition period.
(e) The public interest	**Section 9.0**

In addition to the requirements under section 79C, the consent authority must also have regard to an EIS which meets the requirements of section 78 (8A) of the EP&A Act which requires that the EIS must be prepared in accordance with the requirements of Schedule 2 of the EP&A Regulation. The requirements of Schedule 2 of the EP&A Regulation and where they are addressed in the EIS are set out in **Table 4.2**.

Table 4.2 Schedule 2 EP&A Regulation Requirements

Regulation Clause	Requirement	Relevant EIS Section
Clause 6(a)	Name, Address and Professional qualifications of person preparing the EIS	**Appendix 2**
Clause 6(b)	Name of the Consent Authority	**Section 4.2.1**
Clause 6(c)	Address of Land	**Appendix 2**
Clause 6(d)	Description of development	**Section 3.0**
Clause 6(e)	Assessment of the environmental impact of the Project	**Section 6.0**
Clause 6(f)	A declaration that the EIS has been prepared in accordance with the Schedule, contains all available information relevant to the environmental assessment of the Project and that the information contained in the EIS is neither false nor misleading	**Appendix 2**
Clause 7(1)(a)	Summary of the EIS	**Executive Summary** and **Section 9.0**
Clause 7(1)(b)	A statement of the objectives of the development	**Section 3.0**
Clause 7(1)(c)	An analysis of any feasible alternatives to the carrying out of the development, having regard to its objectives, including the consequences of not carrying out the development	**Section 3.4** and **Section 9.0**
Clause 7(1)(d)(i)	A full description of the development, activity or infrastructure	**Section 3.0**
Clause 7(1)(d)(ii)	A general description of the environment likely to be affected by the development	**Section 6.0**
Clause 7(1)(d)(iii)	The likely impact on the environment of the development	**Section 6.0** and **Appendices 4** to **19**
Clause 7(1)(d)(iv)	A full description of the measures proposed to mitigate any adverse effects of the development on the environment	**Section 3.0**, **Section 6.0** and **Section 8.0**
Clause 7(1)(v)	A list of any approvals that must be obtained under any other Act or law before the development may be lawfully carried out	**Section 4.0**

Regulation Clause	Requirement	Relevant EIS Section
Clause 7(1)(e)	A compilation of the mitigation measures referred to in Clause 7(1)(d)(iv)	**Section 8.0**
Clause 7(1)(f)	The reasons justifying the carrying out of the development in the manner proposed, having regard to biophysical, economic and social considerations, including the principles of ecologically sustainable development	**Sections 3.1** and **3.4** and **Section 9.0**

The EIS has also addressed the revised SEARs provided for the Project which were issued by DPE on 15 December 2015 (noting that these replaced an earlier issue of the SEARs issued in July 2015). The SEARs outline the specific requirements to be addressed by the EIS. A copy of the SEARs is contained in **Appendix 1**. A checklist of the SEARs and where they have been addressed in the EIS is outlined in **Table 4.3**.

Table 4.3 Secretary's Environmental Assessment Requirements for the Environmental Impact Statement

General Requirements	Relevant EIS Section
The Environmental Impact Statement (EIS) for the development must comply with the requirements in Clauses 6 and 7 of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*.	Refer to **Table 4.2**
In particular, the EIS must include: • **an executive summary;**	**Executive Summary**
• **a full description of the development, including:** o **historical mining operations on the site;**	**Section 1.3**
o **the resource to be extracted, demonstrating efficient resource recovery within environmental constraints;**	**Section 3.2.4**
o **the proposed mine layout and scheduling;**	**Section 3.5.1**
o **minerals processing and transport;**	**Sections 3.5.3** and **3.6**
o **proposed infrastructure and facilities (including any existing infrastructure or infrastructure that would be required for the development, but the subject of a separate approvals process);**	**Sections 3.8** and **3.9**
o **a waste (overburden, rejects, tailings, etc) management strategy, having regard to the EPA's requirements (refer to Attachment 2 of the SEARs);**	**Section 6.19**
o **a water management strategy, having regard to the EPA's and NOW's *(note are now DPI – Water)* requirements (refer to Attachment 2 of the SEARs);**	**Sections 3.9.3** and **6.8**
o **a rehabilitation strategy, having regard to DRE's requirements (refer to Attachment 2 of the SEARs):**	**Section 6.13**
- The proposed interactions between the development and the existing and approved operations at Wambo Mine and United Mine (including any relevant statutory Approvals, environmental management regimes and biodiversity offset areas relating to these operations); and	
o **the likely interactions between the development and any other existing, approved or proposed mining development or power station in the vicinity of the site;**	**Sections 6.2** and **6.3**

General Requirements	Relevant EIS Section
• a list of any approvals that must be obtained before the development may commence;	**Section 4.2**
• a risk assessment of the potential environmental impacts of the Project, identifying key issues;	**Section 6.1**
• an assessment of the likely impacts of the development on the environment, focusing on the specific issues identified below, including:	
o a description of the existing environment likely to be affected by the development, using sufficient baseline data;	**Section 6.0**
o an assessment of the likely impacts for all stages of the development, including appropriate worst case scenarios and consideration of any cumulative impacts, and having regard to any relevant laws, environmental planning instruments, guidelines, policies, plans and industry codes of practice;	**Section 6.0**
o a description of the measures that would be implemented to avoid, minimise, mitigate and/or offset the likely impacts of the development, and an assessment of: - whether these measures are consistent with industry best practice, and represent the full range of reasonable and feasible mitigation measures that could be implemented; - the likely effectiveness of these measures, including performance measures where relevant; and - whether contingency measures (including Trigger Action Response Plans) would be necessary to manage any residual risks; and	**Sections 6.0** and **8.0**
o a description of the measures that would be implemented to monitor and report on the environmental performance of the development if it is approved;	**Sections 6.0** and **8.0**
• a consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS;	**Section 8.0**
• consideration of the development against all relevant environmental planning instruments (including Part 3 of the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007);	**Section 4.2**

General Requirements	Relevant EIS Section
• a conclusion justifying why the development should be approved, taking into consideration: o alternatives; o the suitability of the site; o the economic, social, biophysical and environmental impacts of the project as a whole; and o whether the project is consistent with the objects of the Environmental Planning and Assessment Act 1979;	**Section 9.0**
• A signed statement from the author of the EIS, certifying that the information contained within the document is neither false nor misleading.	**Appendix 2**
In addition to the matters set out in Schedule 1 of the *Environmental Planning and Assessment Regulation 2000*, the development application must be accompanied by a signed report from a suitably qualified and experiences person that includes an accurate estimate of the: • capital investment value (as defined in Clause 3 of the *Environmental Planning and Assessment Regulation 2000*) of the development, including details of all the assumptions and components from which the capital investment value calculation is derived; and • jobs that would be created during each stage of the development.	**Provided separately to DPE** **Section 3.12**
Agriculture - including: • an assessment of the likely impacts of the development on the soils and land capability of the site, paying particular attention to the recommendations of any required Gateway Certificate or Site Verification Certificate relating to the assessment of Biophysical Strategic Agricultural Land (BSAL) and Critical Industry Cluster land, and having regard to the EPA's, DRE's and NOW's requirements (refer to Attachment 2 of the SEARs); • justification for any significant long term changes to the potential agricultural productivity of land post-mining, paying particular attention to any highly productive agricultural land that would be affected by the development; and • an assessment of the compatibility of the development with other land uses in the vicinity of the development, in accordance with the requirements of Clause 12 of *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007;*	**Section 6.3** and **Appendix 6**

General Requirements	Relevant EIS Section
Air - including: • **a detailed assessment of the likely air quality impacts of the development in accordance with the *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW* and the EPA's additional requirements (refer to Attachment 2 of the SEARs); and** • **an assessment of the likely greenhouse gas impacts of the development, having regard to the EPA's requirements (refer to Attachment 2 of the SEARs);**	**Section 6.4** and **Appendix 7**
Rehabilitation and Final Landform - including: • **an assessment of the likely impacts of the development on existing landforms and topography, including justification of the final landform design and its long term geotechnical stability;** • **a detailed description of the progressive rehabilitation measures that would be implemented for the development and how this rehabilitation would integrate with the final landform of the mine;** • **a detailed description of the proposed rehabilitation and mine closure strategies for the project, having regard to the key principles in *Strategic Framework for Mine Closure*, and the:** o **rehabilitation objectives, methodology, monitoring programs, performance standards and proposed completion criteria;** o **decommissioning and management of surface infrastructure;** o **nominated final land uses, having regard to any relevant strategic land use planning or resource management plans or policies; and** o **potential for integrating the rehabilitation strategy with any other offset strategies in the region; and** • **the measures which would be put in place for the long term protection and management of the site and any biodiversity offset areas following the cessation of mining;**	**Section 6.13**

General Requirements	Relevant EIS Section
Noise and Blasting - including: • **a detailed assessment of the likely operational noise impacts of the development (including construction noise) under the *NSW Industrial Noise Policy*, paying particular attention to the obligations in chapters 8 and 9 of the policy;** • **if a claim is made for specific construction noise criteria for certain activities, then this claim must be justified and accompanied by an assessment of the likely construction noise impacts of these activities under the *Interim Construction Noise Guideline*;** • **an assessment of the likely road noise impacts of the development under the *NSW Road Noise Policy*;** • **an assessment of the likely rail noise impacts of the development under the *Rail Infrastructure Noise Guideline*; and** • **a detailed assessment of the likely blasting impacts of the development (including noise, vibrations, overpressure, visual and odour) on people, livestock, heritage items, infrastructure and significant natural features, having regard to the relevant ANZECC guidelines and relevant agency requirements (refer to Attachment 2 of the SEARs);**	**Sections 6.6** and **6.7** and **Appendices 9** and **10**
Visual - including: • **a detailed assessment of the likely visual impacts of the development (including dust, blasting and night lighting) on surrounding private landowners and key vantage points in the public domain, paying particular attention to impacts on, private residences, tourists and road users ;**	**Section 6.12**
Waste - including: • **estimates of the quantity and nature of the waste streams that would be generated by the project (including tailings and coarse rejects) and any measures that would be implemented to minimise, manage or dispose of these waste streams;**	**Section 6.19**

General Requirements	Relevant EIS Section
Water - including: • **an assessment of the water balance over the life of the development (including post mining) and the availability of water supplies to meet operational requirements;** • **an assessment of the likely impacts of the development on the quantity and quality of existing surface and groundwater resources, having regard to the EPA's and NOW's requirements (refer to Attachment 2 of the SEARs);** • **an assessment of the likely impacts of the development on aquifers, watercourses, riparian land, water-related infrastructure, and other water users;** • **an assessment of the likely flooding impacts of the development; and** • **a detailed description of the measures that would be implemented to minimise water discharges and mitigate surface and groundwater impacts;**	**Section 6.8** and **Appendices 11** and **12**
Biodiversity - including: • **an assessment of the likely biodiversity impacts of the development, having regard to the *NSW Biodiversity Offsets Policy for Major Projects*, OEH's requirements (refer to Attachment 2 of the SEARs) and Department of Environment's requirements (refer to Attachment 3 of the SEARs); and** • **a description of the measures that would be implemented to avoid, minimise, manage and/or mitigate impacts on biodiversity;**	**Section 6.9** and **Appendix 13**
Heritage - including: • **an assessment of the likely impacts of the development on Aboriginal heritage (cultural and archaeological), including consideration of the significance of these objects or declared places to Aboriginal people and having regard to the OEH's requirements (refer to Attachment 2 of the SEARs);** • **an assessment of the likely impacts of the development on non-Aboriginal heritage, paying particular attention to its settlement by Europeans and pastoral history and having regard to the OEH's requirements (refer Attachment 2 of the SEARs); and** • **evidence of consultation, noting that consultation carried out for the original Wambo Mine and United Mine may be relied upon, but should be augmented with further consultation for this project;**	**Sections 6.10 and 6.11** and **Appendix 14** to **16**

General Requirements	Relevant EIS Section
Transport - including: • **an assessment of the likely transport impacts of the development on the capacity, condition, safety and efficiency of the local and State road and rail networks, having regard to RMS's and Singleton Shire Council's requirements (refer to Attachment 2 of the SEARs) and paying particular attention to the proposed realignment of the Golden Highway;**	**Section 6.15** and **Appendix 17**
Public Safety - including: • **an assessment of the likely risks to public safety, paying particular attention to potential bushfire risks, blasting impacts and the handling and use of any dangerous goods and having regard to the HNE Population Health requirements (refer to Attachment 2 of the SEARs);**	**Sections 6.15**. **6.16**, **6.17** and **6.20** and **Appendix 18**
Social and Economic - including: • **a detailed assessment of the likely social impacts of the development on the local and regional community;** • **a detailed assessment of the likely economic impacts of the development, paying particular attention to:** o **the significance of the resource; and** o **the costs and benefits of the project; identifying whether the development as a whole would result in a net benefit to NSW, including consideration of fluctuation in commodity markets and exchange rates; and** o **the demand for the provision of local infrastructure and services**	**Sections 6.14** and **6.21** and **Appendices 4** and **19**

General Requirements	Relevant EIS Section
Consultation: **In preparing the EIS for the development, you should consult with relevant local, State or Commonwealth Government authorities, infrastructure and service providers, community groups and affected landowners.** **In particular you must consult with the:** • **Commonwealth Department of the Environment;** • **NSW Office of Environment and Heritage (including the Heritage Branch);** • **NSW Environment Protection Agency;** • **NSW Division of Resources and Energy within the Department of Trade and Investment, Regional Infrastructure and Services;** • **NSW Department of Primary Industries (including the NSW Office of Water; NSW Forestry, Agriculture and Fisheries sections; and the Crown Lands Division);** • **NSW Roads and Maritime Services;** • **NSW Health;** • **Australian Rail Track Corporation and the Hunter Valley Coal Chain Co-ordinator;** • **NSW Dams Safety Committee;** • **Mine Subsidence Board;** • **TransGrid; and** • **Singleton Shire Council.** **The EIS must describe the consultation that was carried out, identify the issues raised during this consultation, and explain how these issues have been addressed in the EIS.**	**Section 5.0**

4.2.2 Environmental Planning Instruments

There are a number of environmental planning instruments that are potentially applicable to the Project; these are discussed below.

4.2.2.1 Local Environmental Plans

Singleton Local Environmental Plan 2013

The Project Area is located within the Singleton LGA and is subject to the Singleton LEP. The operation of the Singleton LEP in relation to mining is largely constrained by the application of State Environmental Planning Policies which prevail over LEPs usually to the extent of any inconsistency between a SEPP and LEP.

The Project Area is located within the RU1 Primary Production zone and SP2 Infrastructure zone. The objectives of the RU1 Primary Production zone are as follows:

> *(a) to encourage sustainable primary industry production by maintaining and enhancing the natural resource base*
>
> *(b) to encourage diversity in primary industry enterprises and systems appropriate for the area*
>
> *(c) to minimise the fragmentation and alienation of resource lands, and*
>
> *(d) to minimise conflict between land uses within this zone and land uses within adjoining zones.*

The objectives of the SP2 Infrastructure zone are as follows:

> *(a) provide for infrastructure and related uses, and*
>
> *(b) to prevent development that is not compatible with or that may detract from the provision of infrastructure.*

The Project is considered to be consistent with the objectives of the RU1 Primary Production zone. The proposed relocation of the Golden Highway will ensure consistency with the objectives of the SP2 Infrastructure zone. The permissibility of the Project within these zones is discussed in **Section 4.2.1.1**.

4.2.2.2 State Environmental Planning Policies

The following SEPPs are relevant to the consideration of the development application for the Project.

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

The Mining SEPP regulates the permissibility and assessment requirements for mining, petroleum production and extractive industries and related development. As set out in **Section 4.2.2.1** the Project is on land zoned RU1 Primary Production and SP2 Infrastructure (associated with the Golden Highway) under the provisions of the Singleton LEP, with open cut mining permissible in RU1 but prohibited within SP2. The provisions of the Mining SEPP prevail and provide for the permissibility of open cut mining in the SP2 zoning.

Part 3 of the Mining SEPP requires specific matters to be considered in relation to development applications for mining development or applications that will affect existing or proposed mining operations. Clause 12AB of the Mining SEPP identifies non-discretionary development standards for mining and provides that the consent authority cannot impose more onerous standards in any approval in relation to the matters covered by the development standard. The prescribed criteria are summarised in **Table 4.4**, with the relevant assessment outcomes noted for each criteria.

State Environmental Planning Policy 44 – Koala Habitat Protection (SEPP 44)

SEPP 44 restricts the granting of development consent for proposals on land identified as core koala habitat without preparation of a plan of management. Singleton LGA is listed in Schedule 1 of SEPP 44 and therefore SEPP 44 is relevant to the Project.

An extensive biodiversity assessment (refer to **Section 6.9**) has been conducted for the Project and included a koala habitat assessment. The Project Area does not contain any core koala habitat. Consequently, the requirement for preparation of a koala plan of management does not apply.

State Environmental Planning Policy 33 – Hazardous and Offensive Development (SEPP 33)

SEPP 33 requires the consent authority to consider whether an industrial proposal is a potentially hazardous industry or a potentially offensive industry. A hazard assessment is completed for potentially hazardous development to assist the consent authority to determine acceptability.

The assessment of hazard related to the Project is discussed further in **Section 6.16**. This assessment concluded that with the incorporation of buffer distances into the design of the hazardous materials storages to be relocated as part of the Project, the level of risk to surrounding land users is tolerable. The Project would be carried out in accordance with the environmental management system so that the risk of any hazardous event occurring is minimised.

State Environmental Planning Policy 55 – Remediation of Land (SEPP 55)

SEPP 55 aims to provide a state-wide planning approach to the remediation of contaminated land and to reduce the risk of harm to human health and the environment by consideration of contaminated land as part of the planning process. Under SEPP 55, a consent authority must not consent to the carrying out of development on land unless it has considered any potential contamination issues.

There are no contaminated sites currently recorded within the Project Area, however activities carried out at United and Wambo mines have the potential to cause contamination if not properly managed. The management of contamination risks is discussed further in **Section 6.2.4**. Because the Project is primarily within existing mining tenements, no change of use is proposed and no preliminary land contamination investigation is required.

Table 4.4 Non-discretionary development standards for mining under the Mining SEPP

Matter	Non-discretionary Standard	Assessment Outcomes
Cumulative noise level	The development does not result in cumulative amenity noise level greater than the acceptable noise levels, as determined in accordance with Table 2.1 of the Industrial Noise Policy, for residences that are private dwellings	The cumulative noise impact assessment indicated the potential for cumulative noise impacts at three locations with private residences surrounding the Project Area. These potential cumulative impacts occur as a result of the Project contributing to a noise environment already significantly affected by industrial and road traffic noise. The assessment indicates that while there is potential for the recommended acceptable noise level to be exceeded at these private residences, the Project is generally a minor contributor and the cumulative industrial noise level will not exceed the cumulative noise acquisition criteria specified in DPE's Voluntary Land Acquisition and Mitigation Policy (2014).
Cumulative air quality level	The development does not result in a cumulative annual average level greater than 30 µg/m^3 of PM_{10} for private dwellings	Detailed air quality modelling found that cumulative annual average PM_{10} concentrations are predicted to comply with the non-discretionary cumulative air quality level of 30 µg/m^3 criterion at all surrounding private residences, with the exception of one private residence (receiver 19) in Warkworth village. Receiver 19 has existing acquisition rights under the Wambo mine and train loading facility development consents.
Airblast overpressure	Airblast overpressure caused by the development does not exceed: (a) 120 dB (Lin Peak) at any time, and (b) 115 dB (Lin Peak) for more than 5 per cent of the total number of blasts over any period of 12 months, measured at any private dwelling or sensitive receiver	Detailed blast assessment confirms that airblast overpressure levels can be managed effectively within the non-discretionary airblast overpressure criteria at all private residences and potentially sensitive receivers. Any impacts in excess of these criteria would be the subject of a negotiated agreement with the owner of the residence or sensitive receivers.

Matter	Non-discretionary Standard	Assessment Outcomes
Ground vibration	Ground vibration caused by the development does not exceed: (a) 10 mm/sec (peak particle velocity) at any time, and (b) 5 mm/sec (peak particle velocity) for more than 5 per cent of the total number of blasts over any period of 12 months, measured at any private dwelling or sensitive receiver	Detailed blast assessment confirms that ground vibration levels can be managed effectively within the non-discretionary ground vibration criteria at all private residences and potentially sensitive receivers. Any impacts in excess of these criteria would be the subject of a negotiated agreement with the owner of the residence or sensitive receiver.
Aquifer interference	Any interference with an aquifer caused by the development does not exceed the respective water table, water pressure and water quality requirements specified for item 1 in columns 2, 3 and 4 of Table 1 of the Aquifer Interference Policy for each relevant water source listed in column 1 of that Table	This non-discretionary standard relates to meeting the Level 1 minimal impact considerations specified in the NSW Aquifer Interference Policy. Detailed groundwater modelling confirms that there will be no exceedance of the Level 1 minimal impact considerations except for the impact on one private bore (refer to **Section 6.8.2**). The modelling predicts potential for drawdown of more than 2 metres at one private bore which will exceed the Level 1 minimal impact considerations. The impacted bore is located on a property within the predicted noise affectation zone for the Project, which is likely to have acquisition rights should the Project be approved. Further, the bore is not currently serviceable. As discussed in **Section 6.8.2**, whilst this property remains in private ownership the bore will be monitored and if there is any material impact on serviceable water supply from this bore, United will consult with the property owner to provide appropriate alternate water supply arrangements.

Clause 12 of the Mining SEPP, extracted below, requires the consent authority to consider the compatibility of proposed mining developments with existing land uses in the area.

12 Compatibility of proposed mine, petroleum production or extractive industry with other land uses

Before determining an application for consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must:

(a) consider:

(i) the existing uses and approved uses of land in the vicinity of the development;

(ii) whether or not the development is likely to have a significant impact on the uses that, in the opinion of the consent authority having regard to land use trends, are likely to be the preferred uses of land in the vicinity of the development; and

(iii) any ways in which the development may be incompatible with any of those existing, approved or likely preferred uses.

(b) evaluate and compare the respective public benefits of the development and the land uses referred to in paragraph (a) (i) and (ii); and

(c) evaluate any measures proposed by the applicant to avoid or minimise any incompatibility, as referred to in paragraph (a) (iii).

The Project is located in an area which has been subject to coal mining activity since the 1960s, with this mining activity coexisting with neighbouring land uses for over 55 years. The Project is therefore considered to be compatible with existing land use of the site and broadly compatible with the surrounding land uses. Key elements of the Project have been designed to minimise impacts on surrounding land uses. The compatibility of the Project with surrounding land uses is considered in more detail in **Section 6.0** (in particular **Section 6.2**) and **Section 9.0**.

Clause 13 of the Mining SEPP requires the consent authority to consider the potential impact of proposed mining developments on other mining, petroleum production or extractive industry projects or potential resources. The Project interacts with the existing and proposed Wambo underground operations and is located adjacent to the HVO South coal mining operations. The geology in the Project Area is well understood and the mine design aims to optimise resource recovery and to minimise the potential sterilisation of known coal resources in the area, without adversely impacting on the adjoining mining operations. Under the Joint Venture agreement, the interactions between the Project and the Wambo underground operations are addressed and appropriate management strategies are in place.

The HVO South mining operation is located on the opposite side of the Golden Highway from the Project. The Project will not adversely impact on the HVO South coal mining operations. United will continue to consult with HVO South regarding matters such as information sharing and management of any interaction issues and management of cumulative impacts.

The Project will not adversely impact on any other extractive industry operations or known extractive material resources.

Clause 14 of the Mining SEPP requires the consent authority to consider the impact of a proposed mining project on the natural resources and whether specific environmental management conditions (relating to water resources, biodiversity and greenhouse gas emissions) should be imposed on the development if approved. The Project's potential impact on natural resources is dealt with in detail in **Section 6.0** (specifically, **Section 6.8** (water), **Section 6.9** (biodiversity) and **Section 6.5** (greenhouse gas)) and Project specific commitments regarding the management of potential environmental impacts are contained in **Section 8.0**.

Clause 14(3) of the Mining SEPP requires that the consent authority must consider any certification by OEH for measures to mitigate or offset the biodiversity impact of the Project. As discussed in **Section 4.1**, the biodiversity impacts of the Project are being assessed in accordance with the UHSA which is a strategic assessment which has been developed by OEH and the Commonwealth DoE. United (and its parent company Glencore) has had extensive ongoing consultation with OEH regarding the approach to biodiversity assessment and offsetting for the Project.

Clause 15 of the Mining SEPP requires the consent authority to have regard to the efficiency of a proposed mining development in terms of its ability to optimise extraction of the target resources. A key outcome of the Project is the optimisation of the recovery of coal resources from within the existing lease areas held by United and Wambo. This is discussed in more detail in **Section 3.0** (and particularly **Sections 3.2** and **3.5.1**).

Clause 16 requires the consent authority to consider whether or not the mining development under consideration should be subject to conditions restricting the use of public roads for product transport or other mining related traffic. All product coal from the Project will be transported to markets by train. Road traffic impacts relating to construction, workforce and ancillary services are considered in **Section 6.15**.

Clause 17 of the Mining SEPP requires a consent authority determining a development application for a mining development to have regard to whether or not to impose specific conditions regarding the rehabilitation of land affected by the proposed mining development. The mining and overburden emplacement areas will be progressively rehabilitated as the Project progresses and the Project Area will be fully rehabilitated as part of the closure process following completion of mining. Progressive rehabilitation is discussed in further detail in **Sections 3.5.4** and **6.13**.

Gateway Process

Part 4AA of the Mining SEPP, together with Clause 50A of the EP&A Regulation, provides for the implementation of the NSW Government's Strategic Regional Land Use Plan (SRLUP). The gateway process applies for Projects located within Biophysical Strategic Agricultural Land (BSAL) and Critical Industry Clusters (CIC) (as defined by the regional mapping presented in the Upper Hunter SRLUP) outside of existing mining lease areas.

The majority of the Project Area is located within existing mining lease areas; however there are small portions of land within CCL775 over which United does not hold relevant surface mining leases, primarily associated with the current route of the Golden Highway (refer to **Figure 4.2**). A new mining lease is also required for the proposed deeper mining below ML1572 although the area is already disturbed and/or covered by a surface mining lease. The areas over which a new mining lease will be required have been refined as the Project has been developed, to take into account the iterative refinement of the Project design, including consideration of sensitive environmental values.

An area of approximately 31.7 hectares within the Project Area boundary was mapped as BSAL in the Upper Hunter SRLUP. This area of BSAL is at the margin of a larger area of BSAL, which is predominantly outside the Project Area, and extends towards the Hunter River (refer to **Section 6.3**).

An assessment of areas requiring a new mining lease was undertaken in accordance with the requirements of the *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land* (NSW Government 2013). Based on this detailed assessment, it has been determined that there is no BSAL located within the areas requiring a new mining lease as part of the Project. On 11 May 2016 United lodged a site verification certificate application in respect of the small section of the Project Area for which a mining lease is required. A site verification certificate was issued on 9 June 2016.

The Upper Hunter SRLUP and the Project's potential impact on BSAL and agriculture in general are discussed in more detail in **Section 6.3**.

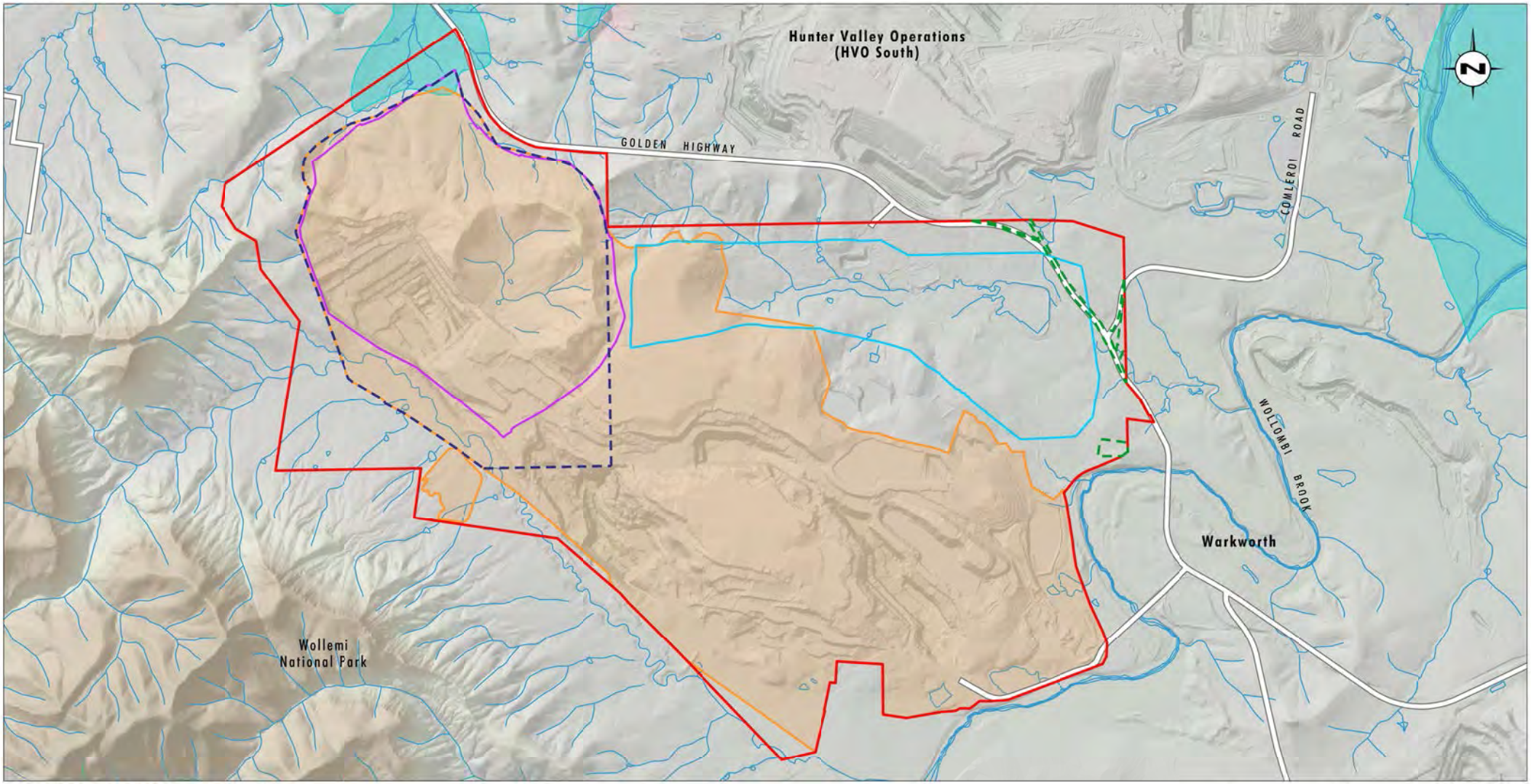


Image Source: United LiDAR (2015)
Data Source: Glencore (2014)

0 1.0 2.0 2.5km
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Legend

- Project Area
- Proposed Conceptual United Open Cut Pit
- Proposed Conceptual Wambo Open Cut Modification
- Approved Wambo Surface Development Area
- Area Requiring New Subsurface Mining Lease
- Area requiring New Surface Mining Lease
- Regionally Mapped Biophysical Strategic Agricultural Land

FIGURE 4.2

Areas Requiring New Mining Leases

File Name (A4): R06/3509_387.dgn
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State Environmental Planning Policy (State and Regional Development) 2011

The SRD SEPP declares that the Project (as development for the purposes of coal mining) is State Significant Development. The application of the SRD SEPP to the Project is largely limited to the issue of approval pathway and is discussed in further detail in **Section 4.2.1**.

State Environmental Planning Policy (Infrastructure) 2007

State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP) aims to facilitate the effective delivery of infrastructure across the State. Amongst a range of other provisions, it specifies that the relocation of power transmission lines and roads constitutes development that is permissible without consent provided that the works are being carried out for or on behalf of a distribution network service provider or pubic authority.

Clause 45 of the Infrastructure SEPP requires that for a development application which involves certain works related to or near electricity infrastructure, the consent authority must give written notice to the electricity supply authority for the area in which the development is carried out, inviting comments about potential safety risks. As discussed in **Section 5.0**, United has consulted with the electricity supply authorities relevant to the Project, being TransGrid and Ausgrid.

4.2.3 Other State Legislation

The Project will be subject to a number of separate regulatory approval processes if approved. Due to the presence of the existing United and Wambo mines, a number of these additional approvals are already held, however they will require modification to cover the Project. There are several additional approvals that are also required specifically for the Project.

Due to the Project being State Significant Development, the assessment and approval process for a number of these approvals is aligned with the Development Application assessment process under Part 4. Section 89K of the EP&A Act requires that a number of approvals, if required for a State Significant Development, cannot be refused and must be substantially consistent with the terms of any development consent granted for the development. Insofar as these approvals apply to the Project, they are discussed in **Section 4.2.3.1** below. Section 89J removes the requirement for a number of approvals for approved State Significant projects; these approvals are discussed further in **Section 4.2.3.2**.

A summary of other relevant environmental and planning legislation that applies to the Project that is not subject to section 89J and 89K of the EP&A Act is discussed in **Section 4.2.3.3**.

It is noted that the exemptions which apply to State Significant Development projects and which apply to the components of the Project for which approval is sought under Division 4.1 of Part 4 of the EP&A Act, do not apply to the Harmonisation Modifications. Although the activities approved under the existing Wambo mine development consent would be State Significant Development under current legislation, due to the date on which the consents were granted, the current exemptions do not apply. The approvals required under State legislation for the Harmonisation Modification are discussed in **Section 4.2.3.4**.

4.2.3.1 Approvals Legislation to be Applied Consistently

If development consent for the Project is granted under Division 4.1 of Part 4 of the EP&A Act, the following approvals (refer to **Table 4.5**), which are required for the Project, cannot be refused by the relevant authority and must be substantially consistent with the terms of the development consent.

Table 4.5 Approvals Legislation to be Applied Consistently with Development Consent

Act	Approval	Authority
Mine Subsidence Compensation Act 1961	An approval under section 15 for development within a mine subsidence district.	NSW Mine Subsidence Board (MSB)
Mining Act 1992	New mining leases are required as part of the Project as shown on **Figure 4.2**. A Mining Operations Plan will also be required to be approved under this Act.	Department of Industry – Division of Resources and Energy (DRE)
Protection of the Environment Operations Act 1997 **(POEO Act)**	Regulates pollution to the environment. Coal mining and coal works are scheduled activities which require licensing. United's existing Environment Protection Licence (EPL) No. 3141 will require a variation to cover changes associated with the Project. Wambo's EPL No. 529 will also require variation to address the changes associated with the Project.	NSW Environment Protection Authority (EPA)
Roads Act 1993 **section 138**	A consent is required under section 138 to work on or above a road or to connect a road to a classified road. Consents under section 138 will be required for: • the road works associated with the realignment of the Golden Highway • any construction activities on or over public roads or in road reserves (e.g. Comleroi Road).	Roads and Maritime Service (RMS) for the Golden Highway. The relevant roads authorities (Council or Department of Lands) for Council or Crown Roads or road reserves.

The various matters regulated by each of the above approvals are assessed in **Section 6.0**.

4.2.3.2 Approvals Legislation Which Does Not Apply

Under section 89J of the EP&A Act, if development consent is granted for the Project under Division 4.1 of Part 4 of the EP&A Act, the following authorisations (refer to **Table 4.6**), which may otherwise have been relevant, will not be required to carry out the Project.

Table 4.6 Authorisations Which Do Not Apply

Act	Approval
Coastal Protection Act 1979	Concurrence under Part 3 of the Act (use of coastal zone).
Fisheries Management Act 1994	A permit under section 201 (dredging or reclamation work), section 205 (harming marine vegetation) or section 219 (blocking of fish passage).

Act	Approval
Heritage Act 1977	An approval under Part 4 (effect on interim heritage orders and listing on State Heritage Register), or an excavation permit under section 139 (disturbance or excavation of relic) and Division 8 Part 6 of the Heritage Act.
National Parks and Wildlife Act 1974	An Aboriginal heritage impact permit under section 90 (Aboriginal Heritage Impact Permit).
Native Vegetation Act 2003	An authorisation referred to in section 12 (to clear native vegetation or State protected land).
Rural Fires Act 1997	A bushfire safety authority under section 100B (bushfire safety authority).
Water Management Act 2000	A water use approval under section 89; a water management work approval under section 90; an activity approval (other than an aquifer interference approval) under section 91 (refer to **Section 4.2.3.3**).

4.2.3.3 Other Relevant State Legislation

A summary of other State environmental and planning legislation potentially relevant to the Project subject to a Development Application under Division 4.1 of Part 4 of the EP&A Act and not previously addressed in the above sections is provided in **Table 4.7**.

Table 4.7 Other State Legislation of Potential Relevance to the Project

Planning Provision	Comments	Further Approval Required?
Crown Lands Act 1989	The Crown Lands Act provides for the administration and management of Crown land in the eastern and central divisions of NSW. Crown land may not be occupied, used, sold, leased, dedicated, reserved or otherwise dealt with unless authorised by this Act or the *Crown Land (Continued Tenures) Act 1989*. The Minister may grant a 'relevant interest' such as a lease, licence or permit, over Crown land for the purpose of any infrastructure, activity or other purpose that the Minister thinks fit. Approvals will be required to undertake works in the land located within the Project Area that is currently declared as Crown road reserves and an area of Crown land, unless they are closed or converted to freehold and sold prior to impact.	Yes

Planning Provision	Comments	Further Approval Required?
Dams Safety Act 1978/ Dams Safety Act 2015	The *Dams Safety Act 1978* has been replaced by the *Dams Safety Act 2015*, however, the 2015 Act has not yet come into force. The provisions of the 1978 Act remain in force until the 2015 Act commences. The Dams Safety Act requires that Dam Safety NSW ensure that any risks that may arise in relation to dams (including any risks to public safety and to environmental and economic assets) are of a level that is acceptable to the community. Dams Safety NSW may, by order published in the Gazette, declare a dam or proposed dam to be a declared dam for the purposes of this Act. Any dams required to be constructed as part of the Project will be subject to assessment in accordance with the Dam Safety NSW requirements to determine if any of these dams will be declared dams. United has undertaken initial consultation with Dams Safety NSW regarding the Project and subject to the detailed design process, approvals under this Act may be required for either tailings dams or water storage dams.	Yes
Explosives Act 2003	A licence is required for the storage of explosives on site. This Act is administered by SafeWork NSW. The relevant licences are in place for the possession and storage of explosives on the Wambo mine. There will be no change in the quantities of explosive materials being stored on site as a result of the Project, however, a licence will be required for United to implement the Project.	Yes
Environmentally Hazardous Chemicals Act 1985	Under the *Environmentally Hazardous Chemicals Act 1985* a licence is required for any storage, transport or use of prescribed chemicals. Should such a licence be required under this Act during the life of the Project, United or the relevant contractor will obtain a licence prior to the storage, transport or use of prescribed chemicals.	If required

Planning Provision	Comments	Further Approval Required?
Threatened Species Conservation Act 1995	Under the EP&A Act, impacts on threatened species listed under the *Threatened Species Conservation Act 1995* are required to be assessed as part of the development assessment process. All threatened species listed in the *Threatened Species Conservation Act 1995* potentially located within the Project Area have been assessed as part of the biodiversity assessment (refer to **Section 6.9**). No further approvals are required under the *Threatened Species Conservation Act 1995*.	No
Water Management Act 2000	The Project will require an aquifer interference approval under section 91 of the *Water Management Act 2000*. All water extractions from water sources (surface and groundwater) regulated by a Water Sharing Plan (WSP) will require licensing under the *Water Management Act 2000* where they are in addition to extractions permitted under harvestable rights. United and Wambo currently hold a number of licences under the *Water Management Act 2000*; these and any additional licence requirements are discussed further in **Section 6.8**.	Yes
Water Act 1912	The licensing provisions of the *Water Act 1912* apply to water sources that are not subject to a water sharing plan gazetted under the *Water Management Act 2000*. The *Water Act 1912* is administered by DPI Water. A permit and/or licence must be obtained to extract groundwater (Part 5 of the Act) not covered by a WSP. Approval under Part 5 for the *Water Act 1912* will be required for groundwater pit inflows and extraction from aquifers not covered by a WSP; this is discussed further in **Section 6.8**. It is noted that a draft WSP has been prepared for the North Coast Fractured and Porous Rock Groundwater Source. Once this WSP commences approvals under Part 5 of the *Water Act 1912* will no longer be required for the Project.	Yes

4.2.3.4 Harmonisation Modification Approval Requirements

As discussed in **Section 4.2.3**, due to the different approval process to be followed for the Harmonisation Modification, the current exemptions relevant to State Significant Development projects do not apply. In addition to requiring a modification to the existing development consents under section 75W of the EP&A Act, the Harmonisation Modification will require a variation to Wambo's EPL No. 529 to address the changes associated with the Harmonisation Modification.

4.2.4 Relevant Strategic Policies

4.2.4.1 Upper Hunter Strategic Regional Land Use Plan 2012

The key strategic policy guiding the assessment of mining development in the Upper Hunter Valley region of NSW is the NSW Government's SRLUP. The Upper Hunter SRLUP was approved in September 2012 and applies to the Project Area. The stated objective of the Upper Hunter SRLUP is to balance the strong economic growth in Regional NSW with the protection of valuable agricultural land and the sustainable management of natural resources. In particular, the Upper Hunter SRLUP identifies the importance of minimising the land use conflicts arising from the rapid growth of coal mining activities and the recent emergence of the coal seam gas industry.

Key to the implementation of the Upper Hunter SRLUP is the assessment of impacts from mining and coal seam gas development on land identified as being strategic agricultural land. There are two types of strategic agricultural land identified in the Upper Hunter SRLUP, BSAL and CICs. BSAL is land that is identified as being of high strategic importance due to the inherent characteristics of the land in terms of soil, topography and access to water which make it ideally suited to agricultural production. CICs are areas in which established specialist agricultural industries are located or have the potential to be located and their continued success as an industry is related to the critical mass of the industry present in these areas. Two CICs have been identified as occurring in the area covered by the Upper Hunter SRLUP, the Equine CIC and the Viticulture CIC.

The potential for the Project to impact on land identified as being BSAL or a CIC is assessed in detail in **Sections 6.2** and **6.3**.

The gateway process under the Upper Hunter SRLUP has been prescribed through amendments to the Mining SEPP. The SEARs require consideration of the gateway criteria in the assessment of the Project. As discussed in **Section 4.2.2.2,** the Project requires new mining leases and therefore Part 4AA of the Mining SEPP must be considered. A site verification certificate was issued for the areas requiring new mining leases on 9 June 2016, therefore the Project is not subject to the gateway process.

An area of approximately 31.7 hectares within the Project Area boundary was mapped as BSAL in the Upper Hunter SRLUP. An assessment of this area in accordance with the *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land* (NSW Government 2013) and *Agricultural Impact Statement Technical Notes* (DPI 2013) has concluded that the area of BSAL located within the Project Area, and potentially subject to disturbance, is actually approximately 3.6 hectares rather than the 31.7 hectares as shown on the Upper Hunter SRLUP mapping. This area is located within an existing surface mining lease (ML1572). The proposed disturbance in this area is related to ancillary activities including water management infrastructure, with the area not proposed to be subject to mining.

The Upper Hunter SRLUP also requires all development applications for mining development that is State Significant Development and which would potentially impact on agricultural resources and industries to be accompanied by an Agricultural Impact Statement (AIS). The SEARs for the Project also require the EIS to include an AIS which has been prepared and is presented in **Appendix 6**. A summary of the AIS is provided in **Section 6.3**.

The Upper Hunter SRLUP also identifies key planning challenges and policy responses to other social, economic and environmental issues in the Upper Hunter Valley which are of direct relevance to the Project including:

- infrastructure

- economic development and employment
- housing and settlement
- community health and amenity (including air quality, noise, visual amenity and water quality)
- natural environment (including the identification of targeted conservation areas and habitat corridors)
- cultural heritage.

Each of the above issues have been considered in the assessment of the Project's potential environmental impacts (refer to **Section 6.0**) and proposed mitigation measures (refer to **Sections 6.0** and **8.0**).

4.2.4.2 NSW Aquifer Interference Policy

The *NSW Aquifer Interference Policy* (AIP) (NOW 2012) is a key component of the SRLUP. The AIP clarifies the requirements for obtaining water licences for aquifer interference activities under NSW water legislation, and establishes and objectively defines considerations in assessing and providing advice on whether more than minimal impacts might occur to a key water-dependent asset.

The AIP requires that, where mining will take water from a source covered by a water sharing plan (WSP), a water access licence is required under the *Water Management Act 2000* to account for this loss of water. In addition, the AIP requires proponents of mining projects seeking consent under Part 4 of the EP&A Act to provide estimates of all quantities of water likely to be taken from any water source during and following cessation of the activity, and all predicted impacts associated with the activity. Groundwater modelling for the Project was undertaken by AGE as part of the Groundwater Impact Assessment (refer to **Section 6.8.2** and **Appendix 12**). This modelling predicts the take of groundwater due to the Project.

Both United and Wambo currently hold licences under the *Water Act 1912* to account for water take from the fractured and porous rock aquifer. A Draft Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources has been placed on public exhibition and would apply to the Project Area. Once this WSP comes into force, the existing licence under the *Water Act 1912* will be converted to licences under the *Water Management Act 2000*.

The AIP requires that potential impacts of the Project on groundwater sources, including groundwater uses and groundwater-dependent ecosystems (GDEs), be assessed against the minimal impact considerations. If the predicted impacts are less than the Level 1 minimal impact considerations, then these impacts will be considered as acceptable. Where the predicted impacts are greater than the Level 1 minimal impact considerations then the AIP requires additional studies to fully assess these predicted impacts. The Project was subject to a detailed Groundwater Impact Assessment which addressed the requirements of the AIP (refer to **Section 6.8.2** and **Appendix 12**).

In addition, potential impacts on GDEs, landholder rights and existing registered bores are assessed in **Section 6.8** and **Appendix 12**.

Section 5.0

Stakeholder Consultation and Identification of Environmental and Community Issues

5.0 Stakeholder Consultation and Identification of Environmental and Community Issues

To support United and Wambo's aim of designing and developing a Project that will coexist with the local community, a comprehensive stakeholder engagement program has been implemented for the Project. It is noted that the stakeholder engagement program was undertaken by United on behalf of the Joint Venture.

The aims for the engagement program were to:

- inform and involve stakeholders during the development of the Project design
- identify key issues of interest or concern to inform the Project assessment
- work together with stakeholders to mitigate and address predicted Project issues/impacts.

As indicated in **Figure 5.1**, the broader program involved a number of elements and built upon the implementation of the existing United stakeholder engagement strategy. The engagement program commenced early during the planning phases of the Project and has continued in an iterative manner throughout the Project design and assessment phases.

In summary, the engagement program has involved two community information sessions, one community workshop, four newsletters and 77 individual meetings during an 18 month program of stakeholder engagement.

The outputs of the engagement program have been used to inform different aspects of the Project's assessment process including the comprehensive Social Impact and Opportunities Assessment (SIOA) (refer to **Section 6.14** and **Appendix 4**). Further discussion of the outcomes of the stakeholder engagement program can be found in **Section 6.14.**

As part of the Joint Venture process, there has also been extensive ongoing engagement between the Joint Venture partners, United and Wambo, regarding the Project and interaction issues.

5.1 Key Stakeholders

A comprehensive stakeholder identification process was undertaken prior to commencement of the program. As Burdge (2004) outlines, stakeholders may be affected groups or individuals that:

- live nearby the resource/project
- have an interest in the proposed action or change
- use or value a resource
- are interested in its use
- are forced to relocate.



FIGURE 5.1

Project Stakeholder Engagement Program

Data Source: Sheridan Coakes Consulting Pty Ltd

File Name (A4): R06/3509_385.dgn
20160222 14.59

These categories formed the basis for stakeholder identification and prioritisation for the program.

Table 5.1 below outlines the stakeholder groups consulted as part of the engagement program for the Project and the number of participants consulted by stakeholder category.

Table 5.1 Project Consultation details

Stakeholder Category	Number of Stakeholders
Landholders/Local Residents	116
Local community groups, businesses and service providers	13
Neighbouring mining operation	2
State and Commonwealth Government Agencies	14
Local Government	1
Infrastructure Service Providers	6
Aboriginal stakeholders	83
Wambo/United employees and contractors	319
Wambo/United Suppliers	111
Sub-total	**665**
Project newsletter distribution	Approximately 700

As the table illustrates approximately 665 stakeholders have been consulted as part of the project, with Project newsletters also being distributed to approximately 700 stakeholders.

5.2 Stakeholder and Community Engagement

5.2.1 Existing Community Engagement

United has an established relationship with the surrounding community and key stakeholders and implemented a program for ongoing engagement during previous mining operations and less intensively during the care and maintenance phase. The program included regular consultation with both individuals and groups from local and regional communities, via a range of mechanisms including:

- regular newsletters to update the community on the Project
- one on one meetings with individuals and/or groups as required/requested, including meetings in response to specific complaints

- regular meetings with the established United Community Consultative Committee (CCC). The CCC is comprised of community representatives, Council representatives, and United personnel and meetings are periodically attended by State government agency representatives

- the Wambo CCC, which also comprises community representatives, Council representatives and Wambo personnel, has also been provided with regular updates about the Project.

Through implementation of this program, United has developed a good understanding of key community issues in relation to mining to be considered in planning for the Project, and have established relationships in place with local and regional community stakeholders.

The learnings from Wambo's community engagement and complaints management programs have also provided an understanding of the key issues of relevance to the local community.

Outputs of these previous consultation activities have therefore been used to inform project planning and the development of the specific stakeholder and community engagement for the Project.

5.2.2 The Project, SIOA and Community Engagement Program

United is committed to working with the community to develop a Project which can coexist with the local communities in proximity to its operations; and has built on the existing engagement program and relationships with the community to implement a detailed stakeholder engagement strategy for the Project.

The Project engagement program aimed to:

- provide meaningful information to key stakeholders and the community about the Project

- identify community issues and opportunities in relation to the Project to inform project planning and assessment

- provide community input on the outcomes of assessment studies and proposed management measures to reduce negative and enhance positive Project impacts.

The stakeholder engagement program was implemented across three main phases to coincide with key Project and assessment program milestones, including:

- Round 1 – Introduction of the Project – with the aim of gathering community issues and feedback relating to the Project (February – March 2015)

- Round 2 – Project update – with the aim of communicating outcomes of the community engagement process (April – August 2015)

- Round 3 – communicating outcomes of the environmental and social studies, and discussion of management strategies (April 2016) with the aim of consolidating proposed management strategies through stakeholder feedback and endorsement.

The engagement methods utilised were selected based on a detailed stakeholder analysis, completed prior to strategy implementation, and were chosen to facilitate stakeholder involvement.

Further details of the engagement methods undertaken and stakeholders consulted in each of these phases are outlined in the following sections, with a summary of the issues raised by stakeholders included in **Section 5.7.**

The program has provided United with valuable input from key stakeholders and local community residents regarding the impacts of United and Wambo's current operations, as well as identifying any perceived impacts associated with the Project. This information has been used to inform Project design, planning and assessment phases.

In addition, a comprehensive Social Impact and Opportunity Assessment (SIOA) has been undertaken as part of the Project environmental assessment process. The SIOA has assessed and predicted the likely consequences of the Project in social terms and involved understanding potential impacts from the perspectives of those involved in a personal, community, social or cultural sense. The SIOA is included as **Appendix 4** and is discussed further in **Section 6.14**.

A summary of the key community engagement mechanisms undertaken across all aspects of the Project, including engagement as part of the SIOA is summarised in **Table 5.2**. The stakeholder groups consulted by each mechanism are also noted.

Table 5.2 Stakeholder Engagement: Summary of Mechanisms

Engagement Mechanism	Phase	Targeted Stakeholder Group	Number of Meetings/ Participants	Description
Personal meetings	1,2&3	Landholders and CCC members (Phase 1) from: • Warkworth • Jerrys Plains • Maison Dieu • Bulga/South Wambo.	27 meetings	Personal meetings during May and June 2015 to provide information on the Project and to identify community issues in relation to the Project.
		Landholders (Phase3) from: • Warkworth • Jerrys Plains • Maison Dieu • Bulga/South Wambo.	31 meetings	Personal meetings during May to July 2016 to provide feedback on outcomes of the environmental and social studies associated with the Project. This included discussions with potentially impacted residents.
		Other mining operations	5 meetings	Meetings with HVO and Warkworth to discuss the Project and potential data sharing.
		Local community groups, businesses and service providers	7 meetings	Personal meetings with: • Jerrys Plains Tavern • Jerrys Plains School • Warkworth Church • Hunter Communities Network/Hunter Environment Lobby • Bulga Milbrodale Progress Association • Hunter Valley Gliding Club.

Engagement Mechanism	Phase	Targeted Stakeholder Group	Number of Meetings/ Participants	Description
		Infrastructure providers	9 meetings	Meetings with: • Roads and Maritime Service (RMS) • Ausgrid • TransGrid • Telstra • Australian Rail Track Corporation • Hunter Valley Coal Chain Coordinator.
		Local Government – Singleton Council	6 meetings	Regular meetings with Council representatives and local Councillors to discuss different aspects of the Project.
Community Information Session	1	Local community residents in Jerrys Plains, Warkworth, Maison Dieu and Bulga	Community Information Session 1 – 50 attendees	A community event was held at Jerrys Plains School of Arts hall in June 2015, to present and discuss the Project. Invitations for the event were provided to the community via written correspondence and verbal communication.
	3	Local community residents in Jerrys Plains, Warkworth, Maison Dieu and Bulga	Community Information Session 2 – 51 attendees	A second community event was held at Jerrys Plains School of Arts hall in July 2016, to discuss the Project and to present the outcomes of the environmental assessment process. Invitations for the event were provided to the community via written correspondence and verbal communication.

Engagement Mechanism	Phase	Targeted Stakeholder Group	Number of Meetings/ Participants	Description
Newsletters	1,2&3	Landholders from: • Warkworth • Jerrys Plains • Maison Dieu • Bulga/South Wambo.	Distribution area includes approximately 700 stakeholders	Four newsletters issued to the local community in November 2014, July 2015, December 2015 and August 2016, providing an introduction to the Project, an update on the status of the Project and outcomes of the environmental assessment. The newsletter has also been distributed to other stakeholders, as relevant.
Workforce Survey	2	United/Wambo employees and contractors	319 participants	A survey conducted with employees and contractors to identify the social and economic linkages between the United and Wambo mining operations and the region.
Online Survey	2	United/Wambo Suppliers	111 participants	An online survey conducted with United/Wambo suppliers to identify the social and economic linkages between the operations and the region.
InFocus Workshop	3	Landholders and near neighbours	5 participants	InFocus Workshop to gain community feedback on designs for final landform (post closure) and site rehabilitation.

5.3 Aboriginal Community Engagement

A comprehensive consultation process was undertaken with the Aboriginal community in regard to the Project in accordance with the *National Parks and Wildlife Act 1974* (NPW Act) and the *National Parks and Wildlife Regulation 2009* (NPW Regulation), and with reference to relevant OEH guidelines (including the Department of Environment and Conservation (DEC, now OEH) 2005 guidelines and Department of Environment, Climate Change and Water (DECCW, now OEH) 2010 guidelines) and in consideration of the principles of The Burra Charter (Australia ICOMOS 1999).

Throughout the course of the Project consultation was undertaken with 83 Aboriginal parties who registered an interest in the Project, including three Native Title claimant groups (the Plains Clans of the Wonnarua People, the Wonnarua Traditional Custodians and the Wonnarua Nation Aboriginal Corporation) and the Wanaruah Local Aboriginal Land Council. Further discussion regarding the consultation process with the Registered Aboriginal Parties (RAPs) for the Project is included in **Section 6.10**.

5.4 Infrastructure Service Provider Consultation

Service providers who have infrastructure located within the Project Area, or who may provide services for the Project, have been consulted by United during the Project design and environmental assessment process. Consultation has been undertaken with these service providers so that relevant design or management issues could be identified and addressed proactively through the Project design. Key service providers consulted include RMS, TransGrid, Ausgrid, ARTC (rail network), Hunter Valley Coal Chain Coordinator (HVCCC) and Telstra (telecommunications). Further consultation will be required with these asset owners and managers as part of the detailed engineering design and Project implementation phases of the Project.

5.5 Agency/Authority Consultation

There has been ongoing consultation with both local and State government representatives throughout the Project planning and environmental assessment process including:

- Government briefings outlining Project details, design and strategies to reduce impacts
- meetings with relevant agencies to discuss assessment outcomes, approach to management, mitigation and offset measures and to address issues specific to the respective agency.

Further details regarding agency consultation are provided in the sections below.

5.5.1 Local Government – Singleton Council

In relation to Local Government, United has met with a range of representatives from Singleton Council including key relevant staff of the Council and the Mayor. The briefings commenced in 2015, with a total of 5 meetings held since this time. Briefings have included:

- Project overview, key impact areas and mitigation strategies
- final landform, land use and mine closure
- ecology and biodiversity offsets
- social impacts and opportunities

- roads and traffic
- noise and air quality impacts.

United will continue regular briefings and updates throughout the ongoing phase of the Project assessment and the determination process.

A briefing was also undertaken to all elected Councillors on 20 June 2016.

The intent of the above consultation was to ensure that Singleton Council representatives were fully aware of the Project; had a good understanding of the Project and its impacts; and that Council representatives had the opportunity to understand and provide feedback on the proposed management approaches to be implemented by the company to address Project impacts.

5.5.2 State and Commonwealth Government Agencies

A summary of the key Government agency consultation undertaken to date is included in **Table 5.3** below. Further consultation with state government agencies/authorities has been undertaken through various mechanisms throughout the assessment process to keep agencies informed of Project progress and outcomes.

Table 5.3 Consultation with Agencies and Authorities

Consultation	Stakeholder	Meetings	Comments
State Government Agencies	DPE	16 meetings	Project briefings and discussions regarding approvals approach, assessment approach, assessment requirements and assessment findings/outcomes.
	NSW Office of Environment and Heritage (OEH)	7 meetings	Project briefings and discussions regarding assessment approach and outcomes, as well as outlining the approach to management, mitigation and offset measures. These meetings specifically addressed issues including Aboriginal Cultural Heritage, ecology, UHSA and offsets.
	Environment Protection Authority	4 meetings	Project briefing and discussions regarding assessment approach and outcomes, as well as outlining approach to management and mitigation measures. These meetings specifically addressed relevant issues including noise, air quality, blasting and water.

Consultation	Stakeholder	Meetings	Comments
	Heritage Council of NSW	1 meeting	Project briefing and discussion regarding historic heritage issues related to the site.
	NSW Department of Trade, Investment (Division of Resources and Energy)	5 meetings	Conceptual Project Development Plan meeting and update including discussions on resource, safety, final voids and geotechnical stability. Meeting to discuss mining lease requirements and application for United.
	NSW Department of Primary Industries (Water)	1 meeting	Letter provided outlining assessment approach, as requested by DPI Water. A meeting was held on 4 July 2016 to discuss the Project, assessment approach and assessment outcomes for the water resource assessments.
	NSW Department of Primary Industries (NSW Forestry, Agriculture and Fisheries)	1 meeting	Project briefing and discussion in relation to agricultural issues.
	NSW DPI – Crown Lands Division	1 meeting	Meeting to discuss Crown Lands and roads impacted by the Project.
	NSW Roads and Maritime Services	3 meetings	Meeting to discuss transport related aspects of the Project and assessment approach, as well details regarding the conceptual design of the Golden Highway realignment. Provision of concept design of Golden Highway realignment for comment.
	NSW Department of Health	1 meeting	Meeting to discuss health related aspects of the Project and assessment approach, including risk assessment.

Consultation	Stakeholder	Meetings	Comments
	ARTC and Hunter Valley Coal Chain Coordinator	Ongoing meetings	Glencore has held regular meetings with ARTC with these meetings including discussions regarding the Project. Wambo has also sent ARTC correspondence regarding the Project. Glencore has also consulted the HVCCC.
	Dams Safety NSW	1 meeting	Briefing provided on the Project and aspects requiring approval or consideration by Dam Safety NSW.
	Mine Subsidence Board		Information provided as a briefing on the Project including details on the realignment of the Golden Highway.
Commonwealth Government Agencies	Department of the Environment	2 meetings	Meeting held in October 2015 to discuss the Project and its relationship to matters of national environmental significance. Phone conference relating to DoE contribution to the SEARs and assessment path for the Project.
		1 meeting	Meeting held on 29 February 2016 to discuss the Project and key assessment issues.
		1 meeting	Meeting held on 23 June 2016 to discuss the outcomes of the relevant assessments.

5.6 Other Stakeholder Consultation

As outlined in **Section 1.6.2**, the land immediately surrounding and including the Project Area is dominated by mining operations which are major landholders within the area.

United and Wambo own the majority of freehold land within the Project Area, other than road reserves, some small parcels of land owned by Coal and Allied, two small parcels of land at the intersection of the Golden Highway and Comleroi Road, and Crown land. United has undertaken ongoing consultation with Coal and Allied and the Department of Lands during the Project design process and the development of feasibility studies for the Project. This consultation has included discussion of matters such as access for baseline studies, the identification of specific issues to be addressed through Project design and outcomes of the environmental assessment process. As discussed in **Section 1.6.2** the company that owns the two small private parcels of land is no longer in existence and United is in consultation with ASIC regarding this land.

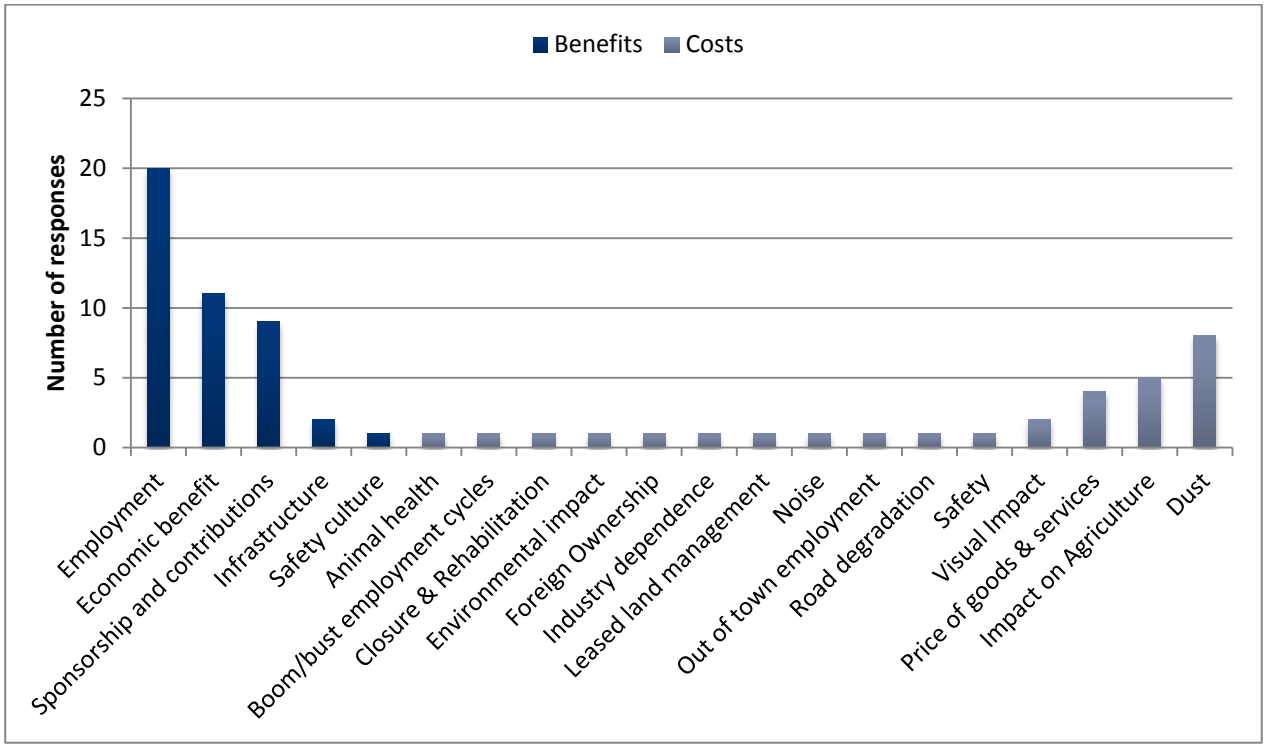
United has had ongoing consultation with nearby mining operations in relation to the Project including HVO South and Mount Thorley Warkworth. This consultation has included discussion of matters such as information sharing and outcomes of the environmental assessment process including cumulative impacts.

5.7 Community Issues

As outlined in the sections above, as part of the SIOA program for the Project, a diverse number of stakeholders have been identified and involved in the assessment program.

As part of the community consultation phase, landholders were also asked to discuss the perceived benefits and costs of mining in the area, and **Graph 5.1** summarises the responses from the Round 1 landholder meetings.

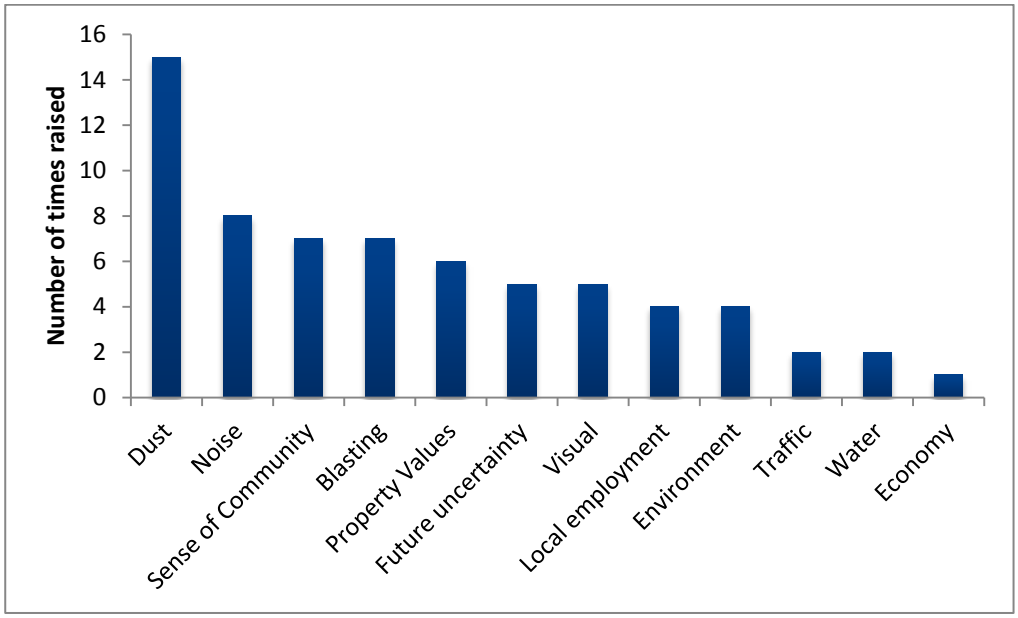
There was greater consensus when discussing the perceived benefits of mining compared with the perceived costs, which was demonstrated by the total number of responses received in each category. The perceived benefits of mining included employment, economic benefit, sponsorship and contributions. These were all noted more consistently when compared to the top three costs of mining, namely dust, impact on agriculture and price of goods and services.



Graph 5.1

Perceived Benefits and Costs of mining

In addition to discussing the benefits and costs of mining in the local area, community residents and key stakeholders identified a number of issues of relevance to the Project. The key issues are summarised in **Graph 5.2** below and include: air quality, noise, blasting and visual impacts. Other issues related to sense of community, traffic, property value, future uncertainty associated with mining, local employment and other environmental issues such as water.



Graph 5.2

Landholder concerns about the Project

The key issues identified in the SIOA and through the broader environmental assessment program, have been identified and assessed to ensure that impacts of relevance to government, technical specialists and community members are adequately discussed and considered in the impact assessment program.

The Project team has considered community and other stakeholder feedback in refining the Project design, with some key elements of the Project being amended to address issues, including:

- project design to minimise impacts to near neighbours, where possible, including controls to reduce noise and dust impacts
- planning for early visual mitigation works including tree screening, progressive rehabilitation and use of temporary rehabilitation
- maximising potential productive agricultural land through rehabilitation planning
- designing the final landform to achieve a more natural landform
- redesign of the relocated transmission lines to avoid the potential for impacts on the Hunter Valley Gliding Club at Warkworth
- redesign of the transmission line alignment to address requests from TransGrid
- redesign of the Golden Highway realignment to address requests from RMS.

A more detailed analysis of the issues raised by key stakeholders and local community residents can be found in **Appendix 4**.

The detailed environment and social assessment outlined in **Section 6.0** of this EIS and associated technical studies included in **Appendices 4** to **19** have sought to address the issues identified during the consultation process.

Section 6.0

Environmental Assessment

6.0 Environmental Assessment

6.1 Identification of Key Environmental and Community Issues

The identification of the key environmental and community issues for the Project (including the Harmonisation Modification) that require detailed assessment as part of this EIS for the Project was based on consideration of:

- the planning and environmental context for the locality (refer to **Sections 1.0**, **4.0** and **7.0**)
- the risk analysis of potential environmental and social impacts associated with the Project (refer to **Section 6.1.1** and **Appendix 5**)
- the outcomes of the stakeholder engagement process and feedback received during operations at United and Wambo mines (refer to **Section 5.0**)
- the SEARs for the Project (refer to **Section 4.2**)
- baseline studies completed as part of preparation of this EIS (refer to **Sections 6.2** to **6.21**).

The extensive stakeholder engagement and social impact assessment processes undertaken for the Project (refer to **Section 5.0** and **Appendix 4**) identified the issues which stakeholders consider to be the key issues for the Project. As discussed in **Section 5.7**, the positive impacts of the Project in terms of employment and economic benefits were the most commonly raised issues. The highest ranking stakeholder issues (based on number of responses) and where they are assessed in the EIS are:

- air quality (dust) (refer to **Section 6.4**)
- noise (refer to **Section 6.6**)
- social issues including sense of community (refer to **Section 6.14**)
- blasting (refer to **Section 6.7**)
- visual amenity (refer to **Section 6.12**)
- local employment (refer to **Section 6.14**)
- cumulative impacts (addressed throughout **Section 6.0**)
- traffic (refer to **Section 6.15**)
- water resources (refer to **Section 6.8**)
- economy (refer to **Section 6.21**).

Further details of the issues raised by stakeholders are outlined in **Section 5.0** and **Appendix 4**.

6.1.1 Preliminary Environmental Risk Analysis

The Preliminary Environmental Assessment (PEA) completed for the Project in June 2015 included an environmental risk analysis to identify the key issues that required detailed assessment as part of this EIS. The preliminary environmental risk analysis was undertaken in accordance with the Glencore Coal Assets Australia Risk Management Standard, which is consistent with the principles outlined in Australian Standard AS/NZS 4360:2004 Risk Management (Standards Australia 2004).

The method used for the environmental risk analysis included:

- establishing the context for the risk analysis process
- identifying environmental and community aspects and potential risks
- analysing risks
- evaluating risks to determine the key issues requiring further assessment.

The environmental risk analysis identified numerous issues that required further assessment as part of the EIS. Following the Glencore risk matrix, risks are rated as high, medium or low. As indicated in **Appendix 5**, the highest risks identified for the Project prior to the technical environmental studies being undertaken were:

- noise – specifically the potential for degradation of noise amenity (refer to **Section 6.6**)
- water resources – specifically the potential for impacts to quality, quantity or flooding regime and potential impacts on aquifers (refer to **Section 6.8**)
- ecology – specifically the potential for loss of native flora and fauna (refer to **Section 6.9**)
- Aboriginal cultural heritage and archaeology – specifically the potential for disturbance of heritage values or Aboriginal places and objects (refer to **Section 6.10**)
- socio-economics – the Project has the potential to result in both positive and negative impacts (refer to **Section 6.14**)
- rehabilitation and mine closure – specifically the potential impact on the landscape and future land use from the final landform design and rehabilitation strategy (refer to **Section 6.13**).

The PEA which included the environmental risk analysis was provided to DPE to assist with issuing the SEARs for the Project. The PEA was also provided to other relevant government agencies with whom DPE consulted regarding the SEARs. A checklist of the issues raised in the SEARs and where these are addressed in the EIS, is provided in **Section 4.2**.

A detailed assessment of each of the environmental and community aspects identified in the environmental risk analysis as requiring further assessment for the Project is provided throughout the remainder of **Section 6.0**.

The preliminary environmental risk analysis has been revised following completion of the relevant technical assessments. The environmental risk analysis provided in **Appendix 5** identifies both the preliminary risk rating as assessed for the PEA and provides a revised risk rating that considers the EIS assessment findings and control measures proposed for the Project.

6.2 Land Resources

As a large scale extractive industry development, the Project will impact on existing land resources by changing the existing topography and relocating soil resources. The Project will also impact to varying degrees on air quality, water resources, biodiversity, visual amenity and other environmental and social aspects, as outlined in this EIS. Some of these impacts have the potential to interact with surrounding land uses. The potential impacts of the Project on land resources and the potential for land use conflicts are discussed in this section. **Section 6.3** deals with the potential impacts of the Project on agricultural productivity in more detail, whilst subsequent sections of the EIS deal with other environmental aspects that have the potential to result in indirect impacts on surrounding land uses (for example, air quality, noise, blasting, visual and water).

6.2.1 Landforms and Topography

The topography of the Project Area has been heavily modified by past mining activity which has been occurring at the site since 1969. The extent of this past mining activity is demonstrated in **Figures 1.4** and **1.6**, with mining of the approved Wambo Open Cut to result in further changes to the existing topography. The topography of the undisturbed portions of the Project Area is typical of the central lowlands of the Hunter Valley and is characterised by an undulating and hilly landscape with lower topographic areas associated with drainage lines. The surrounding mining operations including HVO South and Mount Thorley Warkworth have also contributed to changes to local topography.

An important local topographical feature is a minor ridgeline in the northwest portion of the Project Area which extends to a height of approximately 200 mAHD (refer to **Figure 1.7**). This ridgeline provides a topographic barrier between the area proposed for the United Open Cut and the private land to the northwest, including Jerrys Plains. Part of this ridge will be mined through by the approved Wambo Open Cut. The remaining surrounding topography is characterised by gently sloping alluvial plains and undulating hills (refer to **Figure 1.7**). The flat alluvial plains and gently undulating terrain around the Project Area has been largely cleared in the past for agricultural or mining purposes.

The Project Area is located within the catchments of Redbank Creek, Wollombi Brook, North Wambo Creek and Waterfall Creek, all of which form part of the Hunter River catchment as described in **Section 6.8.1**. The location of the key drainage lines within and surrounding the Project Area is shown on **Figure 1.7**.

Approximately 0.5 kilometre to the west of the Project Area lie the foothills of the Wollemi National Park which form the dominant landscape feature in the vicinity of the Project Area (refer to **Figures 1.2** and **1.7**), with steeper slopes and escarpment areas fringing the Hunter Valley floor.

As discussed above, the topography of the Project Area has been substantially affected since the commencement of mining. Previous mining operations in the Project Area have altered the landform creating both temporary landforms, which are still evolving as the mining operations progress, and rehabilitated final landforms. The Project will further alter the existing topography and landform within the Project Area through the proposed United Open Cut and proposed modifications to the Wambo Open Cut. The proposed changes to the landform are discussed in **Section 3.5.4**.

As part of the Project, a natural landform design approach will be applied to the final landform. The natural landform design approach offers an alternative to the conventional engineered profile design and involves using the key geomorphological characteristics evident in stable landforms within the natural landscape and adapting them to the materials and constraints of the site. The key principles of the approach to be implemented for the Project include:

- designing an appropriate drainage density into the landform reflective of that found in the local natural environment, including the dendritic nature of natural drainage systems
- steeper slopes located close to the watershed where flows are smallest, with gradients that are typically initially convex in profile becoming concave and flattening out moving downstream
- drainage lines that have both a channel component and a floodplain, providing stability during frequent and more extreme events
- the avoidance of knick points or transitions from sub-critical to super-critical flows other than where located in high erosion resistant material or where gentle transitions are constructed emulating natural transitions that maintain a balance between the scour risk and sediment load.

The proposed approach to developing natural landforms as part of the rehabilitation strategy is being successfully implemented at other existing Glencore operations in the Hunter Valley. These more natural designs provide more sustainable long term hydrological and biodiversity outcomes, allow the development of a variable and diverse post mining landform, and are also visually more natural in appearance increasing community acceptability.

The proposed rehabilitation strategy and conceptual final landform for the Project is discussed further in **Sections 3.5.4** and **6.13**.

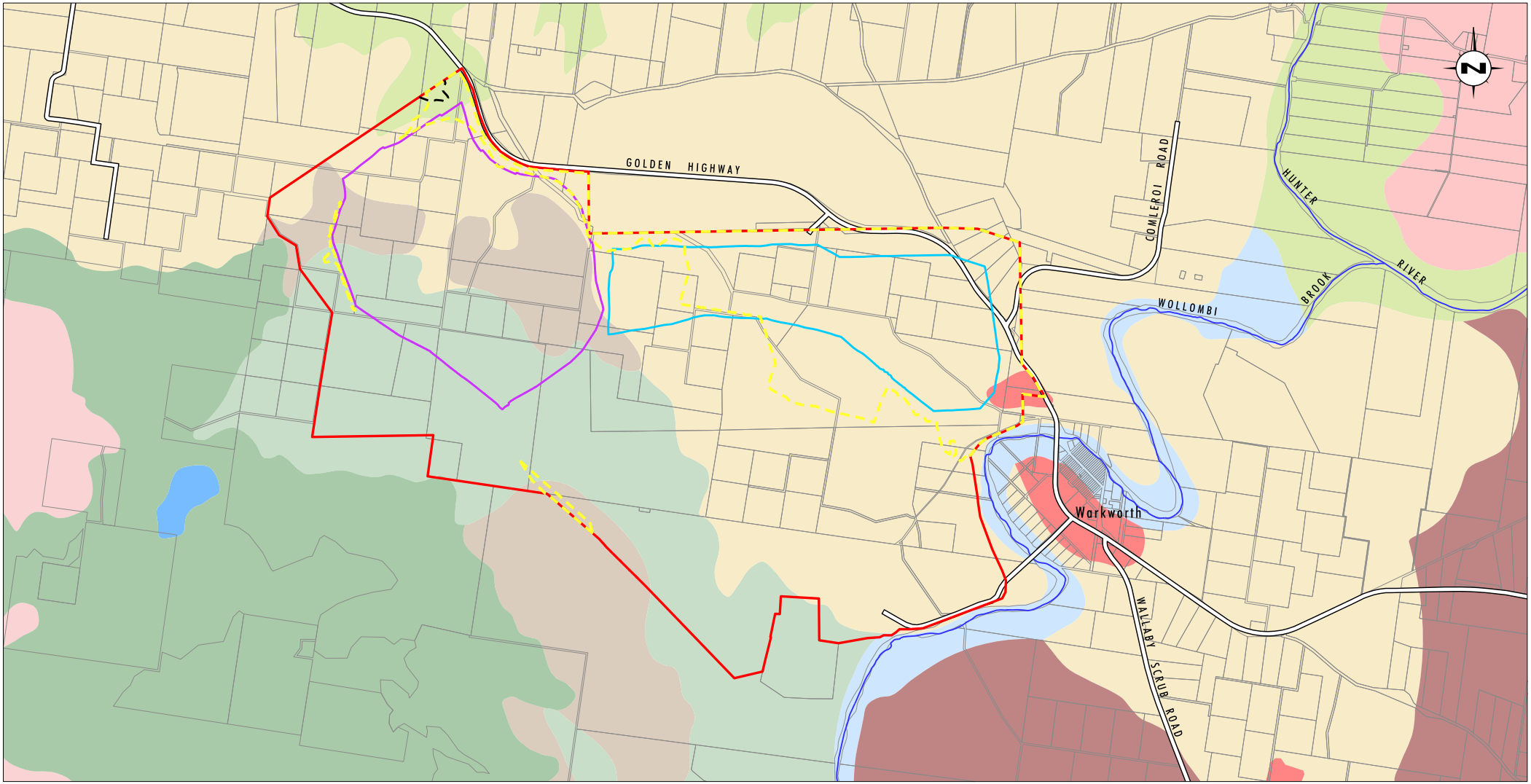
6.2.2 Soil Resources

This section describes the landform and soil context of the Project Area and surrounding rural lands. It presents information from published regional scale land and soil mapping and more detailed Project specific soil mapping and testing.

6.2.2.1 Soil Landscapes within the Project Area

The soil types occurring within the Project Area are mapped on the Singleton 1:250,000 Soil Landscapes Map Sheet and described in Kovac and Lawrie (1991). Soil landscapes identified as being present in the Project Area include Jerrys Plains (jp), Bulga (bu), Benjang (bj), Warkworth (ww) and Hunter (hu) (Kovac and Lawrie 1991). The location of these soil landscapes and their relationship to the key features of the Project are shown on **Figure 6.1**.

The soil landscapes present in the Project Area are discussed in more detail below, with the descriptions adapted from Kovac and Lawrie (1991) and based on the results of the soil survey work undertaken for the Project.



Data Source: LPMA (2009), Department of Natural Resources (2005)

0 1.0 2.0 3.0km
1:60 000

Legend

- Project Area
- Conceptual Additional Disturbance Area
- Proposed Conceptual United Open Cut Pit
- Proposed Conceptual Wambo Open Cut Realignment
- Confirmed Actual BSAL - within Project Area
- Hunter Soil Landscape
- Benjang Soil Landscape
- Bulga Soil Landscape
- Three Ways Soil Landscape
- Warkworth Soil Landscape
- Ogilvie Soil Landscape
- Branxton Soil Landscape
- Wollombi Soil Landscape
- Jerrys Plains Soil Landscape
- Lees Pinch Soil Landscape
- Roxburgh Soil Landscape

FIGURE 6.1

Soil Landscape Mapping Units

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20160512 12.47

Jerrys Plains (jp)

The Jerrys Plains soil landscape is predominantly comprised of Soloths on the crests to midslopes with Solodic Soils on the lower slopes and in drainage depressions. Brown Clays occur in midslope depressions and Solodised Solonetz occurs on slopes where drainage is severely impacted by bedrock. Other soils include Red Earths on upper slopes with some Euchrozem-yellow Solodic Soil intergrades.

The soils of the Jerrys Plains soil landscape are susceptible to severe gully erosion in some drainage lines with occasional salt scalds. Minor sheet erosion can also occur in some disturbed areas on hillslopes. The erodibility of the topsoils ranges from moderate to low while the erodibility of the subsoil ranges from high to low. Soil salinity within the soils also ranges from high to low.

The soil types within the soil landscape have a low fertility; are moderately drained to poorly drained and have a moderate water holding capacity. Typical soil pH varies between 6.0 and 8.5 and mass movement hazard is low.

Bulga (bu)

The Bulga soil landscape is predominantly comprised of Yellow Soloths on the upper to midslopes, with associated Yellow Solodic Soils and Brown Solodic Soils. There are also Brown Earths on the lower slopes.

The soils of the Bulga landscape are susceptible to minor to moderate sheet erosion, while recently disturbed areas show minor rilling. The erodibility of the topsoils ranges from moderate to low, while the erodibility of the subsoils ranges from high to low. Soil salinity within the soils also ranges from high to low.

The soil types within the soil landscape have a low fertility; are well drained to poorly drained and have a moderate to low water holding capacity. Typical soil pH varies between 6.0 and 7.0 and mass movement hazard ranges from low to nil.

Benjang (bj)

The Benjang soil landscape is predominantly comprised of Red, Yellow and Brown Solodic Soils on the steeper benched country with hard rocks where the near horizontal bedding has resulted in poor drainage. Brown Podzolic Soils occur on upper slopes, with Non-calcic Brown Soils on the lower portions of longer flat slopes. Siliceous Sands occurs midslope on quartz sandstone.

The soils of the Benjang soil landscape are susceptible to minor to severe sheet erosion on cleared hillslopes with Solodic Soils, whilst minor rill and gully erosion occurs on mid to lower slopes. The erodibility of the topsoils ranges from high to moderate while the erodibility of the subsoils ranges from moderate to low. Soil salinity within the soils ranges from high to low.

The soil types within the landscape have a low fertility; are rapidly drained to poorly drained and have a low to high water holding capacity. Typical topsoil pH varies between 6.0 and 8.5 and mass movement hazard ranges from moderate to nil.

Warkworth (ww)

The Warkworth soil landscape is predominantly comprised of Siliceous Sands. Topsoil is bright brown to orange loamy-sand. These soils are susceptible to minor sheet erosion where disturbed. The erodibility and soil salinity of both the topsoil and subsoil are low.

The soil type has a low fertility, is rapidly drained and has a low available water-holding capacity. Typical pH is 6.0 and mass movement hazard is nil.

The presence of the Warkworth Sands Woodland CEEC is strongly correlated to this soil landscape, however, this CEEC does not occur within the Project Area.

Hunter (hu)

The Hunter soil landscape is predominantly comprised of Brown Clays and Black Earths on prior stream channels and tributary flats, with Chernozems on prior stream channels adjacent to Dartbrook and Brays Hill soil landscapes and also in many of the valleys. Alluvial Soils including loams and sands occur on levees and flats adjacent to the present river channel. Red Podzolic Soils are located on old terraces with Non-calcic Brown Soils and Yellow Solodic Soils in some drainage lines.

The soils of the Hunter soil landscape are susceptible to minor stream bank erosion on present watercourses with minor sheet and gully erosion occurring on adjacent terraces. The landscape is aggrading and the erodibility of the topsoils and subsoils ranges from moderate to low. Soil salinity within the soils also ranges from moderate to low.

As can be seen from **Figure 6.1**, the Jerrys Plains soil landscape dominates the Project Area, with smaller areas of the Bulga and Benjang soil landscapes in the west of the Project Area. The remaining soil landscapes occupy small areas of the Project Area.

Key conclusions from this regional scale information regarding the soil landscape of the Project Area, including the proposed additional disturbance area and the broader Project Area, include:

- The soils of the Project Area are generally texture contrast profiles of varying depths, and have low fertility. They are subject to a number of hazards that affect their suitability for agricultural uses, including salinity, structural decline, susceptible to sheet erosion and potential for poor drainage and waterlogging.

- Based on regional scale mapping, a small area of the Hunter Soil Landscape is mapped in the northwest corner of the Project Area and the surrounding land to the north. The soils of the Hunter Soil Landscape are deep alluvial loams on the Hunter River floodplain. These soils are also mapped as BSAL in the Upper Hunter SLRUP. The alluvial valley fills of tributaries of the Hunter River are also mapped in the Hunter Soil Landscape at the regional scale. Detailed soil survey and testing prepared for the Project demonstrates that a maximum of approximately 3.6 hectares of the soil within the Project Area meets the requirements for BSAL. As discussed in **Section 6.3**, this area of BSAL is not proposed to be mined but will be subject to some impact due to the establishment of a dam and other water management controls.

6.2.3 Land and Soil Capability

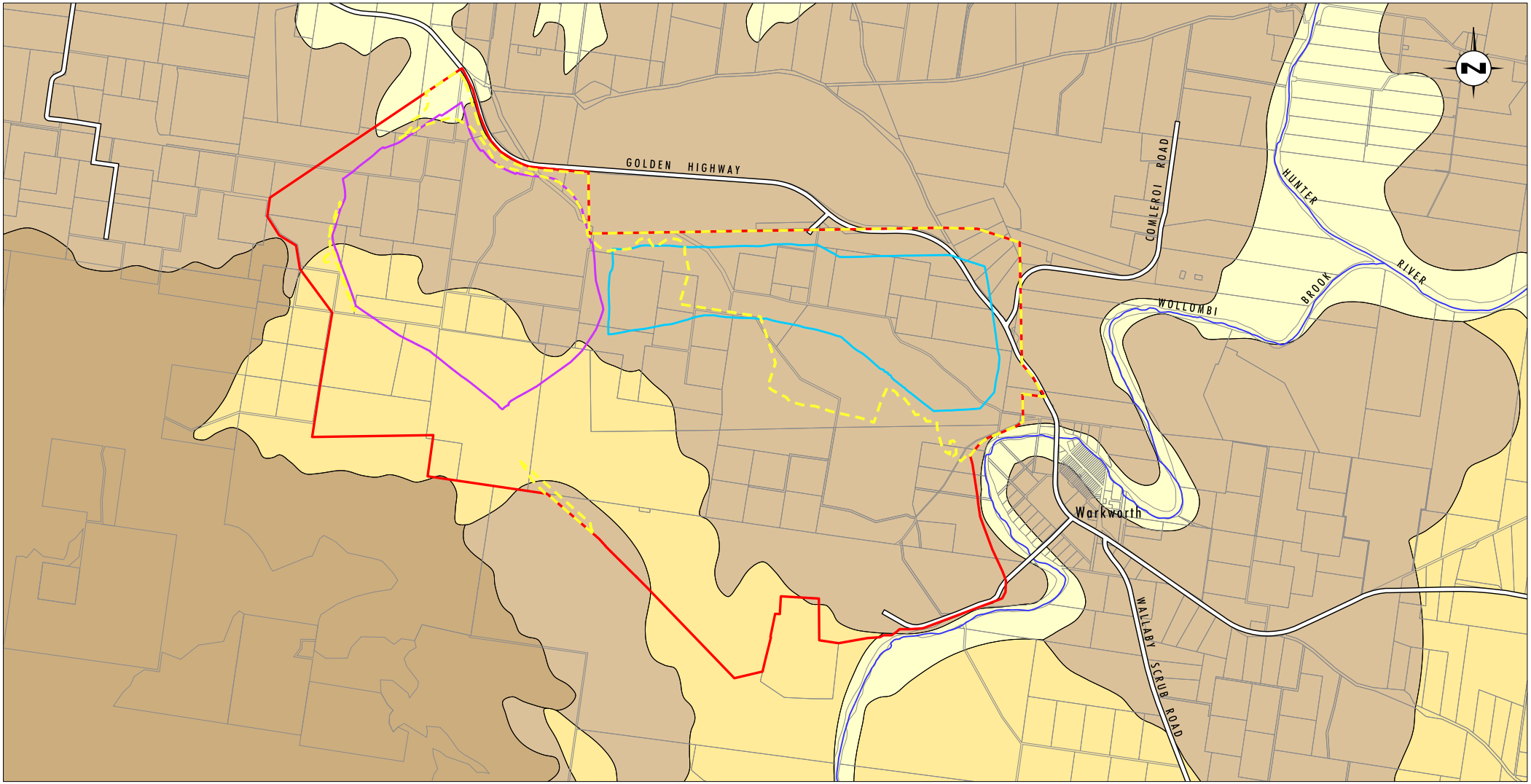
Land and soil capability is the ability of the land to sustain a range of land uses and land management practices in the long term without degradation of soil, land, air and water resources (OEH 2012, drawing on Dent and Young 1981, Emery 1986 and Sonter and Lawrie 2007). Biophysical characteristics and hazards considered in determining land and soil capability include:

Soil and landscape characteristics	Hazards
soil type	water erosion, including sheet, rill and gully erosion
slope	wind erosion
landform position	soil structure decline
acidity	soil acidification
salinity	salinity
drainage	water logging
rockiness	shallow soils and rockiness
climate	mass movement

The land and soil capability scheme (OEH 2012) is designed to provide regional scale information about land capability as applied to broad scale, dry-land agricultural uses.

The classes identify limitations on the type and intensity of use as a result of the severity of limitations related to the physical attributes of the soil and the extent to which intensive management is required to prevent on and off site degradation under varying land uses. The classification does not necessarily reflect existing land uses; rather, it indicates the potential of the land for different agricultural purposes, while maintaining the quality of natural assets.

Table 6.1 presents the rationale and definitions for the eight Land and Soil Capability (LSC) classes currently used in NSW and their presence in the Project Area based on broad scale (1:250,000 scale) mapping undertaken for the Upper Hunter SRLUP. The land within the Project Area, as classified in Land and Soil Capability classes according to OEH (2012), is presented on **Figure 6.2**.



Data Source: LPMA (2009), OEH (2013)

0 1.0 2.0 3.0km
1:60 000

Legend

- Project Area
- Conceptual Additional Disturbance Area
- Proposed Conceptual United Open Cut Pit
- Proposed Conceptual Wambo Open Cut Realignment

Regional Land and Soil Capability:

- 3 - Moderate Limitations
- 4 - Moderate to Severe Limitations
- 5 - Severe Limitations
- 7 - Extremely Severe Limitations

FIGURE 6.2

Regional Land and Soil Capability

Table 6.1 LSC Classes and their Presence in the Project Area

LSC Class	General Information	Present within the Project Area (based on regional scale mapping)
Land capable of a wide variety of land uses (cropping, grazing, horticulture, forestry, nature conservation)		
1	**Extremely high capability land (very slight to negligible limitations):** Land has no limitations. No special land management practices required. Land capable of all rural land uses and land management practices.	Not present in the Project Area
2	**Very high capability land (slight but significant limitations):** Land has slight limitations. These can be managed by readily available, easily implemented management practices. Land is capable of most land uses and land management practices, including intensive cropping with cultivation.	Not present in the Project Area
3	**High capability land (moderate limitations):** Land has moderate limitations and is capable of sustaining high impact land uses, such as cropping with cultivation, using more intensive, readily available and widely accepted management practices. However, careful management of limitations is required for cropping and intensive grazing to avoid land and environmental degradation.	Approximately 19 ha mapped in the northwest corner of the Project Area, within the additional disturbance area Part of this land is currently used for cattle grazing.
Land capable of a variety of land uses (cropping with restricted cultivation, pasture cropping, grazing, some horticulture, forestry, nature conservation)		
4	**Moderate capability land (moderate to severe limitations):** Land has moderate to high limitations for high impact land uses. Will restrict land management options for regular, high impact land uses such as cropping, high intensity grazing and horticulture. These limitations can only be managed by specialized management practices with a high level of knowledge, expertise, inputs, investment and technology.	Approximately 3 ha in the in the additional disturbance area. Note that this land has not been used for agriculture for approximately 20 years.
5	**Moderate- low capability land (severe limitations):** Land has high limitations for high impact uses. Will largely restrict land use to grazing, some horticulture (orchards), forestry and nature conservation. The limitations need to be carefully managed to prevent long term degradation.	Approximately 688 ha in the additional disturbance area. This land has not been used for agriculture for approximately 20 years and was affected by multiple constraints during the period it was used for dryland grazing.

LSC Class	General Information	Present within the Project Area (based on regional scale mapping)
Land capable for a limited set of land uses (grazing, forestry and nature conservation, some horticulture)		
6	**Low capability land (very severe limitations):** Land has very high limitations for high impact land uses. Land use restricted to low impact land uses such as grazing, forestry and nature conservation. Careful management of limitations is required to prevent severe land and environment degradation.	Not present in the Project Area
Land generally incapable of agricultural land use (selective forestry and nature conservation)		
7	**Very low capability land (extremely severe limitations):** Land has severe limitations that restrict most land uses and generally cannot be overcome. On site and off site impacts of land management practices can be extremely severe if limitations are not managed. There should be minimal disturbance of native vegetation.	Approximately 0.3 ha in the Project Area
8	**Extremely low capability land (extreme limitations):** Limitations are so severe that the land is incapable of sustaining any land use apart from nature conservation. There should be no disturbance of native vegetation.	Not present in the Project Area

No land of Classes 1 or 2 has been mapped within the Project Area in the regional mapping prepared by OEH 2012. A small area of the additional disturbance area has been identified in the regional mapping as being Class 3 land, with this area of Class 3 land incorporating approximately 3.6 hectares of BSAL. The remainder of the Project Area is mapped as Class 4 to 7 land, which has high limitations if used for agricultural land uses more intensive than grazing with limited or no cultivation.

Existing strategic land use objectives as well as site opportunities and constraints have been considered in developing the conceptual post mining land use. The conceptual post mining landform and land use includes multiple features that are intended to restore landscape structure and function, as well as provide for rural production where feasible (refer to **Section 6.13**). The landform and soils will be consistent with LSC Classes 5, 6 and 7, other than for two areas where restoration to LSC Class 4 for grazing is proposed. This includes the area identified as LSC Class 3 within the additional disturbance area.

Further information about the agricultural land use potential of the Project Area and potential impacts on agriculture is provided in **Section 6.3**.

6.2.4 Contaminated land

A search of the EPA's NSW Contaminated Lands Public Record Register undertaken for the Project Area did not identify any areas of contaminated land.

During 2009, a Phase 2 contamination assessment was undertaken at United identifying some areas of hydrocarbon contamination in the vicinity of the diesel storage tanks and the refuelling bay area. United notified the EPA of the contamination results under Section 60 of the *Contaminated Land Management Act 1997*. A Remedial Action Plan was developed and United removed the diesel storage tanks and commenced bioremediation of the contaminated soil. Following the completion of the bioremediation process, the soil material was validated and deemed suitable for placement within the box cut void as part of the closure process for the mine (United 2014).

As with all activities that involve earthworks and mining, activities carried out at United and Wambo have the potential to cause contamination if not properly managed. Both mines have a range of controls in place to manage this risk including appropriate chemical handling and storage procedures, appropriate waste management systems, spill and emergency response procedures and equipment, and regular inspection and reporting processes. The management of contamination risks as part of the mine closure process is discussed further in **Section 6.13** and the management of waste is discussed further in **Section 6.19**.

6.2.5 Existing Land Use

As identified in **Section 1.6,** the Project Area exists within a broader area dominated by mining, agricultural and conservation land uses. The Project Area itself is occupied by two existing mining operations and has been subject to heavy disturbance due to extensive open cut and underground mining at the site, as indicated in **Figures 1.4** and **1.6**.

The Project Area is surrounded predominantly by the existing mining activities of Wambo mine (adjoining the Project Area), HVO (adjoining), Mount Thorley Warkworth mine (MTW) (3 kilometres from Project Area) and their associated mine owned lands, with several other mines located further to the north, east and south including Ravensworth Operations (7.5 kilometres), Rixs Creek Mine (8.5 kilometres) and Bulga Mine (9 kilometres) (refer to **Figure 1.2**). Outside of the mining land, the local area is occupied primarily by agricultural land uses, predominantly grazing, with more intensive cropping land located on the alluvial flats associated with the Hunter River and Wollombi Brook.

Other key local land uses include the townships of Warkworth, Jerrys Plains, and Bulga, rural residential landholdings and conservation areas as discussed in further detail below.

The Project Area itself is dominated by existing mining operations including the previous United underground mining infrastructure and the existing Wambo Open Cut, along with areas of rehabilitated land and native vegetation. The majority of the Project Area that is not actively being mined has been historically cleared, with an analysis of historical aerial photography indicating that most of the area had been cleared by the 1960s.

As noted above, the key local land use outside of mining is agriculture, predominantly grazing. Portions of the non-operations mine owned land are also used for agricultural production, including ongoing grazing on Wambo owned land in the northwest and southwest of the Project Area. Grazing operations are widespread throughout the surrounding area, occurring at a number of properties along the Golden Highway, surrounding areas and the outskirts of Jerrys Plains, with dairying occurring on the more productive alluvial floodplains of the Hunter River. Irrigated agriculture is currently being undertaken along the alluvial floodplains of the Hunter River to the north of the Golden Highway. Dairying activity is also undertaken in the southern portion of Maison Dieu, north of the Project Area.

In regard to other agricultural activities, an olive grove and vineyard are located south of Jerrys Plains, some of which are on mine owned land. The closest viticulture CIC is located in the Bulga area approximately 5 kilometres south of the Project Area (refer to **Figure 1.2**).

An equine CIC is mapped approximately 6 kilometres northwest of the Project Area (refer to **Figure 1.2**). The Coolmore horse stud is located to the northwest of Jerrys Plains, approximately 14 kilometres from the Project Area. There are further equine activities undertaken on rural landholdings around Jerrys Plains, including an equine veterinary facility approximately 2 kilometres northwest of the Project Area (refer to **Figure 1.5**). Outside of mining and agriculture, the area surrounding the Project supports the following land uses:

- rural towns (Warkworth, Jerry Plains and Bulga)
- rural residential and small rural holdings , along with residences on larger rural properties occurring to the north, east and south of the Project Area
- recreational activities including the Hunter Valley Gliding Club located immediately northeast of the Project Area and a gun club located east near Warkworth Village (refer to **Figure 1.5**)
- conservation, with Wollemi National Park forming the broader visual context of the area.

The closest privately owned residence is located approximately 1 kilometre to the southeast of the Project Area in the village of Warkworth. This is the only remaining privately owned residence in Warkworth with all other residences in the village mine owned. This one private residence has current acquisition rights (acquisition on request by the owner) under the Wambo mine and Wambo train loading facility development consents.

Other sensitive receiver locations include a cluster of privately owned residences approximately 1.5 kilometres to the northwest of the Project Area along the Golden Highway (referred to as Moses Crossing) and Redmanvale Road, with scattered rural residences further north up to Jerrys Plains which is approximately 6 kilometres northwest of the Project Area, and the rural residential area of Maison Dieu located approximately 4 kilometres to the east of the Project Area (refer to **Figure 1.2**). Each of the surrounding private residences has been allocated a number so that it can be clearly identified in the assessments undertaken as part of this EIS. The allocated numbers are shown in **Figures 1.8**, **1.8a**, **1.8b**, **1.8c** and **1.8d**.

The other key land use in proximity to the Project Area is the Wollemi National Park which is located approximately 0.5 km to the west of the Project Area (refer to **Figure 1.2**). The hills and escarpments within the National Park form the dominant natural features to the west of the Project Area, with steeper heavily vegetated slopes and escarpment areas fringing the Hunter Valley floor. Wollemi National Park and the adjacent Yengo National Park provide a large expanse of conservation land stretching south to the west of Sydney.

6.2.6 Project Impact on Adjoining Land Uses

As required by Clause 12 of the Mining SEPP (refer to **Section 4.2.2**), when considering a development application for a mining project, the consent authority must have regard to the aspects identified in **Table 6.2**.

Table 6.2 Mining SEPP Clause 12 Land Use Impact Considerations

Aspect Requiring Consideration	Assessment
The existing uses and approved uses of land in the vicinity of the development	Refer to **Section 6.2.6.2**.
Whether or not the development is likely to have a significant impact on the uses that, in the opinion of the consent authority having regard to land use trends, are likely to be the preferred uses of land in the vicinity of the development	Refer to **Sections 6.2.6.1** and **6.2.6.2**.
Any ways in which the development may be incompatible with any of those existing, approved or likely preferred uses	Refer to **Sections 6.2.6.1** and **6.2.6.2**. The Project will occur within an existing mining area and so is considered compatible with the existing land use in the Project Area. The assessment concludes that the proposed mining operations are expected to be able to continue to coexist with the surrounding agricultural and non-agricultural land uses in the region.
Evaluate and compare the respective public benefits of the development and other land uses	As noted above, the Project will occur within an existing mining area and the assessment of land use interactions concludes the proposed mining operations are expected to be able to continue to coexist with the surrounding agricultural and non-agricultural land uses in the region.
Evaluate any measures proposed by the applicant to avoid or minimise any incompatibility.	The proposed measures are detailed in **Section 8.0** and include measures to minimise the air quality, water, noise, blasting and visual impacts of the Project (amongst others), provide a sustainable post mining landform and land use, and maximise the economic benefits of the Project.

The development of the Upper Hunter SRLUP provides guidance on the strategic use of land insofar as agriculture and critical industry clusters are concerned. One of the key stated objectives of the Upper Hunter SRLUP is to balance the potentially competing interests of mining and agriculture. Further discussion of the SRLUP is provided in **Section 4.2.4**. The potential impact of the Project on agricultural activities is discussed in more detail in **Section 6.3**.

6.2.6.1 Use of Land within the Project Area

The majority of the Project Area is currently used for mining purposes. A minor portion of Wambo owned land in the northwest corner of the Project Area is currently utilised for low intensity grazing activities. This grazing land use will be replaced by mining and associated infrastructure as a result of the Project, however, ongoing agricultural use is planned for non-operational mining land within the Project Area where practicable. This area adjoins a larger area of mine owned land which is also currently utilised for grazing and which is planned to be retained in agricultural use.

The impact of the Project on these agricultural land uses is discussed in **Section 6.3**.

6.2.6.2 Impact on Land Uses outside the Project Area

As discussed in **Section 2.1** and **2.2**, coal mining has been carried out within the Project Area for over 55 years and the Project is proposed to occur in an area that has been subject to extensive disturbance. During this period, the United and Wambo mines have coexisted with agriculture and other land uses in the area and as the overall nature of the activity undertaken within the Project Area will not change, the continuing use of the Project Area for mining is considered unlikely to change the nature of interactions with surrounding land uses.

The Project will have a minimal impact on adjacent and nearby mining operations, with the Joint Venture agreement providing for ongoing consultation between United and Wambo regarding interaction issues between the open cut and underground mining operations. The HVO South operations are located immediately north of the Golden Highway and the Project is expected to have minimal interaction with this mine. United will continue to consult with the owners of HVO South mine regarding the ongoing interactions between the two operations, including the management of potential cumulative impacts.

As discussed in **Section 6.3**, the Project will have minimal impact on existing agricultural activities located outside the Project Area. The Project is also expected to have no impact on existing equine and viticulture enterprises. These activities are generally shielded by topography and are located approximately 5 kilometres or greater from the Project Area. In particular, the Coolmore horse stud is located approximately 14 kilometres from the Project Area. There will be no views of the Project from Coolmore horse stud.

The Project requires the realignment of the Golden Highway and relocation of the 330 kV transmission lines closer to the Hunter Valley Gliding Club landing strip. United has consulted the Hunter Valley Gliding Club on the design of the Project to minimise any potential impacts to their ongoing operations including maintaining appropriate distances to allow ongoing use of the site as a landing field. United will continue to consult with the Hunter Valley Gliding Club to manage potential impacts from blasting activities and during the construction of the Golden Highway realignment and realignment of the 330 kV transmission line. The Project will not impact on the ongoing use of the Gun Club in Warkworth Village.

Overall, the proposed mining operations are expected to be able to continue to coexist with the surrounding agricultural and non-agricultural land uses in the region. The impacts of the Project on surrounding residences are addressed throughout the relevant sections of this EIS.

6.3 Agriculture

A comprehensive Agricultural Impact Statement (AIS) has been prepared to assess the potential agricultural impacts associated with the Project. The AIS has been prepared in accordance with the SEARs (refer to **Table 4.3**) and the requirements of the *Guidelines for Preparing Agricultural Impact Statements* (DP&I 2012a), *Agricultural Impact Statement Technical Notes* (DPI 2013), the *Upper Hunter SRLUP* (2013) and the *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land* (BSAL) (NSW Government 2013).

In relation to impacts on agriculture, feedback from the stakeholder engagement reflected the long history of mining in this area, focusing on providing opportunities for agriculture as part of the post mining land use, in addition to raising some general land management matters. A summary of the key findings of the AIS is provided in this section and the full report is provided in **Appendix 6**.

6.3.1 Current Agricultural Enterprises

The following section discusses the potential impact of the Project on existing agricultural enterprises and potential agricultural productivity, both within and surrounding the Project Area.

6.3.1.1 Within the Project Area

Pastoral grazing (predominantly dryland sheep and cattle) was the dominant land use in the Project Area from the 1820s to the 1970s. Virtually the entire Project Area has been cleared in the past, with the extent of vegetation clearance clearly demonstrated in historical aerial photograph analysis presented in the AIS in **Appendix 6**. The historical use of the land for grazing is evidenced by the history of native vegetation clearance and associated infrastructure such as dams, fences, and other rural structures which can still be seen in some parts of the Project Area.

Since the 1980s, native woodland regrowth has occurred over much of the land previously cleared and used for grazing, with grazing no longer a significant land use within the Project Area. This is primarily a reflection of the lower land and soil capability of the land within the Project Area (Class 4 land at best, with much of the land being Classes 6, and 7) (refer to **Section 6.2**) and poor quality soils. The exception is a small area (3 hectares) of higher quality (Class 3) land within the northwest corner of the Project Area which is currently being utilised for low intensity cattle grazing. The area of land currently used for agriculture (grazing) that will be directly impacted by the Project is very small, totalling approximately 16 hectares.

6.3.1.2 Surrounding the Project Area

The Hunter Region covers just over 2 million hectares, of which 1,081,841 hectares is farmed land, used for grazing, crops, fallow and horticulture (DP&I 2013 (Fact Sheet 1)). This is 2 per cent of the farmed area of NSW. Approximately 56 per cent of the agricultural lands of the Upper Hunter region are located within the Upper Hunter Shire. Singleton Shire, in which the Project Area is located, accounts for 13 per cent of the agricultural land in the region and 18 per cent of the estimated value of agricultural production in the region.

Changing agricultural focus and rural settlement patterns are key characteristics of the history of the area, responding to changes in short to medium term environmental conditions and to changes in economic, social and policy frameworks, often at a scale well beyond the Project. DPI Agriculture 2013 notes that agriculture industry in the region is adapted to changing conditions and the diversity of activity makes it reasonably resilient to diverse change factors.

Mine owned land, and active mining operations, are the dominant land use in the locality, occupying approximately two thirds of the land within 5 kilometres of the Project Area. National Park occupies a large expanse of land to the west of the Project Area (refer to **Figure 1.2**), with the mining areas proposed as part of the Project being further away from the National Park than the existing open cut and underground mining operations at Wambo.

The dominant agricultural land use in the locality is predominantly grazing, with more intensive cropping and other agricultural activities located on the alluvial flats associated with the Hunter River and Wollombi Brook.

Portions of the mine owned land are used for agricultural production, including ongoing grazing on Wambo owned land in the northwest and southwest of the Project Area. Grazing and fodder operations are still widespread in the locality, occurring at a number of properties along the Golden Highway and the outskirts of Jerrys Plains. Irrigated agriculture is currently being undertaken along the alluvial floodplains of the Hunter River to the north of the Golden Highway. An olive grove and vineyard are located south of Jerrys Plains. There is one dairy farm at Jerrys Plains, although dairying was previously a much more significant industry in the locality, with up to 16 farms in the 1980s. Dairying activities are also present in the southern portion of Maison Dieu, northeast of the Project Area. Some of the areas away from the higher fertility floodplains were historically cleared and used for grazing, however, many of these areas have either returned to woodland or, where still used for grazing, have very low stocking rates due to the generally low land capability of these areas.

6.3.1.3 Within Biodiversity Offset Areas

The agricultural resources (landforms, land and soil capability, access to water, etc.) of the three potential biodiversity offset properties included as part of the Project (refer to **Section 6.9**) will not be impacted by the Project as the potential land use change involves management for conservation and, in some areas, regeneration of native vegetation with no change to soils, landform or water resources.

Land in the proposed biodiversity offset areas is recognised as having high biodiversity value and high potential to further enhance this biodiversity value. In consultation with the agricultural property manager those areas of higher value agricultural land on the properties that are proposed for biodiversity offsets have been excluded from the proposed offset areas. These higher value agricultural land areas will be available for ongoing agricultural land uses.

As noted above, while the proposed biodiversity offset areas include some areas with agricultural value, the use of the land for biodiversity conservation does not change its underlying agricultural resource value. Terrain, soil, water and water access will remain unaffected by the use of the land as a biodiversity offset.

6.3.2 Land and Soil Capability of the Project Area

The land and soil capability of the Project Area is mapped in **Figure 6.2** and was discussed in further detail in **Section 6.2**. The Project Area is dominated by Class 4 to 7 capability land (with Class 1 being the best quality agricultural land and Class 8 being the lowest) due to the combination of soil types and slopes and the disturbance associated with mining. There is a small area (3 hectares) of Class 3 land present within the northwest corner of the Project Area. There is no Class 1 or 2 land located within the Project Area.

6.3.3 Strategic Biophysical Agricultural Land Verification

Within the Project Area, the broad scale strategic mapping undertaken for the Upper Hunter SRLUP (DP&I 2012) indicates the potential for 31.7 hectares of BSAL to occur in the northwest corner of the Project Area (refer to **Figure 4.2**).

A detailed soil survey and assessment conducted for the Site Verification Certificate Application process following relevant soil survey guidelines demonstrated that the extent of BSAL in the Project Area is less than mapped at the regional scale. The actual area of BSAL in the northwest corner of the Project Area is approximately 3.6 hectares. This area of BSAL is entirely outside of the proposed mining area for the Project and is not within the area requiring a new subsurface mining lease.

The soil survey and assessment also identified that all other soils within the Project Area failed to meet the criteria for BSAL based on either terrain constraints, soil fertility or other physical constraints such as effective rooting depth.

6.3.4 Potential Impacts on Agricultural Resources and Enterprises

The AIS took into account the:

- existing land capability and current and historical agricultural uses of the Project Area
- the area and length of time over which agricultural resources will be impacted by the Project, beyond existing approved disturbance and impact
- proposed final landforms, land and soil capability and land uses
- likelihood that specific levels of land and soil capability will be achieved post mining.

The AIS also considers impacts of the Project on agricultural resources and uses/enterprises in the locality. The potential impacts of the Project on agricultural support services and the amenity, lifestyle and connectedness of rural communities were also considered.

6.3.4.1 Within the Additional Disturbance Area

The only agricultural enterprise within the additional disturbance area is a grazing lease over approximately 16 hectares of land in the northwest corner of the Project Area. This land, and adjoining land also used for grazing, is owned by Wambo. The current grazing activities within the Project Area will be discontinued during the operation of the Project. This cessation of grazing activity will occur due to the progression of the approved Wambo Open Cut and will occur regardless of the Project progressing. As noted above, this area is contiguous with other Wambo landholdings which will continue to be used for grazing. The impact of the Project on agricultural activities is therefore negligible given grazing will be excluded from the Project Area as a result of the approved Wambo operations irrespective of whether the Project is undertaken.

It is proposed that at the completion of mining, this area will be returned to agricultural use, with the rehabilitation program planning for LSC Class 4 and Class 5 land (refer to **Section 6.13** for further details). Following the cessation of mining and the rehabilitation of mining related disturbance, the area would be available for grazing and other agricultural activities consistent with its land and soil capability. The location of this land adjacent to other moderate to good agricultural land means, that post mining, it can augment local agricultural enterprises.

Because of the scale and interim nature of the only current agricultural enterprise, the direct impact of the Project on existing agricultural enterprises is very low.

The total area of verified BSAL within the Project Area is approximately 3.6 hectares, and is entirely within the northwest corner of the Project Area. This area will not be mined but will experience some disturbance associated with the construction of a proposed dam and other water management system infrastructure (e.g. drains). Physical disturbance of the soils in areas of verified BSAL will be minimised as much as practicable. The water management system elements proposed for this area will not adversely impact on the agricultural value of the land or the adjoining agricultural land. There is potential for these water management facilities to be retained in the post mining landform and used to support agricultural land uses. These opportunities will be examined as part of the mine closure planning process (refer to **Section 6.13**).

6.3.4.2 Within the Potential Offset Areas

The Project will not change the agricultural resources of the potential offset areas. While these areas are proposed to be managed for biodiversity enhancement and connectivity (refer to **Appendix 13**), the soils and water resources present in the offset areas will not be adversely affected by the use of the land as a biodiversity offset.

The proposed biodiversity offset areas have excluded land identified as having higher agricultural land use value.

6.3.4.3 Surrounding the Project Area

Mining and agricultural land uses have co-existed in this locality for many decades. Existing agricultural uses in the locality, outside land owned by mining companies, are dominated by cattle grazing, but also include fodder crops on irrigated floodplains associated with the Hunter River to the north.

As discussed in **Section 1.6**, there is no identified CIC land within the Project Area or within 5 kilometres of the Project Area. The BSAL land to the northwest of the Project Area is associated with the Hunter River and its tributaries, in terms of terrain, soil type and access to reliable water. Because of the small scale and interim nature of the only current agricultural enterprise directly impacted in this locality by the Project, the direct impact of the Project on existing agricultural enterprises is low.

Seven private rural residential properties (totalling approximately 160 hectares) have been identified as meeting acquisition criteria based on predicted noise and air quality impacts. The agricultural land on these properties will be subject to ongoing agricultural land uses should the properties be purchased by United or Wambo, resulting in no loss of productive agricultural land.

The distribution of existing land uses in the locality and the design and management of mining operations mean that the impact of the Project on surrounding agricultural enterprises will be low. In particular:

- The Project will have a minimal impact on the availability of water resources for agriculture outside the Project Area. The Project is not predicted to result in any impacts on downstream water users.

- The groundwater assessment has identified the potential for impact on a private bore on an agricultural zoned property to the north of the Project Area. This bore is not currently in a serviceable condition and is not being used. When it previously operated, it extracted water from the weathered coal measures which is generally of poor quality and low yielding. The potential for an approximately 6.7 metre drawdown was identified at the bore and United has committed to make good provisions, meaning that should the impact occur and affect the future operation of the bore, and if the landholder

desires to recommission the bore, United would work with the landholder to rectify any impact on the bore supply due to the Project. As the bore is not currently being used for agricultural purposes and with the proposed mitigation measures in place, no impacts on agricultural production are predicted. It is noted that this property is within the noise affectation zone for the Project and is therefore expected to have acquisition rights should the Project be approved

- The Project has no direct or indirect impact on the landforms of the locality surrounding the Project Area.

- The Project has no direct or indirect impact on the soil resources of the locality of the Project Area. No BSAL land is affected in the locality surrounding the Project and the areas of land of various LSC classes in the locality of the Project Area will not change.

The Project will also have a minimal impact on local and regional agricultural services and infrastructure. Changes to the supply and viability of agricultural support services and infrastructure in the locality and the region are driven by agricultural and social trends operating at a scale well beyond this Project.
At the conclusion of mining, it is proposed to rehabilitate the land and soil resources to broadly the same mix of land and soil capability. The proposed rehabilitation plan includes returning the northwest corner of the Project Area to soil capability class 4 agricultural land. As discussed in **Section 6.3.5**, a second area, along the southern boundary of the current approved Wambo mine area, is also proposed to be returned to Land and Soil capability Class 4 agricultural land.

6.3.5 Mitigation of Potential Impacts

The Project will have minimal impact on existing agricultural land uses within the Project Area and surrounding areas. In response to community feedback received during the consultation process, the reinstatement of agricultural land uses within the Project Area post mining will be a key component of the detailed mine closure planning process.

Land management for the Project will also include ongoing sustainable land management measures including control of noxious weeds and feral animals and bushfire management. United will develop land management strategies for the land managed by United, in consultation with relevant stakeholders.

At the conclusion of mining, it is proposed to rehabilitate the land and soil resources to broadly the same mix of land and soil capability. The proposed rehabilitation plan includes returning the northwest corner of the Project Area to soil capability class 4 agricultural land (refer to **Section 6.13** for further discussion and location). As discussed above, the only impact in this area will be due to construction of a dam and associated water management works. Opportunities to retain and/or augment water management infrastructure in this area for agricultural land uses will be considered as part of the mine closure planning process.

A second area, along the southern boundary of the current approved Wambo mine area, is also proposed to be returned to Land and Soil capability Class 4 agricultural land (refer to **Section 6.13** for further discussion and location). This proposal reflects consultation with rural residents of the district who have requested that the better grazing land on the Project Area should be available for agriculture after mining. The remainder of the site will be rehabilitated to class 5 to 7 land, with a focus on native vegetation and habitats. This is consistent with the Synoptic Plan – Integrated landscapes and Coal Mine Rehabilitation in the Hunter Valley of NSW (Department of Mineral Resources 1999) and with regional biodiversity planning. These proposed rehabilitation arrangements, and the character of the existing resource, mean that the final land use for the Project will meet strategic and community objectives for agricultural land use in the locality.

Rehabilitation of land to be suitable for agriculture will involve specific rehabilitation planning, with details provided in **Section 6.13**.

Completion criteria, including those relevant to potential grazing uses of parts of the Project Area, will be finalised as part of the detailed mine closure planning process and presented in the Final Closure Plan for approval by the relevant government agencies. This is also discussed further in **Section 6.13**.

6.4 Air Quality

A comprehensive assessment of the potential air quality impacts of the Project has been prepared by Jacobs. This detailed assessment has been undertaken in accordance with the SEARs for the Project (refer to **Table 4.3**). The SEARs require a detailed assessment of the likely air quality impacts of the Project in accordance with the *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW* and the EPA's additional requirements set out in Attachment 2 (refer to **Appendix 1**).

As outlined in **Section 5.7**, air quality impacts were identified by the community as one of the issues of most concern. The Project design and planning process included identifying air quality mitigation and management measures and incorporating them into the Project design to minimise air quality impacts.

A summary of the key findings of the Air Quality Impact Assessment is provided in this section and the full report is provided in **Appendix 7**.

The Air Quality Impact Assessment was subject to peer review by independent experts. This process was voluntarily undertaken by United to ensure that the assessment was prepared in accordance with appropriate policies and guidelines, used appropriate methodologies, and provided accurate modelled predictions of the likely air quality impacts associated with the Project. The peer review found that the Air Quality Impact Assessment was of high quality and was prepared in accordance with relevant professional standards (refer to **Appendix 7**).

6.4.1 Potential Air Quality Issues

The Project will result in emissions to air from a variety of activities including material handling, material transport, processing, wind erosion, blasting and potentially from the spontaneous combustion of coal. These emissions will mainly comprise particulate matter (dust) from general mining activities, and to a lesser extent, diesel exhaust emissions, fume from blasting and potentially odour and other substances from spontaneous combustion, should this occur.

United understands that air quality is an important issue for the community and has designed the Project to minimise air quality impacts with a range of mitigation and management measures incorporated into the Project design. These measures include:

- minimising the area of disturbed land at any one time as much as practicable
- development of a mine plan that provides for timely progressive rehabilitation
- minimising the length of Project haul roads (where practicable) and adopting controls for haul road dust emissions
- utilising water sprays on ROM coal stockpiles
- maintaining the existing covered conveyors

- using temporary rehabilitation and stabilisation measures on disturbed land
- progressively rehabilitating all overburden emplacement areas and disturbed land associated with the Project
- implementation of the proactive and reactive dust controls discussed in **Section 6.4.6**.

As discussed in **Section 6.4.6**, United will utilise a range of proactive and reactive dust control strategies informed by real-time dust and meteorological monitoring systems. Proactive strategies will include utilising meteorological forecasting to plan activities in advance of potentially adverse conditions. Reactive strategies will include the modification or suspension of activities in response to a series of triggers such as visual conditions, meteorological conditions or elevated ambient air quality conditions.

For this Project, the proposed dust management measures have been compared to the measures outlined in the NSW Coal Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining (Katestone 2011) (hereafter referred to as the NSW Coal Benchmarking Study). This comparison identified that the majority of proposed measures are consistent with best practice dust mitigation measures. These measures are discussed further in **Section 6.4.6**.

6.4.2 Air Quality Criteria

A range of different categories of dust are relevant to the assessment process. Dust concentration refers to airborne dust (or particulate matter (PM)) and is measured in micrograms per cubic metre ($\mu g/m^3$). There are various classifications of dust and relevant criteria are typically prescribed for total suspended particulates (TSP), PM_{10}, $PM_{2.5}$ and deposited levels. TSP relates to all suspended particles which are usually in the size range of zero to 50 micrometres (µm). PM_{10} refers to particulate matter with a diameter less than 10 µm and $PM_{2.5}$ refers to particulate matter with a diameter less than 2.5 µm. Dust deposition levels refer to the quantity of all dust particles that settle out of the air as measured in grams per square metre per month (g/m^2/month).

The air quality assessment criteria adopted for the Project are those recommended by the EPA and specified in the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (DEC 2005a). These criteria are consistent with the national standards set by the National Environmental Protection Council under the National Environment Protection Measures (NEPM) for Ambient Air Quality (NEPC 1998). At this stage the NEPM Advisory Reporting Goals for $PM_{2.5}$ have not been adopted by the EPA for assessment of impacts from specific projects. The relevant long and short term air quality assessment criteria for the Project are specified in **Table 6.3**. Criteria for nitrogen dioxide (NO_2) are also included since there would be sources of this substance associated with the Project such as vehicle exhausts and blast fume.

Table 6.3 Air Quality Assessment Criteria

Substance	Averaging time	Criterion	Agency
Particulate matter (PM_{10})	24-hour	50 µg/m^3	EPA
	Annual	30 µg/m^3	EPA
Particulate matter ($PM_{2.5}$)	24-hour	25 µg/m^3	NEPM Advisory Reporting Goal
	Annual	8 µg/m^3	NEPM Advisory Reporting Goal
Particulate matter (TSP)	Annual	90 µg/m^3	EPA
Deposited dust	Annual (maximum increase)	2 g/m^2/month	EPA
	Annual (maximum total)	4 g/m^2/month	EPA
Nitrogen dioxide (NO_2)	1-hour	246 µg/m^3	EPA
	Annual	62 µg/m^3	EPA

The EPA air quality assessment criteria set out in **Table 6.3** relate to the total concentration of air pollutants in the air (that is, cumulative) and not just the contribution from project-specific sources. Therefore, some consideration of background levels needs to be made when using these criteria to assess impacts. Further discussion of background levels in the area surrounding the Project Area is provided in **Section 6.4.3**.

In December 2015 the Australian Government announced a National Clean Air Agreement (Agreement). This Agreement aims to reduce air pollution and improve air quality via a number of actions, including strengthened ambient air quality reporting standards for particle pollution. Specifically:

> *Taking into account the latest scientific evidence of health impacts, Ministers agreed to strengthen national ambient air quality reporting standards for airborne fine particles. Ministers agreed to adopt reporting standards for annual average and 24-hour $PM_{2.5}$ particles of 8 µg/m^3 and 25 µg/m^3 respectively, aiming to move to 7 µg/m^3 and 20 µg/m^3 respectively by 2025. Ministers also agreed to establish an annual average standard for PM_{10} particles of 25 µg/m^3....The decision was also taken to review PM_{10} standards in 2018.*

While all jurisdictions have agreed to this action, no States (including NSW) have prescribed a change to their air quality criteria to be used for the assessment of specific projects. As such the criteria in **Table 6.3** remain current for the assessment of potential Project impacts. The Agreement indicates an initial work plan of two years to progress the actions.

DPE's Voluntary Land Acquisition and Mitigation Policy (2014) also provides guidance for the consent authority in determining when to apply voluntary mitigation or land acquisition rights due to particulate matter air quality impacts. The policy specifies that a consent authority should only apply voluntary acquisition rights (for any residence on private land and in limited other circumstances) where a development is predicted to contribute to exceedances of the following goals:

- Annual average PM_{10} exceedance of 30 $\mu g/m^3$ (cumulative)
- 24 hour average PM_{10} exceedance of 50 $\mu g/m^3$ (incremental impact, i.e. increase in concentrations due to the Project alone)
- Annual average TSP exceedance of 90 $\mu g/m^3$ (cumulative)
- Annual average deposited dust exceedance of 2 g/m^2/month (incremental impact, i.e. increase in concentrations due to the Project alone) and 4 g/m^2/month (cumulative).

6.4.3 Existing Air Quality Environment

6.4.3.1 Sensitive Receiver Locations

As discussed in **Section 1.6.1**, the Project Area is surrounded predominantly by existing mining operations and their associated surrounding mine owned lands (refer to **Figure 1.7**). The closest privately owned residence is located approximately 1 kilometre to the southeast of the Project Area in the village of Warkworth. This is the only remaining privately owned residence in Warkworth with the remaining residences owned by mining companies (Wambo and Coal and Allied).

Other sensitive receiver locations include a cluster of privately owned residences located approximately 1.5 kilometres to the northwest along the Golden Highway (referred to as Moses Crossing) and Redmanvale Road, with scattered rural residences further north to Jerrys Plains which is approximately 6 kilometres northwest of the Project Area. The rural residential area of Maison Dieu is also located approximately 4 kilometres to the east of the Project Area and the Bulga township located approximately 7 kilometres to the south (refer to **Figure 1.2**).

6.4.3.2 Meteorological Conditions

The Air Quality Impact Assessment analysed data from four meteorological stations to determine the meteorological conditions within and surrounding the Project Area. This included data from stations located at Wambo, Warkworth, Maison Dieu and Jerrys Plains for the five year period from 2011 to 2015. Hourly records of temperature, rainfall, wind speed and wind direction were analysed in order to identify a representative year for air dispersion modelling.

Analysis of annual wind patterns from the Wambo meteorological station for the period 2011 to 2015 indicates that wind patterns are relatively consistent from year to year. The most common winds are from the south-southeast, southeast and west-northwest. This pattern is common for many parts of the Hunter Valley and reflects the northwest-southeast alignment of the valley. Given the lack of variability between the annual data, any of the years analysed were considered potentially representative.

The 2014 calendar year was selected for air dispersion modelling purposes, based on:

- it having similar wind patterns to other years
- rainfall being slightly below the long term average

- typical air quality conditions that were not adversely impacted by bushfire activity in this year.

6.4.3.3 Existing Monitoring

The EPA air quality criteria refer to levels of substances which generally include the Project and existing sources, not just the contribution from local mining activities. To fully assess impacts against all the relevant air quality criteria it is necessary to have information or estimates of the existing air quality conditions in the vicinity of the Project.

Dust deposition and dust concentration (TSP and PM_{10}) are monitored in the vicinity of the Project Area by a network of monitors operated by United, Wambo, HVO and the OEH. The locations of the monitoring sites used as part of the assessment are shown in **Figure 6.3**. Concentrations of $PM_{2.5}$ and NO_2 have not been measured in the region surrounding the Project Area, however the OEH measures these substances as part of its Upper Hunter Air Quality Monitoring Network and so regionally relevant data sets are available.

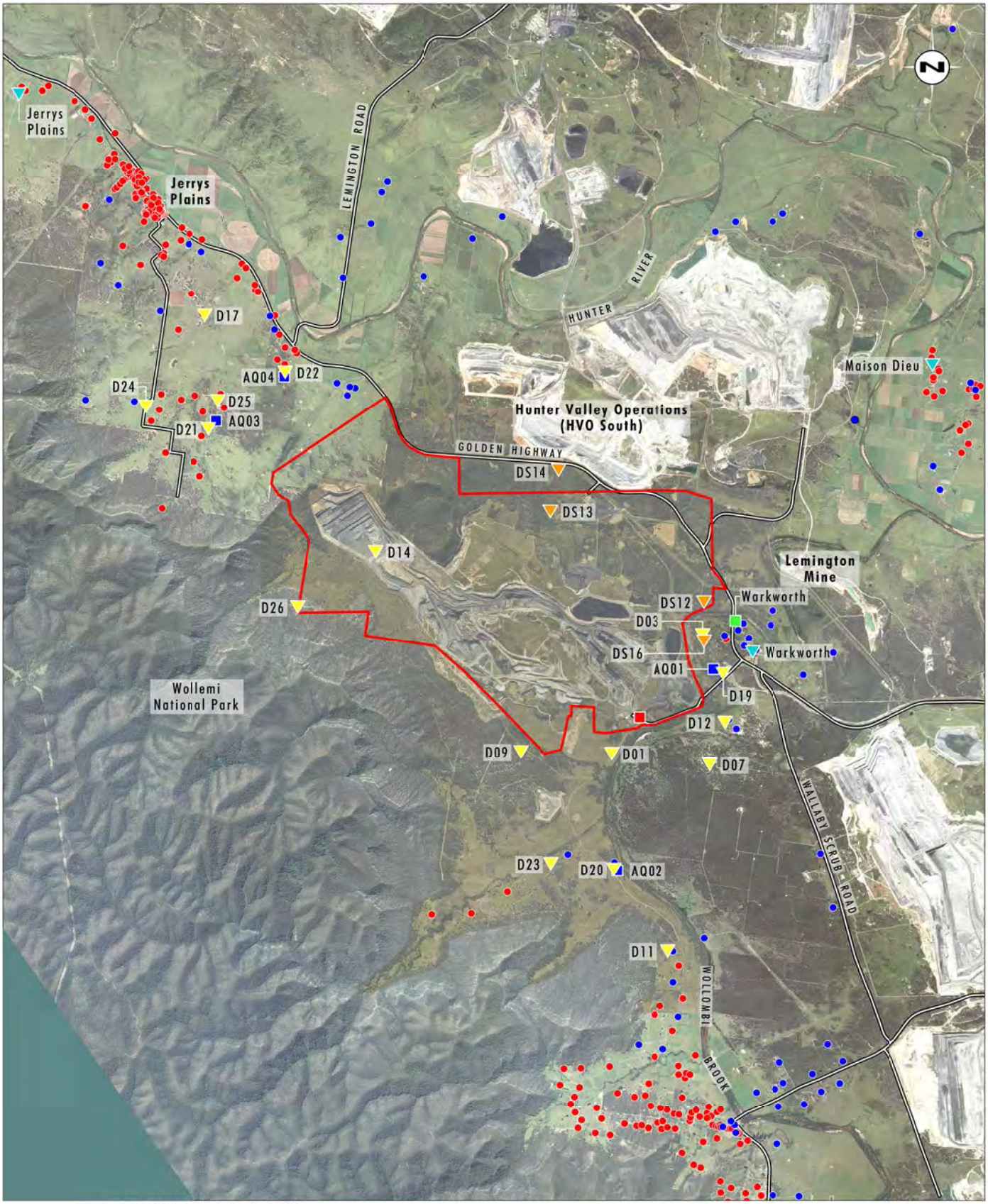


Image Source: AAM (2012), United (2015)
Data Source: Glencore (2015), Jacobs (2016)

0 1.0 2.5 5.0km
1:100 000

Legend

- Project Area
- Meteorological Station
- PM10 by TEOM, TSP by HVAS (Wambo)
- PM10 by HVAS (RTCA)
- Dust Deposition (Wambo)
- Dust Deposition (United)
- Meteorology, PM10 by TEOM (OEH)
- Dwelling/receptor (non-mine owned)
- Dwelling/receptor (mine owned)

FIGURE 6.3

Existing Air Quality Monitoring Network

File Name (A4): R06/3509_482.dgn
20160729 11.16

Particulate Matter – PM_{10}

A summary of the measured PM_{10} concentrations for each of the eight existing monitoring locations surrounding the Project Area from 2011 to 2015 is provided in **Table 6.4**.

Table 6.4 Measured PM10 Concentrations

Year	Jerrys Plains (OEH)	Maison Dieu (OEH)	Warkworth (OEH)	AQ01	AQ02 (Wambo Road)	AQ03	AQ04	Warkworth (RTCA)	Criterion
Maximum 24-hour average in µg/m³									
2011	17[1]	78[1]	26[1]	49[1]	83[1]	43[1]	42[1]	60	50
2012	44	88	50	47	76	47	45	68	
2013	63	84	65	65	97	71	65	63	
2014	64	64	68	55	70	51	56	75	
2015	70	77	68	52	55	43	71	39	
Number of days above 24-hour average criteria									
2011	0[1]	8[1]	0[1]	0[1]	2[1]	0[1]	0[1]	3	-
2012	0	20	0	0	7	0	0	1	
2013	6	28	8	4	20	1	3	2	
2014	6	6	3	2	2	1	1	3	
2015	1	5	3	1	3	0	2	0	
Annual average in µg/m³									
2011	13[1]	22[1]	20[1]	17[1]	17[1]	15[1]	15[1]	20	30
2012	11	26	21	21	21	17	18	19	
2013	19	26	21	19	23	17	17	22	
2014	18	23	21	18	19	15	18	23	
2015	15	20	18	16	16	13	17	16	

[1] Based on an incomplete year of data.
Shaded cells indicate exceedance of criteria.

The trends and spatial variation in PM_{10} concentrations were analysed and the following observations were made:

- all monitoring locations experienced at least one day above the EPA's 50 µg/m^3 maximum criteria between 2011 and 2015, with 2013 data particularly impacted by bushfires
- the Maison Dieu and Wambo Road monitors experienced the highest number of days above 50 µg/m^3. Both Maison Dieu and Wambo Road are in the order of 5 kilometres from the Project and are likely to be influenced by other sources near those monitoring stations
- no exceedances of the annual average PM_{10} criterion of 30 µg/m^3 have been recorded at any of the monitoring sites. The highest annual average concentrations were measured at Maison Dieu
- results for the 2014 calendar year were considered to be typical of the longer term conditions experienced at each site.

For modelling purposes, the hourly PM_{10} concentration data measured at the AQ03 monitor in 2014 have been adopted as the assumed background level that applies at sensitive receptors as this monitor, located in a rural area to the northwest of the Project Area, records dust levels that indicate it is least influenced by local mining activities. This background level was added to predicted dust levels from the Project and surrounding mining operations to predict the future cumulative dust levels for the area.

Particulate Matter – $PM_{2.5}$

The closest air quality monitoring stations which record concentrations of $PM_{2.5}$ with publicly available data are located at Singleton and Camberwell. The Camberwell and Singleton monitoring sites are located closer to more sources of $PM_{2.5}$ than found in the Warkworth area. Such sources include motor vehicles and wood smoke. The $PM_{2.5}$ concentrations in the Warkworth area would therefore be expected to be lower than those measured at Camberwell and Singleton.

The measured $PM_{2.5}$ concentrations for the period 2011 to 2015 are shown in **Table 6.5**. The highest 24-hour average $PM_{2.5}$ concentrations have exceeded the 25 µg/m^3 advisory reporting goal on at least one occasion in one (Singleton) or two (Camberwell) of the past five years. Annual averages are close to the 8 µg/m^3 advisory reporting goal, exceeding the goal in some years. Bushfire activity between September and November of 2013 was identified as a major cause of the elevated particulate matter concentrations in that year.

Table 6.5 Measured PM2.5 Concentrations

Year	Camberwell (OEH)	Singleton (OEH)	Advisory Reporting Goal
Maximum 24-hour average in µg/m^3			
2011	23[1]	22	25
2012	20	20	
2013	30	23	
2014	32	29	
2015	24	25	

Year	Camberwell (OEH)	Singleton (OEH)	Advisory Reporting Goal
Number of days above 24-hour average criteria			
2011	0[1]	0	-
2012	0	0	
2013	1	0	
2014	1	1	
2015	0	0	
Annual average in µg/m^3			
2011	8.5[1]	7.6	8
2012	7.5	8.0	
2013	8.2	7.9	
2014	7.8	7.8	
2015	7.2	7.6	

[1] Based on an incomplete year of data. Monitoring commenced at this location in late 2011.
Shaded cells indicate exceedance of criteria.

For modelling purposes, hourly $PM_{2.5}$ concentration data was estimated (based on ratios from regional data) from hourly PM_{10} concentration data measured at the AQ03 monitor in 2014. This estimated background level has been adopted as the assumed background level that applies at sensitive receptors and has been added to the predicted $PM_{2.5}$ levels from the Project and surrounding mining operations to predict the future cumulative dust levels for the area. The 2014 calendar year results were considered to be typical of the longer term conditions experienced and were assessed as suitable to be adopted as the background level for assessment purposes.

Particulate Matter –- TSP

TSP concentrations have been measured at five locations surrounding the Project Area (refer to **Figure 6.3**). The annual average concentrations from data collected between 2011 and 2015 are shown in **Table 6.6**. None of the monitoring sites have recorded TSP concentrations above the EPA's 90 µg/m^3 criterion.

Table 6.6 Measured TSP concentrations

Year	Warkworth (RTCA)	HV01	HV02 (Wambo Road)	HV03	HV04	Criterion
Annual average in µg/m^3						
2011	50	52[1]	49[1]	32[1]	40[1]	90
2012	51	65	61	39	59	
2013	56	61	62	41	49	
2014	54	67	68	48	62	
2015	52	55	51	41	61	

[1] Based on an incomplete year of data.

An assumed background level of 48 µg/m^3 (annual average) has been adopted for modelling purposes based on the measured result for the HV03 monitoring in 2014. As discussed for PM_{10}, concentration data measured at the AQ03 monitor in 2014 have been adopted as the assumed background level that applies at sensitive receptors as this monitor located in a rural area to the northwest of the Project Area records dust levels that indicate it is least influenced by local mining activities. This background level was added to predicted dust levels from the Project and surrounding mining operations to predict the future cumulative dust levels for the area.

Deposited Dust

Dust deposition monitoring data is collected from 19 locations surrounding the Project Area by United and Wambo. Monitoring data for the period 2011 to 2015 indicates that four locations have experienced deposition levels above the EPA's 4 g/m^2/month criterion in one or more years. All four locations that have experienced exceedances are located on mine owned land within close proximity to existing mining operations. None of these monitors are located in areas representative of sensitive receptors (refer to **Appendix 7**).

An assumed background level of 2 g/m^2/month has been adopted for modelling purposes, based on data collected from the region to the northwest of Project Area in 2014.

Nitrogen Dioxide (NO_2)

The closest known air quality monitoring site that records NO_2 concentrations is located at Singleton. These data show that the maximum NO_2 concentrations have been well below the EPA's 1-hour average criterion of 246 µg/m^3. Annual averages have also been well below the EPA's annual average criterion of 62 µg/m^3.

An assumed 1-hour average background level of 74 µg/m^3 has been adopted for modelling purposes, based on the maximum 1-hour average from Singleton in 2014.

6.4.4 Assessment Methodology

The Air Quality Impact Assessment has followed the EPA's *Approved Methods of the Modelling and Assessment of Air Pollutants in New South Wales* (DEC 2005a), which specifies how assessments based on the use of air dispersion models should be undertaken in NSW.

Background air quality and meteorology data collated for the site and described in **Section 6.4.3**, were used in conjunction with comprehensive emissions inventories to model the potential air quality impacts of the Project.

The CALPUFF modelling system was used to predict off-site dust concentration and dust deposition levels due to the Project. CALPUFF is an air dispersion model which has been approved by the EPA for these types of assessments.

Four conceptual Project years of operation were used for the CALPUFF dispersion modelling. Years 2, 6, 11 and 16 were chosen as these years were considered to be representative of the range of potential air quality impacts for the Project. The selected Project years captured the 'reasonable worst case' scenarios due to production levels, the location of operations and the scale of surface disturbance. In addition, a model performance evaluation was carried out by predicting impacts of existing operations (as they were in 2014) and comparing the predictions to measured results. This process assisted to calibrate the model and ensure that it was appropriately predicting dust levels for the Project Area and surrounds.

The potential cumulative effects of emissions from other mining operations were also considered in the modelling process by assessing the combined effects of other mines operating concurrently with the Project, and at maximum approved production rates. Emissions from the future operations of other approved mines, including HVO, MTW and Wambo Underground Mine were calculated and added to existing background concentrations and Project contribution to predict the potential cumulative impacts.

6.4.5 Air Quality Impact Assessment

6.4.5.1 Particulate Emissions

For each of the four representative operational scenarios modelled, dust impacts were predicted in the form of single point calculations at the nearest private residences to the Project Area. Dust contours were also generated to approximate air quality impacts for the area surrounding the Project.

PM_{10}

Representative dust contours for predicted maximum 24-hour average and annual average PM_{10} concentrations are shown on **Figures 6.4** and **6.5**.

The modelling results indicate that cumulative annual average PM_{10} concentrations will comply with the EPA's 30 $\mu g/m^3$ criterion at all surrounding private residences, with the exception of one private residence (receiver 19) in Warkworth village (which is the only privately owned residence in Warkworth Village). Predicted annual average PM_{10} concentrations at receiver 19 also exceed the DPE property acquisition criteria set out in the Voluntary Land Acquisition and Mitigation Policy (2014), which is numerically identical to the EPA's criterion. It is noted that receiver 19 is also expected to exceed the relevant property acquisition criteria for noise (refer to **Section 6.6**). Receiver 19 is already subject to acquisition rights under the existing Wambo mine, Wambo train loading facility and MTW development consents due to it being within the affectation zones of these operations.

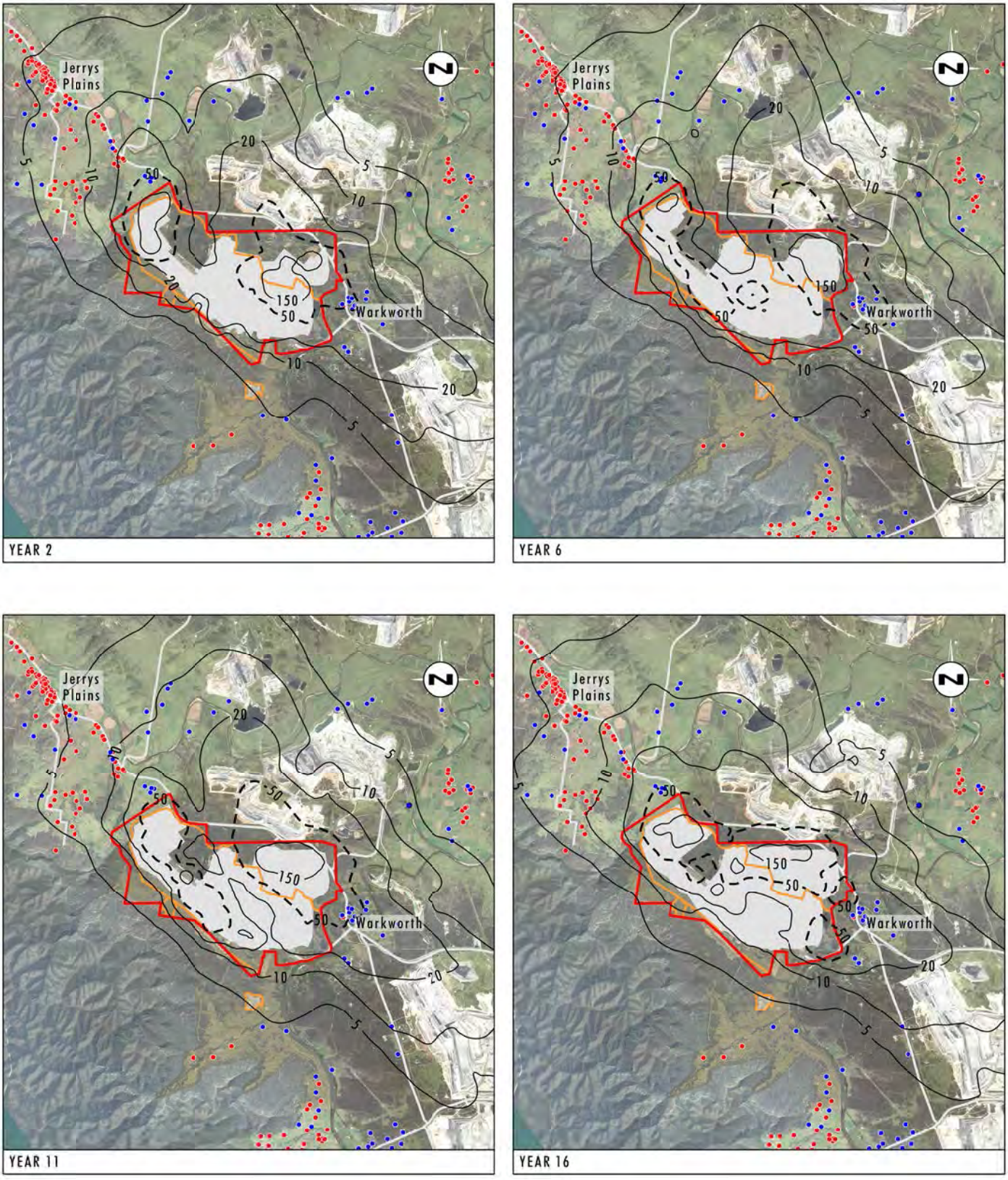


Image Source: AAM (2012), United (2015)
Data Source: Glencore (2014), Jacobs (2016)

0 2.5 5.0 10km
1:200 000

Legend

- Project Area
- Approved Wambo Surface Development Area
- Predicted Project Maximum 24-hour PM_{10} Contour
- Predicted Project Maximum 24-hour PM_{10} Criteria Contour ($50\mu g/m^3$)
- Mining Area
- Private Residence
- Mine Owned Residence

FIGURE 6.4

Predicted Project Maximum 24-hour PM_{10} Concentrations

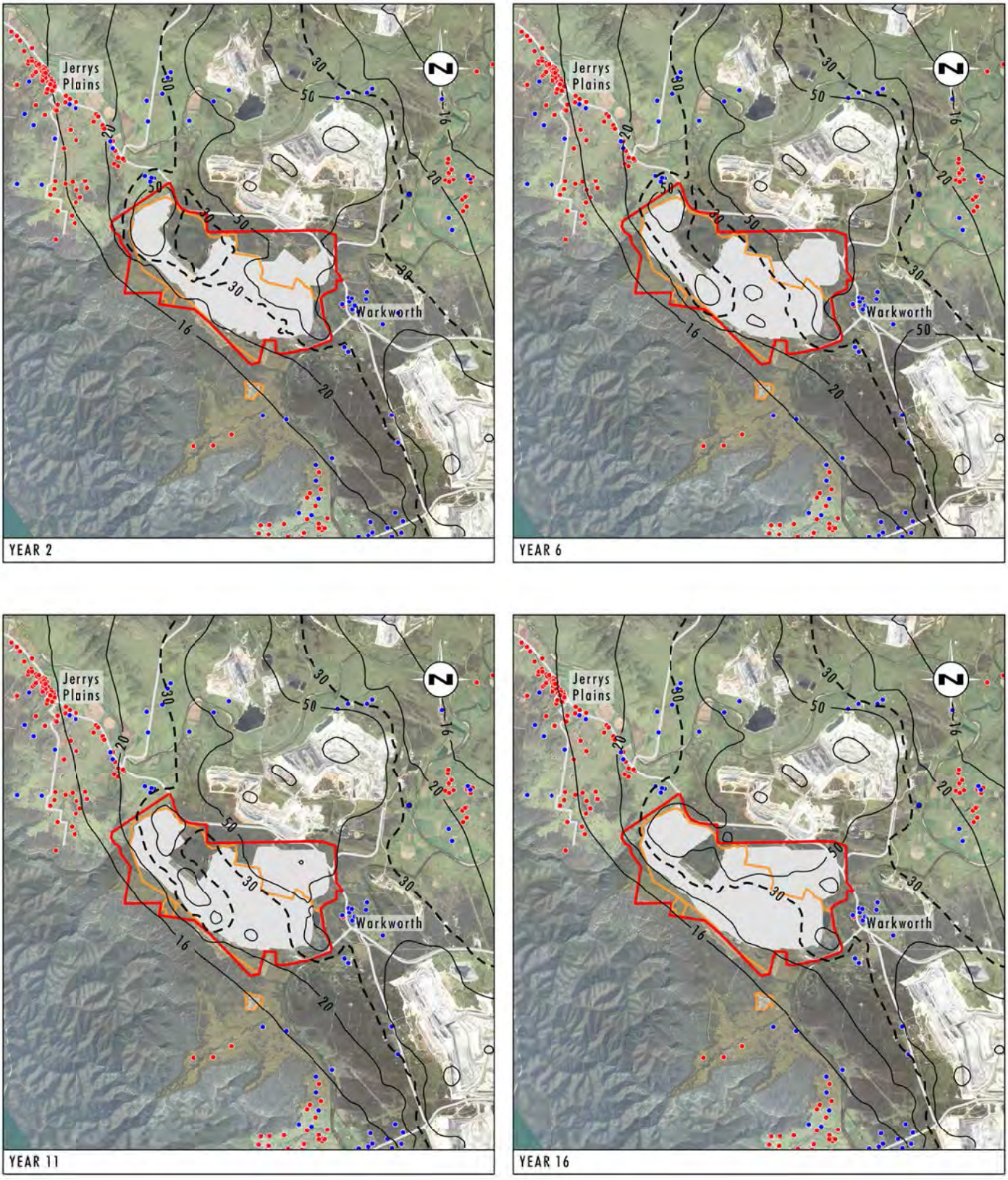


Image Source: AAM (2012), United (2015)
Data Source: Glencore (2014), Jacobs (2015)

0 2.5 5.0 10km
1:200 000

Legend

- Project Area
- Approved Wambo Surface Development Area
- Predicted Cumulative Annual Average PM_{10} Concentrations Contour
- Predicted Cumulative Annual Average PM_{10} Concentrations Criteria Contour ($30\mu g/m^3$)
- Mining Area
- Private Residence
- Mine Owned Residence

FIGURE 6.5

Predicted Cumulative Annual Average PM_{10} Concentrations

File Name (A4): R06/3509_436.dgn
20160512 15.05

Cumulative maximum 24-hour PM_{10} concentrations are expected to continue to exceed the EPA's 50 µg/m^3 criterion on at least one occasion each year for most of the modelled locations. This result is expected as each of the monitoring sites has recorded periodic exceedances of the criteria due to contributions from bushfires, regional dust storms and other such events. The number of days above 50 µg/m^3 is expected to increase at Warkworth village due to the proximity of mining activity associated with the Project and assuming maximum production at the neighbouring operations of HVO South and MTW. Receiver 19 located in Warkworth village, is expected to experience a measurable increase in the number of days above the 50 µg/m^3 criterion. **Figure 6.6** provides a comparison of the existing and modelled number of days above 50 µg/m^3 with the Project and all other sources operating in the surrounding area.

A second privately owned residence, Receiver 28 located to the northwest of the Project Area on the Golden Highway, was identified as having the potential to experience a short term increase in the number of days above 50 µg/m^3 on a cumulative basis. The predicted maximum 24-hour PM_{10} concentration at this residence due to the Project alone of 25 µg/m^3 is well under the criteria of 50 µg/m^3 and the predicted impacts therefore do not exceed the impact criteria specified in DPE's Voluntary Land Acquisition Policy (2014). It is also noted that the calibration exercise undertaken as part of the Air Quality Assessment indicated that the model results are conservatively high in this area and therefore this predicted increase in days above the criteria is unlikely to occur. It is noted that Receiver 28 is subject to noise affectation and is therefore expected to have acquisition rights should the Project be approved (refer to **Section 6.6**).

No other monitored locations are expected to experience an increase in the number of days above 50 µg/m^3 for 24-hour PM_{10}.

Tables 6.7 and **6.8** provide a summary of the predicted PM_{10} concentrations at the two private sensitive receivers where there is potential for exceedance of the PM_{10} criteria. **Table 6.7** represents the contribution of the Project alone. **Table 6.8** represents the cumulative impact of the Project with all other sources and background levels.

Table 6.7 Private sensitive locations predicted to exceed PM_{10} Criteria due to Project Alone

Residence ID	Project Alone				Criteria
	Year 2	Year 6	Year 11	Year 16	
Maximum 24-hour average in µg/m^3					
19	51	87	56	37	50
Number of days above 50 µg/m^3					
19	1	13	1	0	5 (NEPM)
Annual average in µg/m^3					
19	10	12	13	10	30

Note: shaded cells indicate exceedances of the criteria

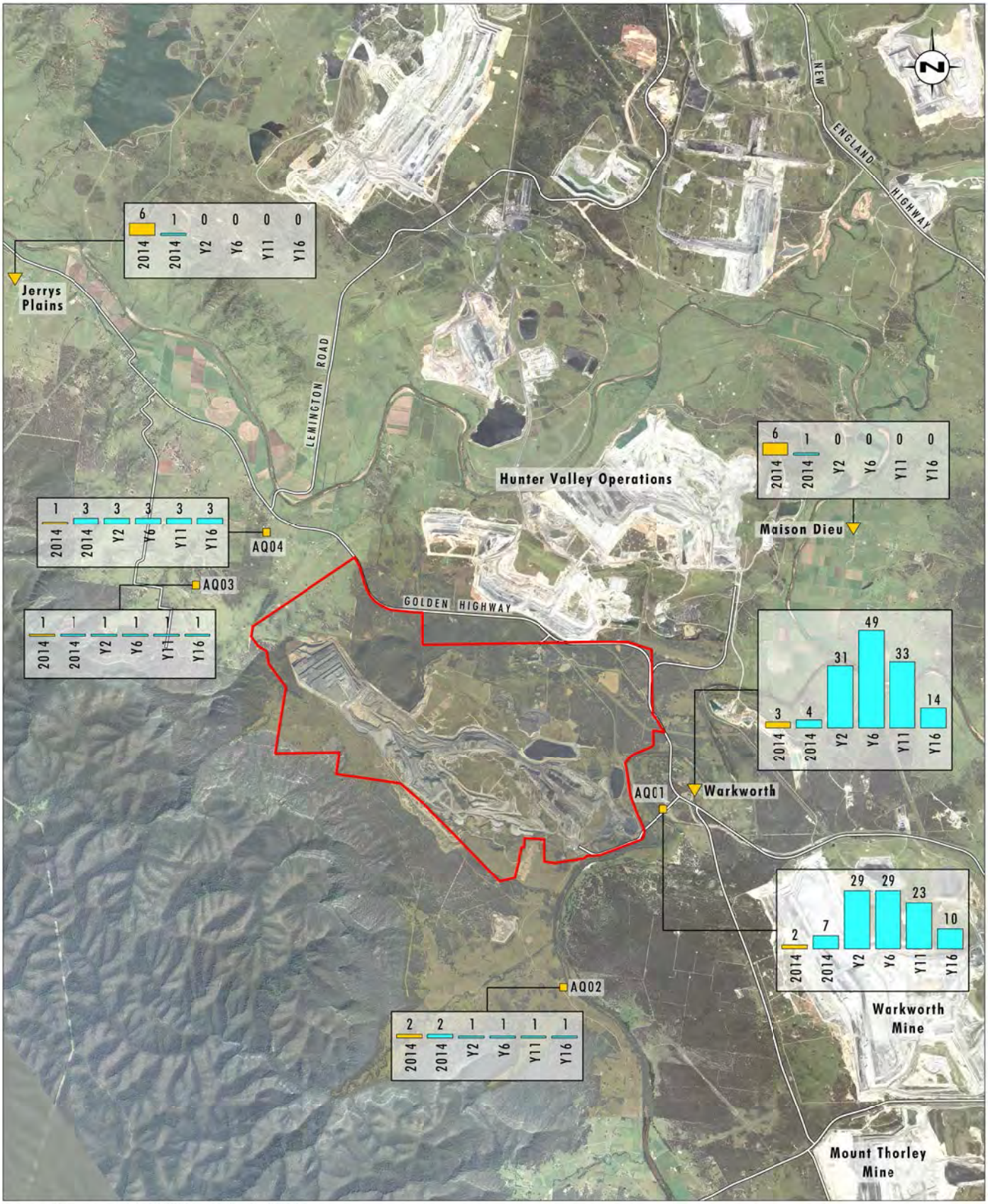


Image Source: AAM (2012), United (2015)
Data Source: Glencore (2014)

0 1.0 2.5 5.0km
1:110 000

Legend

- Project Area
- Wambo Monitoring Site
- OEH Monitoring Site
- Measured Result
- Model Prediction

FIGURE 6.6

Predicted Number of days above 50$\mu g/m^3$ PM_{10} with the Project and all other mining sources

File Name (A4): R06/3509_420.dgn
20160729 11.22

Table 6.8 Private sensitive locations predicted to exceed PM_{10} Criteria due to all sources (Cumulative impact)

Residence ID	Cumulative					Criteria
	2014 (existing)	Year 2	Year 6	Year 11	Year 16	
Maximum 24-hour average in µg/m^3						
19	64	80	120	89	69	50
Number of days above 50 µg/m^3						
19	4	52	64	41	13	5 (NEPM)
28	3	6	3	3	3	
Annual average in µg/m^3						
19	25	36	39	36	32	30

Note: shaded cells indicate exceedances of the criteria

The conclusions of the Air Quality Impact Assessment have been considered in the context of the National Clean Air Agreement with Jacobs concluding that the overall findings of the assessment will not change as a result of the proposal to establish an annual average standard for PM_{10} of 25 µg/m^3.

$PM_{2.5}$

Receiver 19 is predicted to experience a maximum 24-hour average $PM_{2.5}$ concentration above the advisory reporting goal of 25 µg/m^3. Specifically, the cumulative impact of all sources in Year 6 is predicted to result in a maximum 24-hour average $PM_{2.5}$ concentration of 30 µg/m^3 at receiver 19. All other private sensitive receiver locations are predicted to comply with both the 24-hour and annual average advisory reporting goals for $PM_{2.5}$.

TSP and Dust Deposition

There are no private residences that are predicted to experience annual average TSP or dust deposition levels above the air quality assessment criteria, either from the Project alone or from the cumulative impacts of the Project and all other sources.

Mine Owned Residences and Vacant Private Land

Mine owned residences located in Warkworth and other areas surrounding the Project Area are anticipated to experience exceedances of the air quality assessment criteria. These properties are mine owned as they are within the affection zones of the existing mines. United will consult with the owners, and as appropriate the tenants of these properties, to appropriately inform them about the predicted air quality impacts of the Project, over the life of the Project.

A small number of vacant private landholdings located in Warkworth are also predicted to experience exceedances of the EPA's air quality assessment criteria. These landholdings are all on land zoned RU1 rural and do not meet the minimum lot size requirements of the Singleton LEP 2013 for the construction of a dwelling and several are also located at or below the flood planning level. Therefore, based on current planning controls, a dwelling is unable to be built on these lots and no further consideration of air quality impacts on these properties is required under DPE's Voluntary Land Acquisition and Mitigation Policy (2014).

6.4.5.2 Blast Fume Emissions

Blasting activities have the potential to result in fugitive fume and particulate matter emissions. Post-blast fume can be produced in non-ideal explosive conditions when using ammonium nitrate/fuel oil (ANFO) and in such circumstances can be visible as an orange/brown plume. Since 2012, there have been two incidents relating to the emission of odorous fumes from blasting at Wambo which have resulted in prosecution by the NSW EPA. In response to these incidents, Wambo has implemented a Blast Fume Management Strategy (Peabody Energy 2015a), which includes a range of fume minimisation measures for all blasting activities. No significant blast fume events, as defined in the Blast Fume Management Strategy, have occurred since the strategy was implemented.

Post-blast fumes comprise oxides of nitrogen (NO_x) including nitric oxide (NO) and nitrogen dioxide (NO_2). It is the NO_2 which has been linked to adverse health effects. In general, at the point of emission, NO will comprise the greatest proportion of the total emission. Ultimately, however, much of the NO emitted into the atmosphere is oxidised to NO_2. The rate at which this oxidisation takes place depends on prevailing atmospheric conditions and can vary from a few minutes to many hours. If the dispersion is sufficient to have diluted the plume to the point where the concentration is very low then the level of oxidation is unimportant. However, if the oxidation is rapid and the dispersion is slow then high concentrations of NO_2 can occur.

The CALPUFF dispersion model was used to quantify potential NO_2 concentrations due to blasting. The assessment showed that with the proposed blasting procedures in place, the Project is predicted to comply with the criteria at all sensitive receivers.

The odour threshold for NO_2 has been reported by the World Health Organisation as ranging between 100 $\mu g/m^3$ and 410 $\mu g/m^3$. The model predictions of NO_2 at the potentially most affected location are at the lower end of this range (that is, around 100 $\mu g/m^3$ worst-case) which suggests that the odour impacts can be managed with appropriate blasting procedures.

United will implement blasting procedures as part of the Project to avoid blasting in adverse weather conditions and thereby avoiding this potential impact. As discussed in **Section 6.7.6**, United will prepare a Blast Management Plan which will have controls that are consistent with existing Glencore blasting procedures implemented at other Glencore mines in the Hunter Valley, and with consideration of the relevant aspects of the existing Wambo Blast Fume Management Strategy (Peabody Energy 2015a) currently implemented at Wambo mine.

6.4.5.3 Diesel Emissions

Emissions from diesel exhausts associated with off-road vehicles and mining equipment have been assessed as part of the Air Quality Impact Assessment for the Project. The most significant emissions from diesel exhausts are products of combustion including carbon monoxide (CO), oxides of nitrogen (NO_x) and particulate matter (PM_{10} including $PM_{2.5}$). The NO_x (or more specifically NO_2) and PM_{10} (including $PM_{2.5}$) have been considered as part of this assessment.

Modelling of the potential NO_2 concentrations associated with diesel use as part of the Project indicates a maximum 1-hour average concentration in Warkworth (the nearest sensitive receiver location) of approximately 100 µg/m^3. With the addition of maximum background levels of 74 µg/m^3, the model predicts compliance with the EPA criteria of 246 µg/m^3. Predicted annual average NO_2 concentrations at Warkworth are approximately 20 to 30 µg/m^3. With the addition of conservative background levels of 16 µg/m^3, the model predicts compliance with the EPA criteria of 62 µg/m^3. All other surrounding private residences are more distant and will have less impact.

6.4.5.4 Spontaneous Combustion

Spontaneous combustion occurs when coal and other carbonaceous materials undergo natural oxidation and generate heat. Under the right conditions, heat from the oxidation reaction can build up to a point where the coal and overburden materials will ignite and burn. For self-heating to occur, the composition of the coal must be such that low temperature oxidation can occur. Further, the material must be confined in such a way that heat from the oxidation is trapped, allowing the temperature to build up. Once the coal reaches a high enough temperature it will liberate smoke (fine particulate matter), steam and volatile organic compounds (VOCs), some of which are odorous and some of which can be harmful in high concentrations.

Based on the geological investigation undertaken by United and Wambo, the propensity for spontaneous combustion in the strata to be mined is low, and therefore with appropriate management measures in place the risk of adverse air quality impacts associated with spontaneous combustion is low. Specific management measures will also be put in place for open cut mining through the former United underground workings, to minimise the risk of spontaneous combustion in these areas.

United will continue to evaluate and manage potential issues associated with spontaneous combustion during mining operations. This will include development and implementation of a site specific spontaneous combustion management plan for the Project which will provide guidelines for eliminating or minimising the risk of incidents as a result of spontaneous combustion.

6.4.5.5 Construction Phase Emissions

The key construction activities with potential for dust emissions associated with the Project include the realignment of the Golden Highway, powerline realignment and construction of water management infrastructure. The quantity of material handled during the construction phase will be much lower than the quantity handled during the operational phase of the Project, and consequently the air quality impacts during construction will be lower than during operations. Construction activities will be managed so as to minimise dust emissions. Key management actions will include stabilising exposed areas quickly and implementation of dust management measures including the use of water carts, the defining of trafficked areas, the imposition of site vehicle speed limits and constraints on work under extreme unfavourable weather conditions, such as dry windy conditions.

6.4.5.6 Air Quality Impacts of the Harmonisation Modification

The extension of time for continued use of the existing mining infrastructure and changes to these facilities as part of the Harmonisation Modification has been addressed as part of the Air Quality Assessment. Specifically, the development of the air emission inventories considered the continued use of and changes to existing mining infrastructure for Project and cumulative scenarios. These inventories have then been used to make predictions of the potential change in air quality in future mining years. Consequently, the above assessment of air quality impacts has incorporated potential air quality impacts associated with the Harmonisation Modification.

6.4.6 Air Quality Management and Monitoring

Glencore has developed a corporate protocol for air quality management that applies to all Glencore operations. The protocol establishes the minimum requirements for dust management and mitigation at Glencore sites and establishes a framework for coordinated dust management. The protocol includes the use of environmental cameras and source monitoring for effective source tracking and response. Air quality management measures will be implemented for the open cut operations following the protocol.

United and Wambo are committed to effectively managing the air quality impacts associated with the Project and will implement a range of dust management measures for the key dust generating activities. These measures are summarised in **Table 6.9** and have been incorporated into the modelling of the dust impacts of the Project. United will be responsible for the implementation of air quality management measures as they relate to open cut operations, with Wambo responsible for the measures that relate to the Harmonisation Modification.

Table 6.9 Dust Management Measures

Activity/Dust Source	Dust management measures
Stripping topsoil by scraper	Watering of haul routes Restricting vehicle speeds
Drilling overburden	Water injection and/or application of water to drill cuttings upon removal Dust curtains Ceasing operations when visible dust is generated
Blasting overburden	Pre-blast checks including review of meteorological conditions
Hauling overburden and coal on unsealed roads	Watering of haul routes Gravel compaction and maintenance of main haul routes Restricting vehicle speeds Clearly marked haul routes Fleet optimisation to reduce vehicle kilometres travelled Prompt clean-up of any material spillage
Loading and unloading of overburden	Minimisation of fall distances during unloading and loading Planning of dump locations based on weather conditions Ceasing operations during adverse dust conditions
Unloading coal to ROM bin	Water sprays and partial enclosure
Coal processing	Enclosure
Dozers or loaders on ROM and product coal stockpiles	Watering of travel routes Minimisation during dusty conditions Reduced travel speed during dusty conditions
Conveyors to stockpiles	Covered/partial enclosure Belt cleaning

Activity/Dust Source	Dust management measures
Wind erosion from partially rehabilitated dumps	Partial rehabilitation/stabilisation
Wind erosion from ROM and product coal stockpiles	Automated water sprays on ROM coal stockpile, triggered by wind conditions Minimisation of front end loader drop heights when loading
Grading roads	Watering of haul routes Restricting vehicle speeds Clearly marked routes
Machinery exhausts and plant and equipment	Appropriately servicing all machinery in accordance with manufacturer recommendations Targeting the maintenance so that equipment remains fit for purpose over its whole life cycle Defining failure modes, effects and criticality with regard to air emissions

Air Quality Management Plan

United will prepare and implement a detailed Air Quality Management Plan for the open cut mining operations. In addition to the dust control measures outlined above, the plan will incorporate a range of proactive and reactive dust control strategies. Proactive air quality management would involve the planning of activities in advance of potentially adverse conditions. Specifically, the proactive air quality management approach will include:

- implementation of a system to provide the operation with a daily forecast of expected dust conditions in the vicinity of the operation
- discussion of the weather conditions and dust considerations at daily pre-shift meetings
- modifying the planned mining activities, as appropriate, to minimise dust impacts.

Reactive air quality management will include the modification or suspension of activities in response to the following triggers:

- visual conditions, such as visible dust from trucks above wheel height. Visual conditions will be established from both observations by site personnel and from a camera network to be established on site to cover the main dust sources of the operation
- meteorological conditions, such as dry, windy conditions, with winds blowing towards sensitive receptors, and/or
- ambient air quality conditions (that is, elevated short-term PM_{10} concentrations).

Specific triggers will be defined in the Air Quality Management Plan. These triggers will be linked to specific actions for managing dust at both private and mine owned residences.

Wambo will update its existing Air Quality and Greenhouse Gas Management Plan as part of the implementation of the Harmonisation Modification.

Blast Fume Management

United will implement existing Glencore blasting procedures in place at other Glencore Hunter Valley mines relating to fume management, including pre-blast review of weather conditions so as to avoid blasting in adverse conditions. A site specific blast management plan will also be developed and implemented during operations (refer to **Section 6.7**), including key fume management actions such as defining the potential risk zone based upon weather patterns and the ability to fire a blast based on an assessment of real-time weather conditions. The blast fume management actions will be determined in consideration of the relevant aspects of the existing Wambo Blast Fume Management Strategy (Peabody Energy 2015a) currently implemented at Wambo mine.

Spontaneous Combustion Management

United will develop and implement a site specific spontaneous combustion management plan for the Project which will provide guidelines for eliminating or minimising the risk of incidents as a result of spontaneous combustion.

Air Quality Monitoring

United and Wambo currently operate an air quality monitoring program for the existing mining operations. This existing monitoring program will be reviewed and revised as part of the implementation of the Project, with United to develop an air quality monitoring program that supports the proposed proactive and reactive air quality management system for the open cut operations. The monitoring program will be designed to allow evaluation of the effectiveness of the air quality management system, compliance with air quality operating conditions and source tracking monitoring for key emission sources. The locations and types of monitoring will consider the location of sensitive receptors, prevailing meteorological conditions, and location of mining activities. Real-time monitoring will be included in order to assist with reactive management and for the development of ambient air quality triggers. The air quality monitoring program will form part of the Air Quality Management Plan to be developed for the open cut operations.

6.5 Greenhouse Gas and Energy

The SEARs for the Project require an assessment to be undertaken of the likely greenhouse gas impacts of the development (refer to **Table 4.3**). To satisfy the SEARs, a detailed Greenhouse Gas and Energy Assessment (GHGEA) has been completed for the Project by Umwelt, including a quantitative assessment of the potential Scope 1, 2 and 3 emissions associated with the Project; a qualitative assessment of the potential impacts of these emissions on the environment; and an assessment of reasonable and feasible measures to minimise greenhouse gas (GHG) emissions and energy use. The GHGEA is provided in **Appendix 8** and a summary of the key findings of the GHGEA is provided in this section.

United has incorporated a range of measures into the Project design, with the aim of minimising potential GHG emissions and improving energy efficiency. Energy efficiency was a key driver for the design of the mine plan as one obvious consequence of reduced energy usage is a reduction in operating costs. Reduced energy usage also means reduced GHG emissions. The Project design therefore inherently minimises GHG emissions from the mining operations, primarily through energy use reduction initiatives. Key measures included in the Project design to minimise emissions include:

- limiting the length of material haulage routes (where feasible), thus minimising transport distances and associated fuel consumption

- considering energy and fuel efficiency when selecting new equipment
- scheduling activities so that equipment and vehicle operation is optimised.

United has a demonstrated track record of managing GHG emissions from its mining operations. This includes a GHG management program in place as part of its previous underground mining operations. Gas drawn from wells in the underground mining area was piped to a flaring facility for combustion, thus reducing its GHG impact.

6.5.1 Methodology

The GHGEA considered the energy usage and greenhouse gas emission impacts of each stage of the Project, including the construction, operation and closure stages. It also evaluated potential GHG emission mitigation and energy efficiency measures for the Project's operational activities.

The GHGEA was prepared with regard to the following key guidelines:

- *National Greenhouse Accounts (NGA) Factors (2015)* (DoE 2015)
- World Business Council for Sustainable Development and World Resources Institute *Greenhouse Gas Protocol* 2004 (GHG Protocol 2004).

The GHG Protocol provides an internationally accepted approach to the accounting and reporting of GHG emissions by entities. Under the GHG Protocol the establishment of operational boundaries involves identifying emissions associated with an entity's operations, categorising them as direct or indirect emissions, and identifying the scope of accounting and reporting for emissions.

Three 'Scopes' of emissions (Scope 1, Scope 2 and Scope 3) are defined for GHG accounting and reporting purposes. These scopes are outlined below:

- Scope 1 emissions are direct emissions which occur from sources owned or controlled by the reporting entity, over which they have a high level of control (such as fuel use).
- Scope 2 emissions are those generated from purchased electricity consumed by the reporting entity, which can be easily measured and can be influenced through energy efficiency measures. Scope 2 emissions physically occur at the facility where electricity is generated, that is, the power station.
- Scope 3 emissions are indirect emissions that are a consequence of the activities of the reporting entity, but occur at sources owned or controlled by another reporting entity (e.g. outsourced services).

The assessment boundary for the GHGEA incorporates all significant scope 1, 2 and 3 emissions. **Figure 6.7** demonstrates how the assessment boundary interacts with the potential emission sources under United's operational control and other emission sources associated with the Project. It is important to note that the ROM coal produced by the Project will be washed by Wambo at the Wambo CHPP, within the currently approved capacity of the CHPP. As this activity is not under the direct control of United, the greenhouse gas emissions from this operation are properly categorised as a Scope 3 emissions.

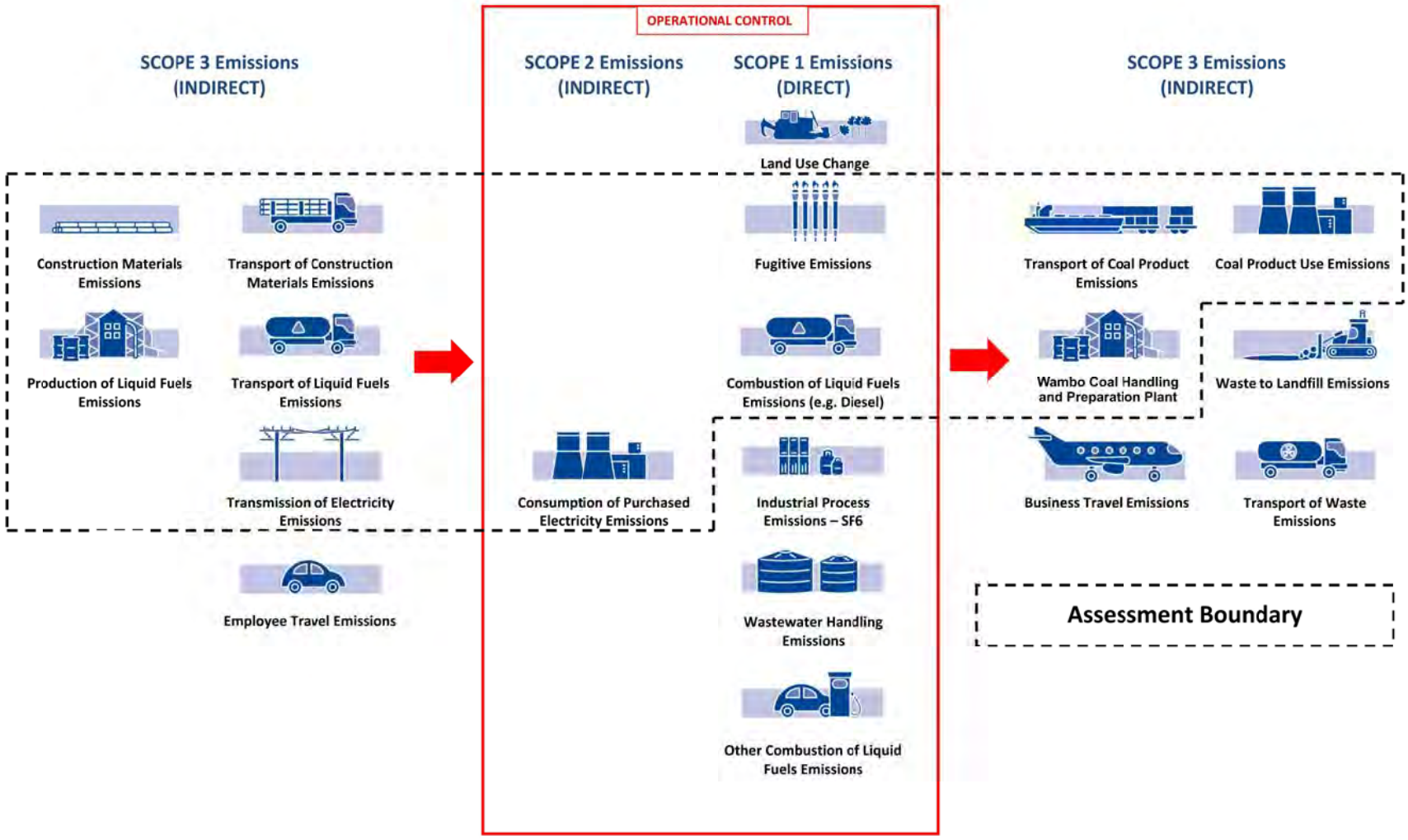


FIGURE 6.7

Greenhouse Gas Assessment Boundary

The GHGEA has calculated the energy use and greenhouse gas emissions separately for the portion of the Project covered by the State significant development application (i.e. the proposed open cut mining operations and associated activities) and the Harmonisation Modification. The assessment boundary for the GHGEA for the Harmonisation Modification includes activities associated with the Wambo offices, MIA, CHPP, train loading facility, water management infrastructure and other ancillary infrastructure, and excludes underground mining activities as they do not form part of the Project.

6.5.2 Project Development Application Assessment

6.5.2.1 Predicted Energy Consumption

The Project's energy requirements will be primarily met through diesel and electricity consumption. Outlined below is a summary of the predicted energy consumption for the Project:

- the construction activities are forecast to require approximately 24,000 Gigajoules (GJ) of energy, with diesel being the primary energy source
- the operational phase of the Project is forecast to require approximately 35,676,000 GJ of energy from diesel and grid electricity over 23 years of operation
- during the closure phase, the Project is forecast to consume approximately 65,000 GJ, all of which will be sourced from diesel.

The industry average energy use for operational open cut coal mines in Australia ranges between 430 and 660 Megajoules (MJ) per product tonne (AGSO 2000). The Project is forecast to operate with an average energy use intensity of approximately 353 MJ per product tonne. The forecast energy use intensity of the Project (excluding the Harmonisation Modification) is lower than the normal operating range for Australian open cut coal mines, as the electricity use associated with coal preparation and handling is assessed separately as it is subject to a separate development consent.

6.5.2.2 Predicted Greenhouse Gas Emissions

Construction Stage

The construction of the Project is forecast to be associated with approximately 3,300 tonnes CO_2-e of Scope 3 emissions. Scope 3 emissions will be generated by third parties combusting energy and generating industrial emissions in the process of producing and transporting construction materials. Scope 3 emissions will also be generated by contractors consuming energy during these construction projects.

Operational Stage

The Project is forecast to generate or be associated with the following GHG emissions over its 23 years of operation:

- approximately 5,802,000 t CO_2-e of Scope 1 emissions, primarily from the combustion of diesel and release of fugitive emissions. Fugitive emissions result from the release of gas (primarily carbon dioxide and methane) stored in the materials mined
- approximately 797,000 t CO_2-e of Scope 2 emissions from consuming electricity
- approximately 259,296,000 t CO_2-e Scope 3 emissions. Scope 3 emissions will be generated by third parties during product transport and consumption activities (electricity generators).

The Project's GHG inventory is dominated by Scope 3 emissions, with approximately 97 per cent of emissions occurring either upstream or downstream of the Project, and generated by third parties. Approximately 3 per cent of the greenhouse gases associated with the Project are related to on-site energy use and fugitive emissions (Scope 1 and 2 emissions).

Scope 2 and 3 emissions have been included in the GHGEA to demonstrate the potential upstream and downstream impacts of the Project. All Scope 2 and 3 emissions identified in the GHGEA are attributable to, and may be reported by, other sectors.

Closure and Rehabilitation Phase

The Project is forecast to generate approximately 4600 tonnes CO_2-e Scope 1 emissions from combusting diesel during the closure phase. The closure phase is also expected to be associated with approximately 250 tonnes CO_2-e Scope 3 emissions. Scope 3 emissions will be generated by third parties undertaking activities such as extracting, refining and transporting diesel.

6.5.3 Harmonisation Modification Assessment

6.5.3.1 Predicted Energy Consumption

The Modification's energy requirements will be primarily met through diesel and electricity consumption. Outlined below is a summary of the predicted energy consumption for the Harmonisation Modification:

- the construction activities are forecast to require approximately 3000 GJ of energy, with diesel being the primary energy source

- the operational phase of the Harmonisation Modification is forecast to require approximately 2,550,000 GJ of energy from grid electricity over 14 years of operation (i.e. from 2025 which is the currently approved life of the CHPP and train loading facility to the end of life of the Project which has been assumed as 2039 for assessment purposes).

6.5.3.2 Predicted Greenhouse Gas Emissions

Construction Stage

The construction of the Harmonisation Modification is forecast to be associated with approximately 2900 tonnes CO_2-e of Scope 3 emissions. Scope 3 emissions will be generated by third parties combusting energy and generating industrial emissions in the process of producing and transporting construction materials. Scope 3 emissions will also be generated by contractors consuming energy during these construction projects.

Operational Stage

The Harmonisation Modification is forecast to generate or be associated with the following GHG emissions over its 14 years of operation:

- approximately 594,000 t CO_2-e of Scope 2 emissions from consuming electricity

- approximately 87,000 t CO_2-e Scope 3 emissions. Scope 3 emissions represent the indirect emissions associated with the extraction, production and transport of fuel burned at the power station, and the indirect emissions attributable to the electricity lost in delivery in the transmission and distribution network (NGA Factors 2015).

6.5.4 Impact Assessment

The GHG emissions generated by the Project have the potential to impact the physical environment and the GHG reduction objectives of national and international governing bodies. The following assessment makes the distinction between environmental impacts and impacts on policy objectives.

6.5.4.1 Impact on the Environment

The Project's greenhouse gas emissions will have a disperse impact as they are highly mobile and are generated up and down the supply chain. The accumulation of greenhouse gases or carbon in 'carbon sinks' is the primary impact of greenhouse gas emissions. Since the industrial revolution, anthropogenic greenhouse gas emissions have accumulated in three major carbon sinks – the ocean (30 per cent), terrestrial plants (30 per cent) and the atmosphere (40 per cent) (BOM and CSIRO 2014).

The accumulation of greenhouse gases in the atmosphere is an important driver of global warming, sea level rise and climate change (IPCC 2013). Sea level rise and climate change may have many ramifications for the natural and built environment. The accumulation of greenhouse gases in the ocean is an important driver of ocean acidification (IPCC 2013).

The Project's direct emissions are forecast to be approximately 253,000 t CO_2 –e per annum.

To put the Project's emissions into perspective, global greenhouse gas emissions are forecast to be 46,000,000,000 t CO_2-e by 2020 (Sheehan et al. 2008). During operation, the Project will contribute approximately 0.00055 per cent to global emissions per annum (based on its projected Scope 1 emissions). The Scope 2 and 3 emissions associated with the Project should not be considered in a global context, as global projections only represent Scope 1 emissions (i.e. the sum of all individual emission sources).

Impact on Climate Change

The Intergovernmental Panel on Climate Change (IPCC) defines climate change as a change in the state of the climate that can be identified by changes in the mean and/or variability of its properties, and persists for an extended period, typically decades or longer (IPCC 2007).

Climate change is caused by changes in the energy balance of the climate system. The energy balance of the climate system is driven by atmospheric concentrations of greenhouse gases and aerosols, land cover and solar radiation (IPCC 2007).

Climate change models forecast many different climate change impacts, which are influenced by future greenhouse gas emission scenarios. Climate change forecasts also vary significantly from region to region. The Project, in isolation, is unlikely to influence global emission trajectories. Future emission trajectories will largely be influenced by global scale issues such as; technology, population growth and greenhouse gas mitigation policy.

The extent to which global emissions and atmospheric concentrations of GHGs have a demonstrable impact on climate change will be largely driven by the global response to reducing total global emissions that includes all major emission sources and sinks.

6.5.4.2 Impact on Policy Objectives

The Australian Government has committed to reduce Australia's greenhouse gas emissions by 26–28 per cent on 2005 levels by 2030 (Commonwealth of Australia 2015). If Australia is able to meet a 26 per cent reduction target by 2030, the nation will be generating approximately 393,548,000 t CO_2-e per annum (National Greenhouse Gas Inventory 2015). In year 2030 it is anticipated that the Project will generate approximately 208,000 t CO_2-e of Scope 1 emissions, if emissions are not mitigated. The Project's forecast emissions will represent approximately 0.053 per cent of Australia's annual national emissions in 2030.

While the Project is likely to increase the mitigation effort required to reach national targets, the Project itself is unlikely to prevent the Federal Government achieving its national greenhouse gas targets.

The majority of the Project's Scope 3 emissions will be generated outside Australia and will be managed by the domestic greenhouse gas policies where the Project's products are consumed. The Project's Scope 2 emissions will be generated by facilities with environmental approval to generate greenhouse gas emissions in Australia and will therefore be considered and managed as part of the reporting and management of these facilities' emissions.

6.5.5 Greenhouse Gas and Energy Management

United has incorporated a range of measures into the Project design that will minimise potential Scope 1 and Scope 2 GHG emissions and improve energy efficiency. Energy efficiency was a key driver for the design of the mine plan as reduced energy usage results in reductions in operating costs and GHG emissions. The Project design therefore inherently minimises GHG emissions from the mining operations, through measures such as:

- limiting the length of haulage routes (where feasible) and associated fuel consumption
- considering energy and fuel efficiency when selecting new equipment
- scheduling activities so that equipment and vehicle operation is optimised.

The GHGEA evaluated the Project's planned GHG mitigation measures against what may be considered best practice for an open cut coal mine. The evaluation considered a range of potential management measures targeting the key contributors to Scope 1 and Scope 2 emissions, including management of fugitive emissions, diesel use efficiency and electricity use efficiency. A summary of the measures found by United to be both technically feasible and financially reasonable for the Project, and which are therefore proposed to be implemented, is provided in **Table 6.10**. The detailed evaluation of all measures is provided in **Appendix 8.**

Table 6.10 Proposed Scope 1 and Scope 2 Greenhouse Gas Mitigation Measures for Open Cut Operations

Proposed Mitigation Measure	Application to the Project
Limiting the length of material haulage routes to reduce diesel usage and associated emissions	Length of haulage routes has been optimised to minimise dust, noise, fuel use and improve operating efficiency.
Optimising ramp gradients to reduce diesel usage and associated emissions	Ramp gradients have been optimised according to pit geometry parameters and mobile equipment performance characteristics.

Proposed Mitigation Measure	Application to the Project
Continually improve the fuel efficiency of haul trucks operating at the mine to reduce diesel usage and associated emissions	United will seek opportunities to use the existing trucks currently in use at Wambo and from within the Glencore and Peabody groups to maximise the life of this equipment. Where new trucks are purchased during the life of the Project, fuel/energy efficiency will be considered in the selection criteria. Haul road design parameters such as gradient and haul length are optimised resulting in the efficient haulage of overburden per unit of fuel consumed.
Payload management to reduce diesel usage and associated emissions	Payload will be constantly monitored and actively managed to maintain efficiency, over time reducing the overall diesel consumption of the mine and thereby reducing greenhouse gas emissions.
Increasing haul truck payload to reduce the number of truck loads required and consequently reduce diesel usage and associated emissions	Truck tray capacity will be reviewed as part of the efficient management of the operation, including the option of fitting custom built trays to maximise payloads. Payload will also be maximised by blasting strategies that optimise material size characteristics.
Improving rolling resistance of haul roads to reduce diesel usage and associated emissions	Haul roads are planned to be constructed on solid rock rather than on soil or subsoil material where practical.
Reducing idling times to reduce diesel usage and associated emissions	Reducing idle times will be an ongoing performance measure. Initiatives to reduce idle times will continue to be introduced over the life of the Project. A reduction in idle times will improve fuel consumption rates per volume of material moved.
Scheduling activities so that equipment operation is optimised to reduce energy usage and associated emissions	Scheduling activities to optimise equipment operation will be a routine activity. United will prepare long, medium and short term plans to optimise production. Over time this will reduce the overall diesel consumption of the mine and thereby reduce greenhouse gas emissions.
Seek to continually improve the fuel efficiency of mine equipment during the purchase of new equipment	United will seek opportunities to use the existing equipment currently in use at Wambo and from within the Glencore and Peabody groups to maximise the life of this equipment. Where new equipment is purchased during the life of the Project, fuel/energy efficiency will be considered in the selection criteria
Blasting strategies to improve extraction and processing energy use efficiency and reduce associated emissions	Blast management practices will be employed to size material for optimum payloads and minimise the need for secondary treatment of waste material.
Maximising resource recovery efficiency to maximise energy use efficiency and reduce associated emissions	Long, medium and short term operational plans will be developed to optimise the recovery of approved resources.

Proposed Mitigation Measure	Application to the Project
Working machines to their upper design performance to optimise energy usage and associated emissions	Glencore's business objectives support and promote effective equipment utilisation and performance rates, resulting in improved fuel consumption rates per volume of material moved.
Preventing unnecessary water ingress to reduce pump energy usage and associated emissions	The surface water management system is designed to maximise separation of clean and dirty water systems. Clean water will be diverted away from mining areas, consistent with the mine water management system design outlined in **Section 6.8**.
In-pit servicing to reduce diesel usage associated with transporting equipment	Equipment will be serviced in pit where practical reducing unnecessary unproductive travel time and energy use.
High efficiency workshop lighting	New workshop areas will use high efficiency lighting, reducing energy use.
High efficiency heating, ventilation and cooling (HVAC) systems for administrative buildings	New administration buildings will use high efficiency HVAC systems reducing energy use.

Glencore supports low-emission coal technology projects via the Australian coal industry's $1 billion COAL21 Fund. Projects supported by this fund include the Callide Oxyfuel project and the Otway Basin Carbon Capture and Storage project.

Separately, Glencore is involved in the following Projects:

- member of the FutureGen CCS project in the USA
- investigating options for carbon capture and storage in the Wandoan area in Queensland.

Glencore has also completed a number of research projects related to low emission technologies, including direct injection coal engines, biochar, nanotechnology, chemical looping and membrane research for power station applications. Glencore is also a Foundation member of the International Energy Centre with a number of Australian Universities which offers a Masters of Energy Studies.

6.6 Noise

A comprehensive assessment of the potential noise impacts of the Project has been prepared by Umwelt. This detailed assessment has been undertaken in accordance with the SEARs for the Project. The SEARs in relation to the assessment of noise impacts require:

- a detailed assessment of the likely operational noise impacts of the development (including construction noise) under the NSW *Industrial Noise Policy*, paying particular attention to the obligations in chapters 8 and 9 of the policy (refer to **Section 6.6.3** and **Appendix 9**)

- if a claim is made for specific construction noise criteria for certain activities, then this claim must be justified and accompanied by an assessment of the likely construction noise impacts of these activities under the *Interim Construction Noise Guideline* (refer to **Section 6.6.6** and **Appendix 9**)

- an assessment of the likely road noise impacts of the development under the NSW *Road Noise Policy* (refer to **Section 6.6.7** and **Appendix 9**)

- an assessment of the likely rail noise impacts of the development under the *Rail Infrastructure Noise Guideline* (refer to **Section 6.6.8.2** and **Appendix 9**).

The noise impact assessment for the Project is included as **Appendix 9**. A summary of the key findings of the assessment is provided in this section.

6.6.1 Project Design Process

Noise was a key issue raised by the local community during the consultation program for the Project and was consistently noted when discussing the existing Wambo Open Cut operations and the Project. Consequently, potential noise impacts were a key consideration throughout the design phase of the Project. Predictive noise modelling was undertaken on an iterative basis throughout the mine planning and design phase of the Project so that, as far as practicable, noise impacts associated with the Project were minimised.

This process sought to quantify the noise impacts associated with different operating scenarios to minimise the extent of potential noise affectation on private residences, and to enable consideration of reasonable and feasible noise control measures early in the Project design and optimisation process. This iterative process has resulted in a significant reduction in the noise impacts of the Project. A range of proactive noise controls have been incorporated into the Project design, which combined with the reactive management process that will be implemented, has resulted in a reduction of noise impacts and the number of noise affected residences.

The controls that were found to be reasonable and feasible, which contributed to the effective control of potential impacts, were incorporated into the Project design. These controls have been included as part of the noise model for the Project. Key noise controls for the Project include:

- identifying activities that could be modified during times of adverse noise propagating meteorological conditions and the management of equipment during such conditions to minimise noise impacts

- developing designs for emplacement areas to enable alternative dumping locations during adverse conditions

- the inclusion of bunds in strategic locations along key haul roads, where practicable, to shield trucks and equipment on exposed sections of the ramps

- locating key haul roads below the ground surface to maximise topographical shielding to surrounding receiver areas, where practical

- incorporation of reasonable and feasible noise attenuation on key plant and equipment.

6.6.2 Existing Environment

6.6.2.1 Existing Noise Monitoring

An assessment of the existing noise environment in the area surrounding the Project Area was undertaken using monitoring data from the existing Wambo continuous monitoring network, a mobile continuous noise monitor, four noise loggers providing supplementary data in other areas plus data from the HVO South continuous monitoring network. An attended noise monitoring program was used to confirm noise source identification at the noise monitor/logger locations. The analysed noise monitoring dataset covers representative seasons and has been sourced from both long-term and temporary noise monitoring sites set up specifically for the Project. The location of monitoring sites is shown on **Figure 6.8**.

The noise monitoring locations used to assess the existing noise environment are representative of the nearest and/or potentially most affected residences surrounding the Project Area.

6.6.2.2 Existing Acoustic Environment

The noise monitoring results were used to determine the Assessment Background Levels (ABLs), Rating Background Levels (RBLs) and mean $L_{Aeq,period}$ (where 'period' refers to the day, evening or night period) noise levels in the region surrounding the Project Area. The noise monitoring results include noise contributions from road and rail noise sources as well as the existing Wambo, HVO and Mt Thorley/Warkworth mining operations. In accordance with Section 3 of the NSW Industrial Noise Policy (INP), the assessment of the background noise environment has, where practical, excluded the noise impact from the Wambo Open Cut from the analysis (as it forms part of the Project).

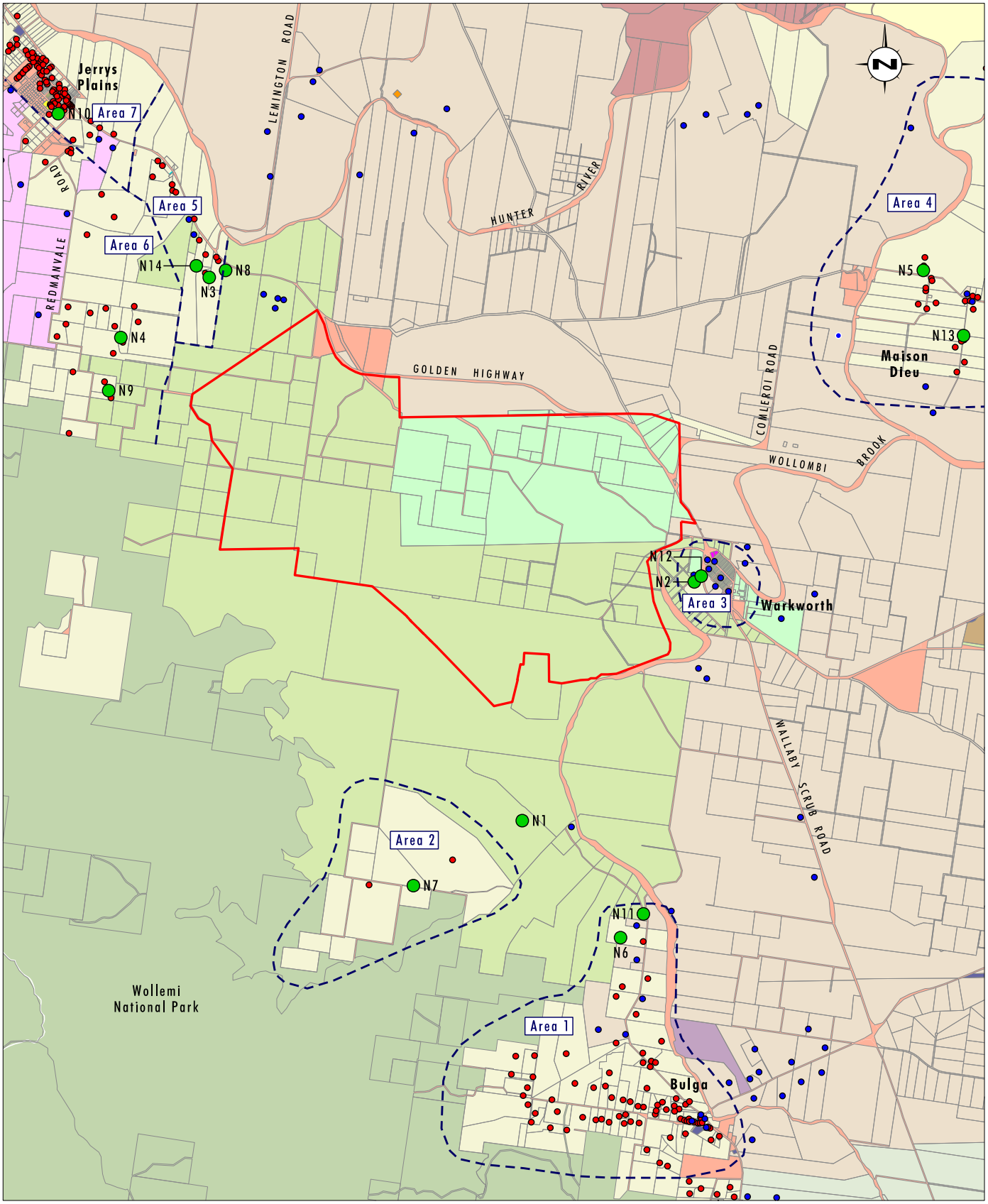
As per the process outlined in the INP, the RBLs were used to determine the Project Specific Noise Levels (PSNL) for surrounding land uses. Residences in the surrounding area were grouped into localities or areas that have similar representative background noise levels. These areas have been defined giving consideration to topographical features that may enhance or attenuate the transmission of noise and the relative location of other noise sources (such as mining, train and road traffic). The location of surrounding properties and residences are shown on **Figure 6.8** and detailed in the NIA in **Appendix 9**.

The background noise monitoring found that the RBLs in the more remote areas surrounding the Project Area are generally between 30 and 35 dB(A) during the day-time, evening and night-time. The noise environment in the vicinity of the Golden Highway shows the influence of road traffic noise with the RBLs ranging from 35 to 39 dB(A) depending on the time of day and proximity to the highway. In Maison Dieu, the day-time, evening and night-time RBLs range from 36 to 37 dB(A) due to the influence of existing land uses, including mining operations in the surrounding area.

6.6.2.3 Existing Meteorological Conditions

The atmospheric conditions that most affect noise propagation are temperature and wind velocity gradients. Noise levels are increased when the wind blows from noise source to receiver or under temperature inversion conditions (both of which are often referred to as adverse weather conditions), and decrease when the wind blows from receiver to the source or under temperature lapse conditions.

The noise impact assessment for the Project analysed representative meteorological data for the region surrounding the Project Area to determine the percentage of occurrence of inversions and/or wind effects. Meteorological data for the period 2008 to 2015 from the Wambo weather station was analysed for the assessment. The 2014 period was considered representative of the data set and was analysed to determine the prevailing meteorological conditions for use in the noise modelling.



Data Source: LPMA (2009), Department of Natural Resources (2005)

0 1.0 2.0 4.0km
1:90 000

Legend

- Project Area
- Noise Monitoring Location
- Receiver Area
- Mine Owned (Ashton)
- Mine Owned (Bulga)
- Mine Owned (Coal and Allied)
- Mine Owned (Doyles Creek)
- Mine Owned (Glencore)
- Mine Owned (Integra)
- Mine Owned (Peabody)
- Mine Owned (Ravensworth)
- Mine Owned (Wambo)
- AGL Energy
- Ausgrid
- Bulga Community Centre
- Government Authority (Federal, State or Local)
- Department of Education and Communities
- Diocese of Newcastle
- National Parks and Wildlife Service
- Private
- Redbank Energy
- Singleton Council
- Telstra
- Wanaruah Local Aboriginal Land Council
- Private Residence
- Mine Owned Residence

FIGURE 6.8

Location of Background Noise Monitoring Sites and Receiver Areas

File Name (A4): R06/3509_424.dgn
20160729 11.26

6.6.3 Operational Noise Assessment of the Project

6.6.3.1 Methodology and Approach

As part of the noise impact assessment, operational noise levels were predicted using RTA Technology's Environmental Noise Model (ENM) to determine the noise impacts of the Project. The noise model was used to assess the noise impacts from the Project under a range of wind speed, wind direction and temperature gradient combinations considered representative of the meteorological conditions of the region (refer to **Section 6.6.2.3**).

Based on the differences in meteorological conditions depending on time of day and season, the noise assessment investigated the potential noise impacts during the day-time (all season combined), non-winter evenings, non-winter nights and winter evening/night-time periods in order to cover a range of potential worst case meteorological conditions. Results provided for assessment against intrusive criteria are 90th percentile L_{Aeq} values; that is, the noise level that is likely to be exceeded 10 per cent of the time.

6.6.3.2 Modelling Scenarios

ENM was used to predict the noise levels from the Project at the nearest potentially affected receivers for four conceptual stages of the Project. The conceptual mine stage plans for Years 2, 6, 11 and 16 were selected as they were considered likely to represent the range of worst case noise impacts at sensitive receivers.

Noise source models representative of the acoustically significant plant and indicative equipment in each of the conceptual mine stages were developed for ENM. Representative sound power levels (SWLs) for the plant and equipment were sourced from similar Glencore mining operations, Wambo mine and Umwelt's SWL database.

6.6.3.3 Noise Criteria

The PSNLs set the benchmark against which noise impacts and the need for noise mitigation are assessed. The PSNLs for the Project have been determined in consideration of the INP and Draft Industrial Noise Guideline (ING) (EPA 2015 – the draft ING is proposed to replace the INP) for each area of the residential receivers in the region surrounding the Project Area (refer to **Figure 6.8**). The target PSNLs determined for each sensitive receiver location are summarised in **Table 6.11**.

The PSNLs are the initial noise targets, with the aim of the Project being to achieve the PSNLs where possible. Should it not be possible with reasonable and feasible noise controls to achieve the PSNLs, noise criteria can be set for an operation by the consent authority that are different to the PSNLs. This has been the case for the existing Wambo mine, with the current Wambo mine development consent noise criteria also shown in **Table 6.11**. These current criteria are included for context regarding the noise levels currently permitted from Wambo. The noise impact assessment compares predicted noise impacts with the PSNLs as per the INP.

Table 6.11 Residential Receiver Target PSNL, dB(A) and Current Wambo Mine Noise Criteria

Residential Receiver Locations	Time Period	Target PSNL $L_{Aeq,15minute}$	Existing Wambo mine development consent noise criteria $L_{Aeq,15minute}$
Area 1 and 2 **South Wambo** **North Bulga**	Day	35	35
	Evening	35	38 – 40
	Night	35	38 – 40
Area 3 **Warkworth**	Day	44	-[2]
	Evening	39 [1]	-[2]
	Night	38 [1]	-[2]
Area 4 **Maison Dieu**	Day	42	35
	Evening	42	35 – 41
	Night	37 [1]	35 – 41
Area 5 **Moses Crossing**	Day	41	35
	Evening	40	40
	Night	37 [1]	40
Area 6 **Redmanvale**	Day	35	35
	Evening	35	35 – 40
	Night	35	35 – 40
Area 7 **Jerrys Plains**	Day	39	35
	Evening	39	35
	Night	36	35

Note 1: Proposed alternate 15 minute noise criteria target for locations where $L_{Aeq,period}$ amenity criteria form the PSNL

Note 2: No criteria in consent, recommended operating noise limits in EIS of $L_{Aeq,15minute}$ 45 dB(A) day and 43 dB(A) evening and night

DPE's Voluntary Land Acquisition and Mitigation Policy (2014) also provides guidance on the approach to managing noise impacts in excess of the target PSNLs. This approach is presented in **Table 6.12**.

Table 6.12 Voluntary Land Acquisition and Mitigation Policy Noise Impact Assessment Approach

Residual Noise Level above Target PSNL	Characterisation of Impact	Potential Treatment	Classification of Impact
0 – 2dB(A)	Negligible. Not discernible by the average person	Not warranted	Noise Management Zone
3 – 5dB(A)	Moderate. Noticeable by some people and not by others	Receiver based treatments or controls such as air conditioning or facade treatment	Active Noise Management Zone
>5dB(A)	Significant. Noticeable by most people	Receiver based treatments or controls and voluntary land acquisition	Noise Affectation Zone

Noise Management Zone

The noise management zone is applicable where the predicted noise levels exceed the target PSNLs by up to 5 dB. The noise impacts in this zone range from negligible (0 to 2 dB above) to moderate (3 to 5 dB above).

Management procedures that can be implemented in the Noise Management Zone for negligible impacts of 0 to 2 dB above the PSNL include:

- prompt response to any issues of concern raised by community
- noise monitoring on-site and within the community
- making changes to operational noise mitigation measures, where practicable, to further reduce noise impacts.

Management procedures that can be implemented in the Active Noise Management Zone for moderate impacts between 3 and 5 dB above the PSNL include:

- as for Noise Management Zone, plus consideration of receiver based treatments of controls such as air conditioning or facade treatment.

Noise Affectation Zone

The noise affectation zone occurs where the predicted noise levels are more than 5 dB above the target PSNL. Noise emissions at this level are considered likely to be unacceptable by some property holders and implementation of the following measures may be required:

- implementation of acoustic mitigation at receivers or other negotiated agreement
- up front advice to property owners who have the right to request acquisition in any future development consent.

6.6.3.4 Noise Assessment Findings

The noise model was used to determine noise levels from the Project at the nearest residential receivers, under a range of meteorological conditions, including adverse conditions that propagate noise. The modelling found that after the application of reasonable and feasible noise controls, the Project is predicted to exceed the PSNLs at a number of private residences as summarised in **Table 6.13**. Residence locations are provided on **Figures 1.8, 1.8a**, **1.8b**, **1.8c** and **1.8d**.

Table 6.13 Number of Residences Predicted in Excess of PSNL

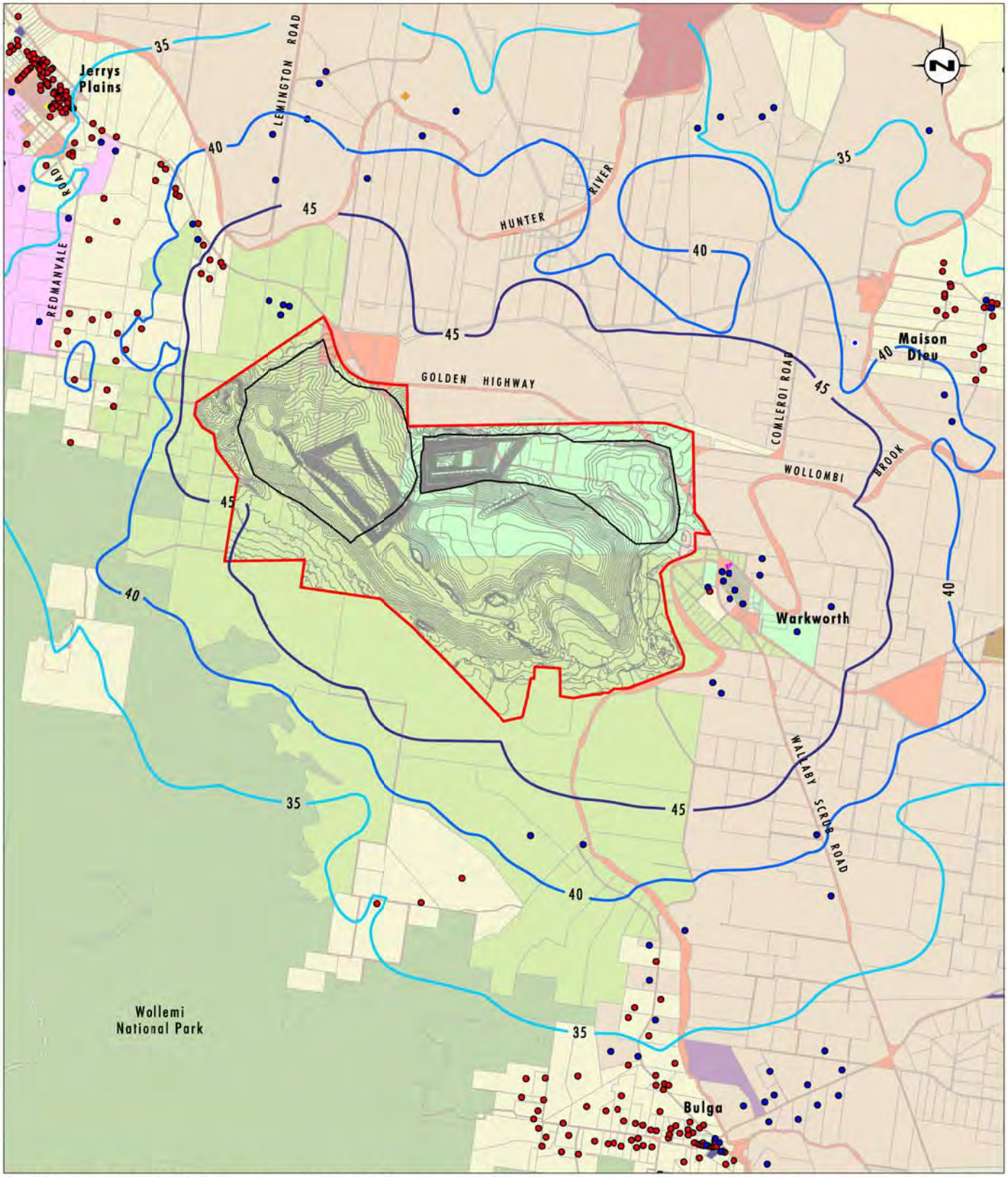
Residual Noise Level above Target PSNL	No. of Residences	Receiver ID	Classification of Impact
0 – 2dB(A)	13	R6, R7, R35, R41, R46, R44, R133, R379, R485, R487, R493, R495, R496	Noise Management Zone – negligible impacts
3 – 5dB(A)	18	R3, R25, R29, R30, R33, R41, R42, R48, R49, R50, R75, R163, R320, R343, R344, R345, R346, R348	Active Noise Management Zone – moderate impact
>5dB(A)	7	R16, R17, R19[1], R28, R39, R40, R43	Noise Affectation Zone

Note 1: Residence already subject to acquisition rights under an existing consent

Table 6.14 presents a summary of results for the seven residences where the operational noise level is predicted to exceed the target PSNL by more than 5 dB (i.e. the Project Noise Affectation Zone). It is noted that Residence 19 in Warkworth Village currently has acquisition rights under the existing Wambo mine and Train Loading Facility development consents and the Warkworth Continuation Project development consent.

Modelling indicates that a further 18 residences have results where the operational noise level is predicted to exceed the target PSNL by 3 to 5 dB. These 18 residences represent the residences within the Project's Active Noise Management Zone. A summary of the results for these residences is presented in **Table 6.15**.

As noted in **Table 6.13**, there are also 13 residences where negligible exceedances (up to 2 dB(A)) of the PSNLs are predicted. The PSNLs are predicted to be met at all other private residences, including all residences in Jerrys Plains village. A combined worst case noise contour for all stages of the Project is presented in **Figure 6.9**. As discussed earlier in this section, it is noted that the predicted noise impacts of the Project as presented in this EIS are significantly reduced from the initial noise impacts predicted for the Project. This included reducing the number of residences in the Project Noise Affectation Zone by approximately two thirds, and approximately halving the number of residences within the Project Active Noise Management Zone. These significant reductions in noise impact were achieved through modification to the design of the mine and application of reasonable and feasible noise mitigation and management measures (refer to **Section 6.6.10**).



Data Source: LPMA (2009), Department of Natural Resources (2005)

0 1.0 2.0 4.0km
1:90 000

Legend

- Project Area
- Conceptual Proposed Extent of Open Cut Mining
- 35 dB(A) Noise Contour
- 40 dB(A) Noise Contour
- 45 dB(A) Noise Contour
- Mine Owned (Ashton)
- Mine Owned (Bulga)
- Mine Owned (Coal and Allied)
- Mine Owned (Doyles Creek)
- Mine Owned (Glencore)
- Mine Owned (Integra)
- Mine Owned (Peabody)
- Mine Owned (Ravensworth)
- Mine Owned (Wambo)
- AGL Energy
- Ausgrid
- Bulga Community Centre
- Government Authority (Federal, State or Local)
- Department of Education and Communities
- Diocese of Newcastle
- National Parks and Wildlife Service
- Private
- Redbank Energy
- Singleton Council
- Telstra
- Wanaruah Local Aboriginal Land Council
- Private Residence
- Mine Owned Residence

FIGURE 6.9

Combined Noise Impacts - All Meteorological Conditions

Table 6.14 Summary of Results for Properties in the Project Noise Affectation Zone, dB(A)

Receiver ID	Period	Target PSNL	Year 2				Year 6				Year 11				Year 16				Max Predicted 10th%ile Noise Level
			All Seasons Day	Non-winter Evening	Non-winter Night	Winter Night	All Seasons Day	Non-winter Evening	Non-winter Night	Winter Night	All Seasons Day	Non-winter Evening	Non-winter Night	Winter Night	All Seasons Day	Non-winter Evening	Non-winter Night	Winter Night	
Area 3 - R019	Day	44	57	-	-	-	54	-	-	-	49	-	-	-	49	-	-	-	57
	Evening	39	-	52	-	-	-	49	-	-	-	45	-	-	-	45	-	-	52
	Night	39	-	-	48	56	-	-	46	54	-	-	44	49	-	-	44	49	56
Area 5 - R016	Night	37	-	-	45	44	-	-	37	39	-	-	42	42	-	-	38	42	45
Area 5 - R017	Night	37	-	-	44	42	-	-	37	40	-	-	41	40	-	-	37	40	44
Area 5 - R028a [1]	Night	37	-	-	47	46	-	-	37	39	-	-	43	42	-	-	37	40	47
Area 5 - R028b [1]	Night	37	-	-	46	46	-	-	37	39	-	-	43	42	-	-	37	40	46
Area 5 - R039	Night	37	-	-	45	46	-	-	40	42	-	-	43	42	-	-	41	45	46
Area 5 - R040	Night	37	-	-	45	46	-	-	40	41	-	-	44	42	-	-	39	42	46
Area 5 - R043	Night	37	-	-	43	43	-	-	37	39	-	-	40	39	-	-	37	40	43

Note 1: Residence 028a and 028b are located on the same property and as such for the purposes of the assessment are counted as one private property predicted to exceed the Target PSNL by more than 5 db over the life of the Project.

Table 6.15 Summary of Results for Properties in the Project Active Noise Management Zone, dB(A)

Receiver ID	Period	Target PSNL	Year 2				Year 6				Year 11				Year 16				Max Predicted 10th%ile Noise Level
			All Seasons Day	Non-winter Evening	Non-winter Night	Winter Night	All Seasons Day	Non-winter Evening	Non-winter Night	Winter Night	All Seasons Day	Non-winter Evening	Non-winter Night	Winter Night	All Seasons Day	Non-winter Evening	Non-winter Night	Winter Night	
Area 1 - R003	Day	35	38	-	-	-	34	-	-	-	32	-	-	-	32	-	-	-	38
Area 2 - R025	Day	35	39	-	-	-	36	-	-	-	34	-	-	-	34	-	-	-	39
	Evening	35	-	38	-	-	-	35	-	-	-	31	-	-	-	32	-	-	38
	Night	35	-	-	35	38	-	-	32	37	-	-	< 30	35	-	-	35	37	38
Area 5 - R050a	Night	37	-	-	40	40	-	-	36	39	-	-	38	37	-	-	38	40	40
Area 5 - R050b	Night	37	-	-	40	40	-	-	37	39	-	-	38	37	-	-	37	40	40
Area 5 - R050c	Night	37	-	-	41	41	-	-	37	39	-	-	38	38	-	-	38	40	41
Area 6 - R029	Day	35	39	-	-	-	35	-	-	-	36	-	-	-	37	-	-	-	39
	Evening	35	-	40	-	-	-	35	-	-	-	36	-	-	-	38	-	-	40
Area 6 - R030	Day	35	37	-	-	-	36	-	-	-	38	-	-	-	38	-	-	-	38
	Evening	35	-	36	-	-	-	38	-	-	-	36	-	-	-	39	-	-	39
	Night	35	-	-	36	35	-	-	34	35	-	-	38	38	-	-	35	37	38
Area 6 - R033	Day	35	37	-	-	-	39	-	-	-	40	-	-	-	39	-	-	-	40
	Evening	35	-	37	-	-	-	40	-	-	-	38	-	-	-	39	-	-	40
	Night	35	-	-	36	33	-	-	33	39	-	-	38	39	-	-	37	39	39
Area 6 - R041b	Night	35	-	-	37	38	-	-	33	34	-	-	36	36	-	-	33	34	38
Area 6 - R042	Day	35	36	-	-	-	37	-	-	-	37	-	-	-	39	-	-	-	39
	Evening	35	-	37	-	-	-	38	-	-	-	36	-	-	-	40	-	-	40

Receiver ID	Period	Target PSNL	Year 2				Year 6				Year 11				Year 16				Max Predicted 10th%ile Noise Level
			All Seasons Day	Non-winter Evening	Non-winter Night	Winter Night	All Seasons Day	Non-winter Evening	Non-winter Night	Winter Night	All Seasons Day	Non-winter Evening	Non-winter Night	Winter Night	All Seasons Day	Non-winter Evening	Non-winter Night	Winter Night	
	Night	35	-	-	34	32	-	-	34	36	-	-	37	37	-	-	34	38	38
Area 6 - R048	Day	35	37	-	-	-	36	-	-	-	39	-	-	-	39	-	-	-	39
	Evening	35	-	36	-	-	-	36	-	-	-	37	-	-	-	39	-	-	39
	Night	35	-	-	36	34	-	-	32	36	-	-	39	39	-	-	36	38	39
Area 6 - R049	Day	35	36	-	-	-	36	-	-	-	38	-	-	-	39	-	-	-	39
	Evening	35	-	36	-	-	-	37	-	-	-	36	-	-	-	39	-	-	39
	Night	35	-	-	37	34	-	-	34	35	-	-	38	38	-	-	35	37	38
Area 6 - R075	Day	35	36	-	-	-	36	-	-	-	37	-	-	-	38	-	-	-	38
	Evening	35	-	37	-	-	-	37	-	-	-	36	-	-	-	39	-	-	39
Area 6 - R163	Day	35	36	-	-	-	36	-	-	-	37	-	-	-	38	-	-	-	38
	Evening	35	-	37	-	-	-	37	-	-	-	35	-	-	-	39	-	-	39
	Night	35	-	-	36	33	-	-	35	36	-	-	37	36	-	-	35	38	38
Area 6 - R320	Day	35	38	-	-	-	37	-	-	-	40	-	-	-	40	-	-	-	40
	Evening	35	-	38	-	-	-	36	-	-	-	39	-	-	-	39	-	-	39
	Night	35	-	-	35	36	-	-	33	35	-	-	39	40	-	-	36	39	40
Area 6 - R343	Day	35	38	-	-	-	36	-	-	-	40	-	-	-	38	-	-	-	40
	Evening	35	-	39	-	-	-	36	-	-	-	40	-	-	-	39	-	-	40
	Night	35	-	-	36	37	-	-	32	34	-	-	39	40	-	-	36	38	40
Area 6 - R344	Day	35	36	-	-	-	37	-	-	-	37	-	-	-	38	-	-	-	38
	Evening	35	-	36	-	-	-	37	-	-	-	35	-	-	-	38	-	-	38
Area 6 – R345	Day	35	37	-	-	-	39	-	-	-	40	-	-	-	39	-	-	-	40
	Evening	35	-	37	-	-	-	40	-	-	-	38	-	-	-	39	-	-	40

Receiver ID	Period	Target PSNL	Year 2				Year 6				Year 11				Year 16				Max Predicted 10th%ile Noise Level
			All Seasons Day	Non-winter Evening	Non-winter Night	Winter Night	All Seasons Day	Non-winter Evening	Non-winter Night	Winter Night	All Seasons Day	Non-winter Evening	Non-winter Night	Winter Night	All Seasons Day	Non-winter Evening	Non-winter Night	Winter Night	
	Night	35	-	-	36	33	-	-	33	39	-	-	38	39	-	-	37	39	39
Area 6 - R346	Evening	35	-	36	-	-	-	36	-	-	-	32	-	-	-	38	-	-	38
Area 6 - R348	Evening	35	-	36	-	-	-	33	-	-	-	34	-	-	-	38	-	-	38

6.6.4 Predicted Noise Impacts Compared to Current Wambo Noise Limits

The approach to noise modelling for the Project is different to that undertaken for the 2003 EIS for Wambo mine (*Wambo Development Project EIS*, Resource Strategies 2003), with increased consideration of different meteorological conditions including adverse conditions that result in noise propagation. To provide a 'like for like' assessment of the Project compared to the approved Wambo mine, a comparison was undertaken of the predicted noise impacts of the Project under the same meteorological conditions modelled in the Wambo mine EIS.

A comparison of the predicted noise levels for Years 2, 6, 11 and 16 of the Project, for each of the meteorological conditions considered in the *Wambo Development Project EIS* (Resource Strategies 2003) Appendix A – Noise and Blasting Assessment, with the Wambo mine development consent (DA 305-7-2003) Noise Criteria (refer to **Table 6.11**). This comparison indicated that the noise impacts of the Project at the vast majority of residences surrounding the Project are within the existing noise limits in the Wambo mine development consent, despite the addition of a new mining area being the United Pit.

Specifically, the results indicate the Project achieves the original noise criteria in Area 1 – Bulga, Area 2 – South Wambo, Area 4 – Maison Dieu and Area 7 Jerrys Plains. No noise criteria are provided for Area 3 – Warkworth in the Wambo mine development consent, however, the predicted noise impacts at Residence R19 (Area 3 – Warkworth Village) are up to 11 dB higher than the Recommended Operating Limits in the 2003 EIS. As discussed previously, Residence R19 currently has voluntary acquisition rights under existing development consents for Wambo mine, Wambo train loading facility and MTW.

The predicted noise impacts in Area 5 – Moses Crossing, to the north west of the Project Area, are up to 2 dB higher than original noise criteria during Years 2, 11 and 16 of the Project. All six residences identified in the area predicted to be subject to higher impacts (R16, R17, R28, R39, R40 and R43) are also predicted to be in the Noise Affectation Zone, as presented in **Section 6.4**. The noise impacts in Area 6 – Redmanvale, to the west of the Project Area, are predicted to comply with the Wambo mine development consent criteria at all residences in this area except for one residence (R343) during night time of Year 11 of the Project where the noise level is predicted to be 2 dB higher than the Wambo mine development consent noise criterion. At R343, the noise level under adverse conditions is predicted to increase from 38 to 40 dB(A).

In summary, the comparative assessment found that the noise impacts of the Project at the vast majority of private residences surrounding the Project Area are within the existing noise limits in the Wambo mine development consent and that all of those residences where higher impacts associated with the Project are predicted are within the Affectation Zone or Active Management Zone for the Project.

6.6.5 Low Frequency Noise

The INP requires an assessment of noise sources that have the potential to contain annoying characteristics such as tonal components, impulsiveness, intermittency, irregularity or dominant low frequencies. Where these characteristics are an inherent component of the noise source, the INP requires modifying factors to be applied to the predicted noise levels.

For the assessment of low frequency noise the test set out by the INP compares the difference between the C-weighted and A-weighted noise levels. The INP requires that, if the difference between the C-weighted and A-weighted noise levels is greater than 15 dB, a 'modifying factor' of 5 dB is added to the predicted noise level. The underlying approach is that the modifying factor provides an incentive to engineer out the annoying noise characteristics during the design phase of a project.

However, research into the annoyance of low frequency noise (Broner 2011), suggests that this approach may overstate the level of perceived annoyance. DPE has suggested in a draft guideline (DP&I 2013) that a more appropriate criterion be adopted based on the work of Broner (2011), of 65 dB(C) during the daytime or evening and 60 dB(C) during the night. This approach has been accepted by DPE and EPA for a number of recently approved mining developments located in the Hunter Valley.

The draft Industrial Noise Guideline (ING) (EPA 2015) also presents a method for the assessment of low frequency noise based on the UK Department for Environment, Food and Regional Affairs (DEFRA) low frequency noise assessment curve.

All three of these approaches to assessing low frequency noise impacts were undertaken as part of the noise impact assessment.

The assessment concluded that tonal noise, impulsive noise and intermittent noise during the night time, as well as single event duration noise did not require the application of modifying factors to the predicted noise levels. It was, however, found that a strict application of the INP may require the addition of a low frequency noise modifying factor at some receivers under noise enhancing meteorology. The assessment found that the predicted low frequency noise levels for the Project were all below the DPE 65 dB(C) day time and evening criteria and 60 dB(C) night time criteria. In addition, the predicted low frequency noise levels were found to be generally close to the threshold of hearing and therefore unlikely to be intrusive or cause annoyance. It is also noted that no low frequency noise impacts were identified following the draft ING low frequency noise assessment process. Based on this assessment no low frequency modifying factors were applied to the predicted noise levels.

6.6.6 Sleep Disturbance

Noise sources that could lead to sleep disturbance are typically transient noises and often have tonal characteristics. Mining activities occurring within the night time that could lead to sleep disturbance include activities such as:

- an excavator bucket striking the ground
- heavy objects (rocks) being dropped into a truck tray
- air horns used to control truck movement
- reversing beepers
- track clatter from bulldozers.

The Sleep Disturbance Criteria are based on the INP which suggests that to prevent sleep disturbance the $L_{A1,1\ minute}$ or $L_{A\ max}$ noise level should not exceed the L_{A90} background noise level by more than 15 dB when measured outside the bedroom window. The INP further explains that other factors are also important in assessing the extent of impact on sleep and, 'that where the criterion is met, sleep disturbance is not likely, but where it is not met, a more detailed analysis is required'.

The INP states that the sleep disturbance criteria are normally assessable for the night time period only (10.00 pm to 7.00 am). As some of the residents that live in the region surrounding the Project are shift workers, the assessment of sleep disturbance for the Project has also considered the day and evening assessment periods. The sleep disturbance criteria for all the residential receiver locations are presented in **Table 6.16**.

Table 6.16 Sleep Disturbance Criteria, dB(A)

Residential Receiver Locations	Sleep Disturbance Criteria $L_{A1,1minute}$		
	Day	Evening	Night
Area 1 and 2 South Wambo/North Bulga	45	45	45
Area 3 Warkworth Village	54	49	49
Area 4 Maison Dieu	52	52	44
Area 5 Moses Crossing	51	49	49
Area 6 Redmanvale Road	45	45	45
Area 7 Jerrys Plains	49	49	46

The noise model was used to determine noise levels at the nearest residential receiver locations under calm and adverse meteorological conditions. The $L_{A1, 1 minute}$ noise levels were predicted to be less than 45 dB(A) at all private residences except receiver 19 in Warkworth and therefore readily comply with the relevant criteria. During the early stages of the United Open Cut the $L_{A1, 1 minute}$ noise levels at receiver 19 (Warkworth Village) could exceed 55 dB(A) due to bulldozer operations and impact noises from heavy objects being dropped into truck trays. As noted above, receiver 19 is currently within the affectation zone for Wambo and MTW and has current acquisition rights for both mining operations.

6.6.7 Construction Noise

The EPA recognises that construction activities could potentially generate higher noise levels than those of an industrial operation. The DECC *Interim Construction Noise Guideline* (ICNG) (DECC 2009) provides noise management criteria for construction activities.

The major components of the non-mining infrastructure related construction phase of the Project include:

- the realignment of the Golden Highway
- relocation of the 330 kV transmission line.

Other construction activities such as upgrades and modifications to the water management system and mining infrastructure are considered to generate minor noise impacts that are consistent with general activities considered in the operational noise assessment.

The activities required to construct the proposed Golden Highway realignment and 330 kV transmission line will occur mostly during recommended standard construction hours as defined by the ICNG. Section 2.3 of the ICNG allows for construction activities to be undertaken 'outside recommended standard hours' when there is a *requirement to sustain the operational integrity of public infrastructure* (DECC 2009). Some

activities associated with the realignment of the Golden Highway may be required outside of the ICNG 'recommended standard hours' to minimise disruption to the public. The construction noise management levels for the representative residential receivers surrounding the Project Area are detailed in **Table 6.17**.

Table 6.17 Construction Noise Criteria, dB(A)

Residential Receiver Locations	Management Level, $L_{Aeq,15minute}$	
	Standard Construction hours (based on day-time RBL)	Outside Standard Construction Hours (based on night-time RBL)
Area 1 and 2 South Wambo/North Bulga	40	35
Area 3 Warkworth Village	49	39
Area 4 Maison Dieu	47	34
Area 5 Moses Crossing	46	39
Area 6 Redmanvale Road	40	35
Area 7 Jerrys Plains	44	36

Two scenarios were considered when modelling the construction noise impacts of the Project, one being construction during standard hours and one being construction during non-standard hours. The noise impacts associated with an indicative suite of acoustically significant plant and equipment was considered.

To assess worst case noise levels, the construction activities during standard hours were assessed based on full machine utilisation when the construction activities are occurring at a point closest to the nearest receivers. The construction scenario assessed for 'non-standard hours' were based on the use of half the machines that would be used during 'standard hours'.

The noise model was used to determine the construction noise levels at the nearest residential receiver locations under worst-case meteorological conditions of source to receiver winds of 3 m/s. The $L_{Aeq,15minute}$ noise levels associated with the construction activities were found to not exceed 35 dB(A) at any sensitive receiver. This is well below the construction noise management level presented in **Table 6.17**. Therefore, no significant construction noise impacts are predicted as a result of the Project.

6.6.8 Road Traffic Noise

The *NSW Road Noise Policy* (RNP) (DECCW 2011) sets out criteria for road traffic noise associated with developments. The main access to the Project Area will be via the existing Wambo Access Road, with the primary traffic route being from the east along the Golden Highway and Putty Road. **Table 6.18** outlines the road traffic noise criteria for the Project.

Table 6.18 Road Noise Criteria, dB(A)

Road Category	Type of Project/Land Use	Assessment Criteria dB(A)	
		Day (7.00 am – 10.00 pm)	Night (10.00 pm – 7.00 am)
Freeway/arterial/ sub-arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	LAeq, 15 hour 60 external	LAeq, 9 hour 55 (external)

Source: NSW Road Noise Policy (DECCW 2011)

The road noise impacts associated with the Project's construction and operational phases were modelled using the US Federal Highway Administration Traffic Noise Model (TNM). Project traffic volumes were based on those presented in the Traffic and Transport Impact Assessment undertaken for the Project (refer to **Section 6.15**). Road traffic noise impacts were predicted at the closest receivers along the Project transport routes to the east and west.

The results indicate the traffic volumes predicted with the Project would result in road traffic noise levels less than the road traffic noise assessment criteria.

6.6.9 Noise Assessment of the Harmonisation Modifications

6.6.9.1 Wambo Mine Development Consent Modification (DA 305-7-2003)

Operational Noise

The noise impacts from the operation of the Wambo CHPP and associated infrastructure beyond 2025 were assessed and found to result in no change to the currently approved noise impacts associated with the facility. As previously discussed, no changes are proposed to the CHPP that are predicted to alter noise impacts.

6.6.9.2 Wambo Train Loading Facility Modification (DA 177-8-2004)

Rail Noise

The Project will utilise existing approved rail infrastructure which connects Wambo to the Main Northern Rail Line via a privately owned rail line and loop. The Wambo rail loop is approved to transport up to 15 Mtpa product coal until 2025. The Project does not seek to change the approved maximum annual coal volumes transported via the Wambo rail loop. The Project does, however, seek to extend the approved life of the rail loop to correspond to the life of the Project and increase the maximum number of daily train movements from six to eight trains to allow flexibility in managing rail movements on the line.

Noise emissions from the Main Northern Rail Line are regulated via ARTC's EPL (EPL 3142). The EPA *Rail Infrastructure Noise Guideline* (RING) 2013 specifies rail noise assessment trigger levels for rail traffic generating developments (refer to **Table 6.19**).

Table 6.19 Noise Criteria for Rail Traffic due to the Harmonisation Modification on the Main Northern Rail Line, dB(A)

Type of Development	Noise trigger levels dB(A) External [1]	
	Day (7 am - 10 pm)	Night (10 pm - 7 am)
Rail traffic-generating development	Development increases existing $L_{Aeq, period}$ rail noise levels by greater than 0.5 dB and predicted rail noise levels exceed:	
	65 $L_{Aeq, day\text{-}time}$ 15 hour OR 85 L_{Amax}	60 $L_{Aeq, night\text{-}time}$ 9 hour OR 85 L_{Amax}

Source: Rail Infrastructure Noise Guideline (EPA 2013)
Note 1: Refer to RING technical notes for further definition of terms

Wambo Train Loading Facility

The noise impacts from the operation of the Wambo train loading facility beyond 2025 were assessed and found to result in no change to the currently approved noise impacts associated with the facility. There are no changes proposed to the facility as part of the Project.

Main Northern Rail Line

There will not be any increase in the L_{Amax} pass-by noise levels on the Main Northern Rail Line as a result of the Harmonisation Modification.

The ARTC 2015-2024 Hunter Valley Corridor Capacity Strategy (June 2015) indicates the contract coal tonnage in 2015 due to all coal haulage on the Main Northern Rail Line between the Whittingham Junction and Maitland is 170 Mtpa. The prospective demand tonnage in 2024 on the Main Northern Rail Line between the Whittingham Junction and Maitland is 250 Mtpa. This would represent a 1.6 dB increase in the noise level associated with coal train movements on the Main Northern Rail Line between the Whittingham Junction and Maitland.

Wambo's current coal train movements on the Main Northern Rail Line contribute 0.4 dB to the noise levels generated by coal train movements on the Main Northern Rail Line between the Whittingham Junction and Maitland. At ARTC's predicted coal train movement to meet the demand tonnage rate of 250 Mtpa by 2024, the Harmonisation Modification's coal train movements on the Main Northern Rail Line combined with the Wambo underground requirements would contribute 0.3 dB to the noise levels generated by coal train movements on the Main Northern Rail Line between the Whittingham Junction and Maitland. Based on the guidelines in the RING, the Harmonisation Modification's contribution to the overall train related noise levels from the Main Northern Rail Line is unlikely to be audibly perceptible at any of the current setback distances from the railway corridor.

Mt Thorley to Main Northern Rail Line

Wambo train loading facility development consent covers the operation of the trains servicing the Wambo train loading facility via the Mt Thorley to Main Northern Rail Line spur line. With respect to the prediction of the L_{Amax} levels at residences from passing trains on the Mt Thorley to Main Northern Rail Line spur line, there will be no change in the sound power level and associated L_{Amax} pass-by noise levels of the trains servicing the Project.

The Project includes the use of existing Wambo CHPP, train loading facility and rail line within their currently approved total annual capacities. While there will be no change to total approved capacity, the Project will increase the approved number of trains from a maximum of six per day to eight per day. This will result in an approximate increase of 1 dB in the $L_{Aeq,\ day\text{-}time}$ and $L_{Aeq,\ night\text{-}time}$ noise emissions from the Mt Thorley to Main Northern Rail Line spur line during those periods when up to eight trains are required by the Project per day. As there will be no increase in the total annual capacity, any increase in daily movements will be offset by a decrease in daily movements at other times. The proposed change in the maximum number of trains per day will have no impact on the L_{Amax} by-pass noise level.

6.6.10 Cumulative Noise Assessment

The INP addresses potential cumulative noise impacts from existing and subsequent developments by ensuring that appropriate noise criteria and consent limits are established to maintain acceptable noise amenity levels for residents. This is consistent with the Mining SEPP which states that cumulative noise levels should not exceed the acceptable noise levels as defined in Table 2.1 of the INP.

The Project will be in a noise environment already significantly affected by industrial and road traffic noise. The assessment indicates that while there is potential for the recommended acceptable noise level (refer to **Tables 6.20** and **6.21** for criteria) to be exceeded at three surrounding locations, the cumulative industrial noise level will not exceed the cumulative noise acquisition criteria specified in DPE's Voluntary Land Acquisition and Mitigation Policy (2014).

The assessment of cumulative noise levels from the Project combined with surrounding industrial noise sources was undertaken using two different methods. The first method involved adding the modelled noise from the Project (including the Harmonisation Modification) to the existing industrial noise level adjusted to exclude the contribution of the existing Wambo Open Cut. This approach was taken as the existing industrial noise level is known and captures the noise impacts of the key surrounding industrial operations (HVO and MTW) which contribute to cumulative noise impacts, and as there is a high degree of confidence in the predicted noise impacts of the Project. The assessment results using this approach are provided in **Table 6.20** and show that there is the potential for a cumulative noise impact at properties at Moses Crossing and the southern-most properties at Maison Dieu with predicted cumulative noise levels of 42 dB(A) compared to criteria of 40 dB(A). At these locations the Project is estimated to contribute 40 per cent and 30 per cent respectively of the cumulative industrial noise level.

The second assessment process involved summing the predicted noise levels from all the significant industrial noise sources (including the Project) that surround or are adjacent to a receiver and comparing this with the relevant criteria. This option involved establishing the maximum potential cumulative impact based on summing the Noise Impact Assessment Criteria from Development Consents and Project Approvals as these represent the highest predicted noise levels permitted from each noise source at residential receivers. The estimated L_{Aeq}, period amenity noise level contribution has been based on the 15 minute intrusiveness noise level target criteria. The generally accepted difference between the L_{Aeq}, period and a $L_{Aeq,15minute}$ noise levels for a proposed mining development is 2 dB. This approach is likely to overestimate actual cumulative noise levels as not all mines will operate at maximum noise levels simultaneously. This method also does not take into account the direction from which a noise emanates, the meteorological effects on noise propagation, or the operational aspects of other developments over which the Project has no control (production rates, equipment location or equipment utilisation).

The assessment undertaken using this method identified the potential for cumulative noise impacts at the southern-most properties at Maison Dieu and the northern-most private residence at Bulga (refer to **Table 6.21**), with predicted cumulative noise levels of 42 dB(A) and 41 dB(A) respectively compared to criteria of 40 dB(A). At these locations the Project is estimate to contribute 30 per cent and 10 per cent respectively of the cumulative industrial noise level.

At Maison Dieu the cumulative noise levels are driven by other, closer, mining operations with the Project contributing approximately 30 per cent of the cumulative noise. It is also noted that the target PSNLs for the Project reflect the fact that there is already a significant existing industrial noise contribution at these locations.

In Moses Crossing, there are two key mining operations that contribute to the cumulative noise levels, the Project and the nearby HVO South. While assessment approach one indicated the potential for cumulative impacts at this location, assessment approach two predicted compliance with the recommended amenity noise levels.

In Bulga, the Project is a very minor contributor to cumulative noise levels at 10 per cent.

As noted above, there is uncertainty about whether or not the potential cumulative noise impacts identified in the assessment would actually occur due to the likelihood of the assessment methods over-predicting actual cumulative noise impacts. For these reasons, it is recommended that as part of the Project an appropriate monitoring program is established to provide for the ongoing assessment of cumulative impacts over the life of the Project. Should cumulative noise impacts be identified and should the Project be a significant contributor to this impact (i.e. 40 per cent or greater), appropriate management responses will need to be put in place by United in cooperation with other contributing mining operations.

Table 6.20 Cumulative Noise Impacts – Existing plus United/Wambo, LAeq,period dB(A)

Location	Period	Maximum Contribution from the Project (including Harmonisation Modification)	Estimated Industrial Contribution excluding Wambo Open Cut	Worst Case Cumulative Summation	Criteria		Project Contribution	
					Mining SEPP Cumulative Noise Level (i.e. Recommended Acceptable)	Voluntary land acquisition (i.e. Maximum Acceptable)	Increase in Noise Level, dB	% Contribution from the Project
North Bulga exc. properties with acquisition rights	Day	34	37	39	50	55	2	30%
	Evening	30	35	36	45	50	1	20%
	Night	31	33	35	40	45	2	40%
South Wambo	Day	37	35	39	50	55	4	60%
	Evening	36	34	38	45	50	4	60%
	Night	36	31	37	40	45	6	80%
Maison Dieu	Day	36	41	42	50	55	1	20%
	Evening	35	41	42	45	50	1	20%
	Night	37	40	42	40	45	2	30%
Moses Crossing exc. properties in affectation	Day	37	40	42	50	55	2	30%
	Evening	37	39	41	45	50	2	40%
	Night	38	39	42	40	45	3	40%
Redmanvale	Day	38	32	39	50	55	7	80%
	Evening	38	32	39	45	50	7	80%
	Night	37	30	38	40	45	8	80%
Jerrys Plains	Day	33	34	37	50	55	3	40%
	Evening	33	34	37	45	50	3	40%
	Night	34	34	37	40	45	3	40%

Table 6.21 Cumulative Noise Impacts – Project Contribution: Mount Thorley, Warkworth, HVO South Rixs Creek plus United/Wambo, LAeq,period dB(A)

Location	Period	Maximum Contribution from the Project (including Harmonisation Modification)	Estimated Maximum Contribution Mt Thorley Continuation Project	Estimated Maximum Contribution Warkworth Continuation Project	Estimated Maximum Contribution HVO South	Estimated Maximum Contribution Rixs Creek	Worst Case Cumulative Summation	Criteria		Project Contribution	
								Mining SEPP Cumulative Noise Level (Recommended Acceptable)	Voluntary land acquisition (Maximum Acceptable)	Increase in Noise Level, dB	Per cent Contribution from the Project
North Bulga (WW ID 17, 19)	Day	34	36	38	-	-	41	50	55	1	20%
	Evening	30	36	38	-	-	41	45	50	0	10%
	Night	31	36	38	-	-	41	40	45	1	10%
South Wambo (WW ID 266)	Day	37	33	35	-	-	40	50	55	3	50%
	Evening	36	33	35	-	-	40	45	50	2	40%
	Night	36	33	35	-	-	40	40	45	2	40%
Maison Dieu (WW ID All Other) (HVO ID 34)	Day	36	33	33	38	33	42	50	55	1	20%
	Evening	35	33	33	38	33	42	45	50	1	20%
	Night	37	33	33	38	33	42	40	45	1	30%
Moses Crossing exc. properties in affectation (HVO ID Other)	Day	37	-	-	33	-	38	50	55	5	70%
	Evening	37	-	-	33	-	38	45	50	5	70%
	Night	38	-	-	33	-	39	40	45	6	80%
Redmanvale (HVO ID All Other)	Day	38	-	-	33	-	39	50	55	6	80%
	Evening	38	-	-	33	-	39	45	50	6	80%
	Night	37	-	-	33	-	38	40	45	5	70%
Jerrys Plains (HVO ID All Other)	Day	33	-	-	33	-	36	50	55	3	50%
	Evening	33	-	-	33	-	36	45	50	3	50%
	Night	34	-	-	33	-	36	40	45	3	50%

6.6.11 Noise Management and Monitoring

6.6.11.1 Reasonable and Feasible Noise Management Measures

As outlined in **Section 6.6.1**, the identification and assessment of reasonable and feasible noise controls have been considered throughout the Project design process and incorporated into detailed noise modelling (refer to **Appendix 9**). The incorporation of these reasonable and feasible controls has reduced the extent of the noise affectation and management zones and related noise impacts associated with the Project as far as practicable. A combination of proactive and reactive/adaptive controls would need to be implemented over the life of the Project. Proactive control measures to be implemented over the life of the Project include:

- Incorporation of reasonable and feasible noise attenuation on key items of plant and equipment that will be re-used from the current Wambo Open Cut operations or other controls achieving the same overall noise outcome.

- Include reasonable and feasible noise attenuation measures on new plant and equipment that has the potential to contribute to the Project's noise level.

- Using 'silent horns' to communicate with trucks and smart broadband 'Quacker' reversing alarms.

- The inclusion of bunds in strategic locations along haul roads, where practicable, to shield trucks and equipment on exposed sections of the haul road ramps.

- Locating key haul roads below ground surface or topographical features to maximise shielding to surrounding receiver areas, where practicable.

- Designing emplacement areas to create sheltered dumping locations that can be used during adverse weather conditions where feasible and practicable.

- Managing the drop height of the first load into truck bodies to minimise impact noise from the material.

In addition to the measures above, United intends to achieve the predicted noise levels at private residences through the implementation of a performance based adaptive management approach (refer to **Section 6.6.10.3**) that focuses on implementing appropriate operational controls and management strategies to minimise noise impacts. The approach will vary during different mine stages and weather conditions, and considering evolving technology and associated equipment noise levels. A range of controls and strategies will be adopted as required to meet noise performance requirements for the Project. Examples of such controls and strategies include those incorporated into the noise model to demonstrate each stage of the Project could be managed to meet the noise performance requirements for the Project, including:

- strategic relocation or shut down of acoustically significant equipment during adverse meteorological conditions that could result in noise propagation towards sensitive receivers

- limiting the activities of ancillary equipment in exposed locations

- progressive shut down of production machines in elevated locations.

In addition to the implementation of noise mitigation strategies during periods of adverse weather conditions, United will implement the following general noise mitigation measures as part of the Project:

- regular inspection and maintenance of noise attenuation systems
- implementation of a process for periodic review of noise performance of the equipment fleet
- implementation of systems that identify adverse meteorological conditions which are likely to result in elevated noise impacts
- the implementation of noise awareness training for key employees to facilitate effective noise management
- offering reasonable and feasible noise mitigation measures, which may include measures such as double glazing, insulation or air conditioning, to landowners in the active noise management zone.

6.6.11.2 Noise Management Plan

United will develop and implement a Noise Management Plan for the open cut operations. The Noise Management Plan will detail the implementation of monitoring and management controls to be utilised to manage noise impacts. The Noise Management Plan will include:

- noise objectives and targets consistent with the development consent
- noise management measures in place at the site
- consultation processes to monitor and manage the potential for cumulative noise with neighbouring mining/industrial operations
- requirements for general noise awareness training for key operational staff
- a noise monitoring program that provides for proactive noise management, ongoing noise performance monitoring and determination of compliance with relevant noise criteria provided in the development consent
- the development of a Trigger Action Response Plan (TARP) that includes an Incident Investigation and Response process
- stakeholder consultation
- complaint/enquiry handling process including maintenance of a 24 hour community contact line
- a roles and responsibilities matrix, with responsibilities being clearly defined through all levels within the operation.

Wambo will continue to manage its operations in accordance with its development consents and will update its existing Noise Management Plan as part of the implementation of the Harmonisation Modification.

6.6.11.3 Proactive Noise Management and Monitoring

The incorporation of reasonable and feasible noise control measures has reduced the noise impacts associated with the Project. Central to the ongoing management of noise impacts is the implementation of an appropriate continuous noise monitoring program that will enable the proactive and real time management of operations during adverse noise propagating conditions. The noise monitoring program proposed for the Project will include:

- predictive forecasting of adverse weather conditions based on local meteorological data
- operation of four continuous noise monitors, directional monitoring, operational alerts, continuous online data collection and audio recording capabilities
- a program of attended noise monitoring as identified in the Noise Management Plan. This will include monitoring at suitable locations (initially proposed at five locations) to validate the findings of the continuous monitors, attended monitoring undertaken monthly during winter nights and quarterly during the day, evening and night periods for the remainder of the year, subject to the requirements of the development consent
- appropriate data assessment and review procedures
- a noise incident investigation and response plan
- change management processes to assess potential noise impacts of significant operational changes.

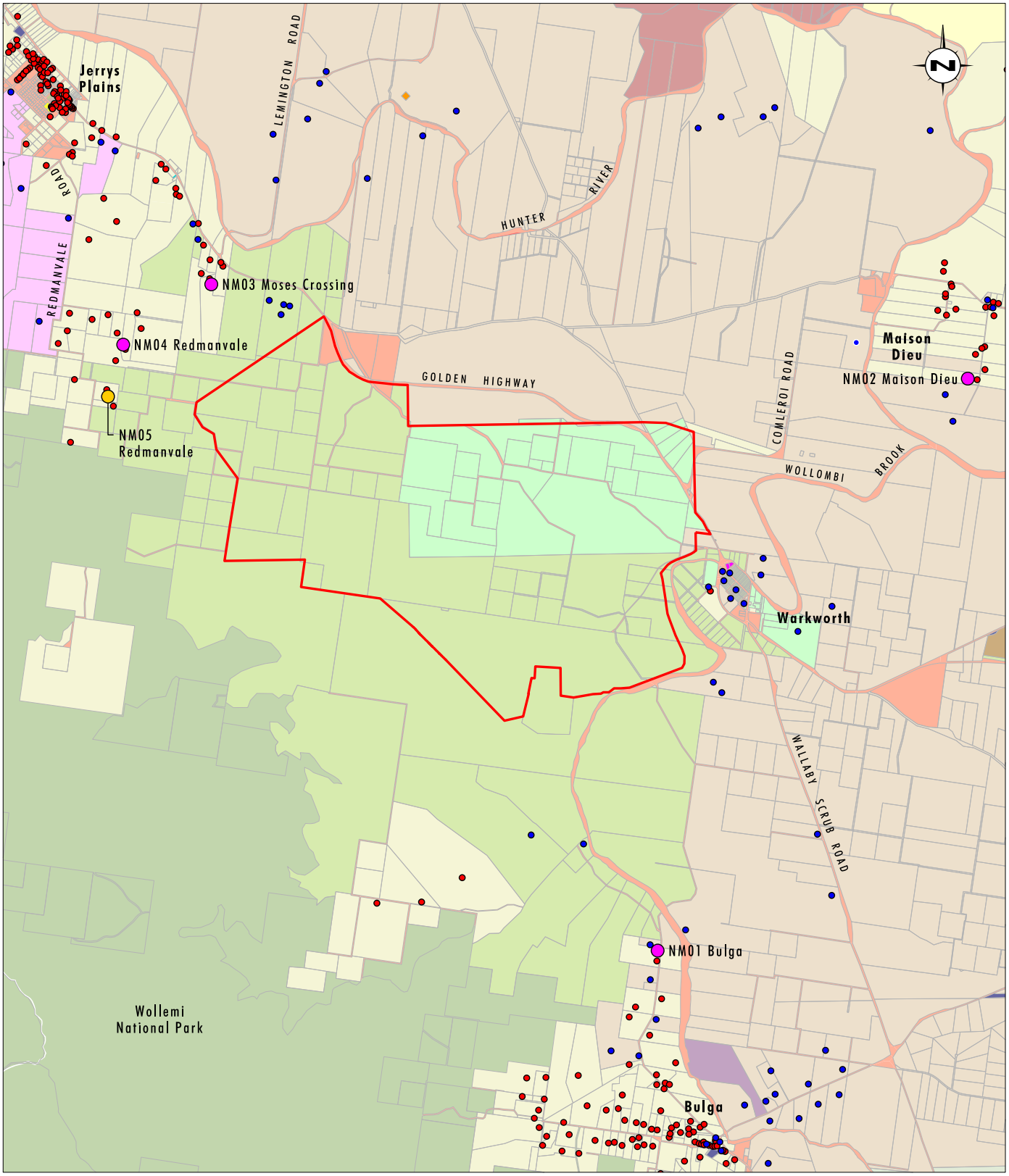
The proposed noise monitoring locations are shown on **Figure 6.10**. This monitoring program will be reviewed and adapted as appropriate during the life of the Project.

6.7 Blasting

Blasting is a necessary part of the open cut mining process. As outlined in **Section 3.5.3**, overburden will be blasted to break it up prior to removal, haulage and emplacement. In addition, where strength and thickness is sufficient, coal seams may also be blasted prior to extraction. Blasting is currently undertaken at Wambo between the hours of 9.00 am and 5.00 pm Monday to Saturday, with no blasting to be undertaken on Sundays or public holidays, and this will continue with the Project. Any variation to these times would be conditional on receipt of the written consent of the EPA. If blasting for safety or environmental reasons is required outside these hours EPA will be consulted prior to blasting.

When blasting occurs at mines, the energy from the blast can propagate through the ground to the surrounding area in the form of vibration. In addition, the energy can be released into the air and can propagate over the ground into the surrounding area. This latter phenomenon is a type of low frequency noise which is often termed airblast or overpressure. Blasting has the potential to cause both annoyance to people and, at higher levels, structural damage within surrounding properties and infrastructure. Blasting can also eject rock fragments (known as fly rock) into the air. Flyrock has the potential to cause damage in the area immediately surrounding the blast site, however, blasts are designed to minimise the potential for flyrock.

The SEARs for the Project require a detailed assessment of the likely blasting impact of the development (including noise, vibration, overpressure, visual and odour) on people, livestock, heritage items, infrastructure and significant natural features (refer to **Table 4.3**).



Data Source: LPMA (2009), Department of Natural Resources (2005)

0 1.0 2.0 4.0km
1:90 000

Legend

- Project Area
- Proposed Continuous and Attended Noise Monitoring Location
- Proposed Attended Noise Monitoring Location
- Mine Owned (Ashton)
- Mine Owned (Bulga)
- Mine Owned (Coal and Allied)
- Mine Owned (Doyles Creek)
- Mine Owned (Glencore)
- Mine Owned (Integra)
- Mine Owned (Peabody)
- Mine Owned (Ravensworth)
- Mine Owned (Wambo)
- AGL Energy
- Ausgrid
- Bulga Community Centre
- Government Authority (Federal, State or Local)
- Department of Education and Communities
- Diocese of Newcastle
- National Parks and Wildlife Service
- Private
- Redbank Energy
- Singleton Council
- Telstra
- Wanaruah Local Aboriginal Land Council
- Private Residence
- Mine Owned Residence

FIGURE 6.10

Proposed Noise Monitoring Locations

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A detailed Blasting Impact Assessment has been undertaken by Enviro Strata Consulting Pty Ltd and is presented in **Appendix 10**. A summary of the key findings are provided in this section. The potential impacts from blast fumes and odour are discussed in **Section 6.4**.

In the period 2011 to 2014, a number of complaints were received about blasting operations at Wambo. Over this period, blast vibration, overpressure and dust/fume associated with blasting was the second highest reason for community complaints.

Wambo has been monitoring airblast overpressure and ground vibration around the Wambo Open Cut since 2004. A review of monitoring data from 1093 blasts for the period to June 2015 identified no exceedances of ground vibration criteria at private residences. Four blasts were found to have exceeded the maximum airblast overpressure criteria of 120 dBL at private residences, with a further 12 blasts in excess of the 115 dB recommended airblast overpressure criteria. The number of blasts that exceeded the recommended airblast overpressure criteria of 115 dB constituted less than 5 per cent of the total number of blasts in a 12 month period and is therefore compliant with relevant criteria (Peabody Energy 2015).

Since 2012, there have been two incidents relating to the emission of odorous fumes from blasting at Wambo which have resulted in prosecution by the EPA. As discussed in **Section 6.4**, in response to these incidents, Wambo has implemented a Blast Fume Management Strategy (Peabody Energy 2015), which includes a range of fume minimisation measures for all blasting activities.

During Phase 1 of the stakeholder engagement process undertaken for the Project (refer to **Section 5.0**), blasting was identified as a key concern with regard to both existing operations at Wambo, and the Project. Specific concerns included vibrations, air quality, potential impacts to stock and structural damage to residences and businesses.

6.7.1 Proposed Blasting Practices

Blasting within the Wambo Open Cut is currently undertaken between the hours of 9.00 am and 5.00 pm Monday to Saturday, in accordance with the conditions of the Wambo mine development consent. These conditions permit up to 15 blasts per week and up to three blasts per day that generate ground vibration greater than 0.5 mm/s at any residence on privately owned land, with an allowance for an additional blast required following a blast misfire. United will manage blasting practices for the Project within the limits of these existing blasting conditions. That is, no more than 15 blasts per week or three blasts per day from the combined operation of the Wambo Open Cut and United Open Cut, with an allowance for additional blasts where there are low vibration blasts or misfires.

To avoid any potential issues due to blast interaction, procedures will be put in place to seek to avoid concurrent blasts with the HVO South mine which is located to the north of the Project on the opposite side of the Golden Highway.

United will undertake blasting for the Project in accordance with a detailed blast design process that considers operational, geological and environmental constraints, with the design and size of each blast determined to meet these constraints and satisfy blasting criteria. Blast design and sizes will vary over the life of the Project and will depend on a number of factors including the nature of the overburden/ interburden strata material, the design of open cut benches and environmental considerations. The detailed blast design process will seek to maximise blast efficiency, and minimise potential vibration and overpressure impacts. Blasts will be designed to achieve compliance with the site specific blast conditions. This detailed blast design process will be set out in a Blast Management Plan (BMP) to be prepared for the Project and implemented for all blasting activity. This BMP will be prepared in consideration of the relevant aspects of the existing Wambo Open Cut BMP (Peabody Energy 2014) and Wambo Blast Fume Management Strategy (Peabody Energy 2015a) which are currently being implemented at Wambo.

The Project will utilise a mixture of explosive materials depending on the needs of the specific blast design and considering the strata conditions in which the blast will occur. A Nonel delay system or electronic detonators (or alternate achieving the same outcome) will be used to initiate blasts, allowing for single hole initiation to minimise blast impacts. This approach results in a short delay between each blasted hole and provides greater control of the ground and air vibration impacts.

6.7.2 Blast Sensitive Locations

The Blasting Impact Assessment identified a number of blast sensitive locations within a 5 kilometres radius of the Project. These are shown on **Figure 6.11** and include:

- private residences
- public roads and bridges, including the Golden Highway, proposed Golden Highway realignment and Comleroi Road
- power transmission lines
- Prescribed Dams within Wambo
- Hunter Valley Gliding Club and Warkworth Shooting Complex
- telecommunications infrastructure
- historical sites, including St Philips Church in Warkworth, the Wambo Homestead Complex, the former Warkworth Pubic School, Piggery and Butcher's Hut, former Queen Victoria Inn, Springwood Homestead, the Montrose property (including the shearing shed) and Dog-leg Fence.

The majority of land surrounding the Project Area is mine owned (refer to **Figure 1.8**). The closest private residence (Receiver 19) is located to the southeast of the United Open Cut in Warkworth village and is within approximately 1 kilometre of the proposed pit boundary. All other residences within Warkworth Village are mine owned. The closest private residence to the north of the open cut pit (Receiver 40) is located approximately 1.8 kilometres from the Wambo Open Cut pit boundary on the Golden Highway. A group of residences in the Redmanvale Road area to the northwest of Wambo Open Cut are located a minimum of approximately 2 kilometres from the proposed pit boundary and the village of Jerrys Plains is located approximately 6 kilometres to the northwest of the Wambo Open Cut.

6.7.3 Blast Impact Assessment Methodology

A ground vibration predictive model and an airblast overpressure predictive model were developed to predict the blasting impacts of the Project. The models were calibrated using vibration and airblast monitoring data collected from blasts undertaken in Wambo Open Cut between 2005 and 2012.

A range of blast charge masses and bench heights were modelled for the Project. The modelled blast sizes were selected as being representative of the range of blast sizes that may occur at the mine in practice and to show that blasts can be designed at sizes which enable compliance with the relevant criteria based on the varying distance to the surrounding sensitive receivers.

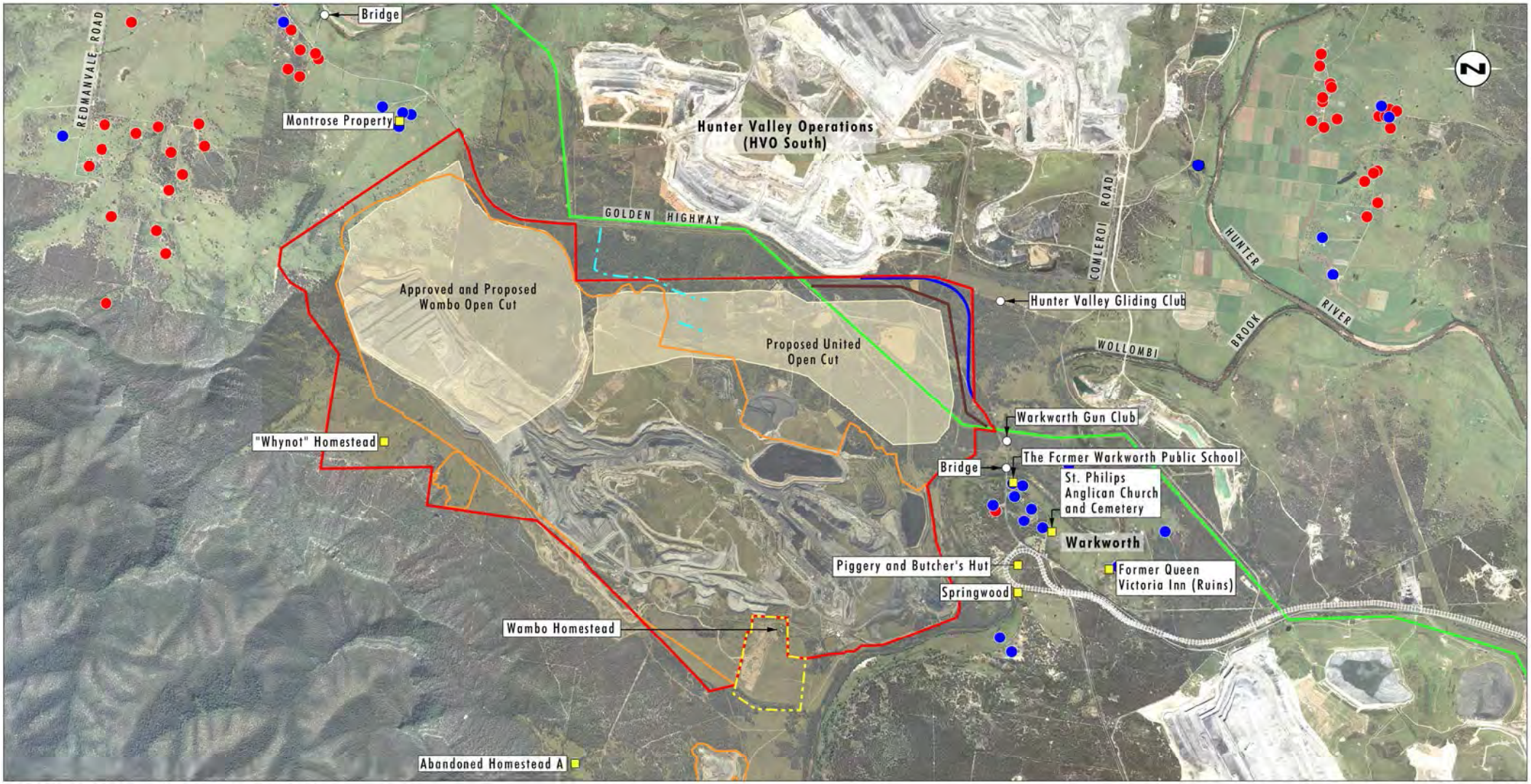


Image Source: AAM (2012), United (2015)
Data Source: Glencore (2014)

0 1.0 2.0 3.0 3.5km
1:65 000

Legend

- Project Area
- Proposed Conceptual Extraction Area
- Approved Wambo Surface Development Area
- Existing 330kV Transmission Line
- Proposed Relocated 330kV Transmission Line
- Proposed Golden Highway Realignment
- Listed and/or Potential Heritage Sites
- Dog Leg Fence
- Mine Owned Residence
- Private Residence

FIGURE 6.11

Blast Sensitive Locations

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6.7.4 Blast Assessment Criteria

A range of blast assessment criteria are relevant to the Project based on the range of blast sensitive locations identified in **Section 6.7.2**. These criteria are outlined below.

The relevant blast assessment criteria associated with human comfort from the ANZECC guidelines '*Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibrations*' are provided in **Table 6.22**.

Table 6.22 Residential Blast Impact Criteria for Human Comfort

Receiver	Peak Particle Velocity (mm/s)	Allowable Exceedance	Overpressure (dBL)	Allowable Exceedance
Residence on privately owned land	5	5 per cent of the total number of blasts over a 12 month period	115	5 per cent of the total number of blasts over a 12 month period
	10	0 per cent	120	0 per cent

The blast assessment criteria associated with property damage relevant to infrastructure and historical items are provided in **Table 6.23.** It is noted that these criteria are impact assessment criteria and not necessarily limits. That is, for some sites blasting impacts greater than these impact criteria may occur and the impacts that occur will be appropriately managed (e.g. for heritage sites this may include heritage recording prior to impacts) as opposed to limiting impacts to below the criteria. These impact criteria may also be revised as an outcome of consultation with the infrastructure or asset owner (e.g. criteria for transmission lines).

Table 6.23 Infrastructure and Historical Site Blast Impact Criteria for the Prevention of Structural Damage

Receiver	Minimum Distance from Proposed Mining Areas (km)	Peak Particle Velocity (mm/s)	Overpressure (dBL)
Public Roads and Bridges	0.1	100	No limit specified
High Voltage Transmission Towers – Tension towers	0.1	50	No limit specified
High Voltage Transmission Towers – Suspension towers	0.1	100	No limit specified
Wambo Tailings Dam	1.3	40[#]	No limit specified
Hunter Valley Gliding Club and Warkworth Shooting Complex	0.5	25	133
Telecommunications infrastructure	0.1	100	No limit specified

Receiver	Minimum Distance from Proposed Mining Areas (km)	Peak Particle Velocity (mm/s)	Overpressure (dBL)
St Philips Church	1.9	5	No limit specified
Wambo Homestead Complex	2.5	5	120
Dog-leg Fence	0.15	No limit specified	No limit specified
Other Historical Sites	0.75	5	133

[#] Progressive limit of 20, 30, 40, 50 mm/s applies, Progressive limit currently set at 40 mm/s.
Note: refer to **Appendix 10** for source of criteria.

6.7.5 Predicted Blast Impacts

The results of the blasting impact assessment indicate that ground vibration and air blast overpressure levels can be managed to meet relevant blast emission criteria at all sensitive receiver locations through appropriate blast design. This may include measures such as the use of variable charge masses and/or precise initiation timing of blasted holes.

6.7.5.1 Private Residences

The predicted ground vibration and airblast overpressure levels that will be experienced at each private residence within a 5 kilometre radius from the proposed open cut extraction areas have been modelled for each of the Wambo and United Open Cut mining areas.

Modelling indicates that ground vibration and airblast overpressure levels can be managed effectively within the relevant blast emission criteria at all private residences, with the exception of residence 19 (refer to **Figure 1.8**). Residence 19 is located in close proximity to the proposed United Open Cut and could potentially experience ground vibration exposure levels and airblast impacts in excess of the relevant limits for human comfort set out in **Table 6.22**. This residence is currently subject to voluntary acquisition rights under the Wambo mine, Wambo train loading facility and MTW development consents. While impacts at this residence could theoretically be managed to meet the criteria by only undertaking very small blasts in the United Open Cut, this is unlikely to be practical operationally. Any blasting impacts in excess of the criteria at residence 19 would be the subject of a negotiated agreement with the resident while it remains privately owned.

In order to achieve the blast emission criteria at all other private residences, management of charge masses (or other techniques) may be required when blasting in proximity to some residences. In the Wambo Open Cut, lower charge masses may be required when blasting in proximity to four private residences located to the northwest along the Golden Highway and Redmanvale Road areas to manage blast overpressure levels. It is noted that three of these residences (receivers 28, 39 and 40) are located within the predicted noise affectation zone for the Project and are likely to have voluntary acquisition rights should the Project be approved. Predicted vibration levels at these four private residences are well within the vibration criteria for human comfort for the full range of blast charge masses modelled. A detailed blast design process would be undertaken for each blast in order to establish the charge masses required to meet the relevant blast emission criteria at these locations (refer to **Section 6.7.4**)

The risk of flyrock to surrounding private residences has been assessed as low given the substantial distances (greater than 1 kilometre) from the extraction areas and the implementation of appropriate exclusion zones. As discussed below, blasts are specifically designed and exclusion zones are established for all blasts to manage the risk of flyrock.

6.7.5.2 Golden Highway and Comleroi Road

The Golden Highway is located (at its closest point) approximately 120 metres from the edge of the proposed Wambo Open Cut and will also be within 120 metres of the United Open Cut, once realigned as part of the Project. Ground vibration modelling indicates that impacts to the Golden Highway can be managed effectively below the relevant 100 mm/s criteria through the application of lower charge masses for some blasts (those closest to the Golden Highway). Similarly, ground vibration impacts on Comleroi Road and bridges surrounding the Project Area can be managed below the 100 mm/s criteria through the application of lower charge masses in some areas, as required.

Flyrock will be managed through the implementation of appropriate exclusion zones and in accordance with a road closure protocol to be developed in consultation with RMS and Singleton Council as part of the Blast Management Plan for the Project. Closures of the Golden Highway will be managed in consultation with HVO in order to minimise the frequency of closures for road users. United will limit road closures associated with the Project on the Golden Highway to a maximum of one per day, consistent with the requirements of the existing Wambo mine development consent.

6.7.5.3 Infrastructure

Ground vibration impacts on the existing and relocated 330kV and 66kV transmission lines and telecommunications infrastructure surrounding the Project Area can be managed effectively below the relevant criteria through the application of lower charge masses.

Predictions of ground vibration and airblast overpressure were found to comply with the relevant criteria at all assessed blast bench sizes, for all other infrastructure identified in **Table 6.23**.

In regard to potential impacts on mine owned infrastructure and underground mine workings, the interactions between the Project and the Wambo mine will be managed in accordance with the Joint Venture agreement. In regard to HVO South infrastructure, the closest infrastructure is over 1 kilometre from the United Open Cut and the blasting impact assessment found that vibration impacts can be managed effectively below the applicable vibration criteria for these infrastructures. An addendum to the Blasting Impact Assessment has been prepared in regard to the HVO Riverview Pit Dam wall, which became a prescribed dam in 2016, is also included in **Appendix 10**. There are no vibration limits set for the dam wall, with the addendum identifying that United will continue to consult with HVO regarding blast notifications so that appropriate inspections can be undertaken for blasts within 500 metres of the dam wall.

6.7.5.4 Historical Sites

Predictions at the Wambo Homestead Complex are well within the ground vibration and airblast overpressure criteria established under the existing Wambo mine development consent and no impacts due to blasting are predicted.

Predictions of ground vibration and airblast overpressure were found to be below the impact criteria at all assessed blast bench sizes, for all other historical sites identified in **Table 6.23**, with the exception of the Former Warkworth Public School and Montrose property (including the shearing shed). As discussed in **Section 6.11**, the shearing shed associated with the Montrose Property will be subject to heritage archival recording prior to any blasting which may impact on the building. The house associated with the Montrose Property has been subject to archival recording as part of the Heritage Impact Statement for the Project. In regard to the former Warkworth Public School, which is no longer a school and is owned by a mining company, blasts will be managed to meet 5 mm/s to negate the risk of vibration impacts except where agreed otherwise with the owner and/or based on a structural assessment that identifies an alternate acceptable vibration level.

The Dog-leg Fence, which has been assessed as being of a state level of significance (refer to **Section 6.11**), is predicted to experience vibration impacts in the order of 0.5 mm/s to 140 mm/s. Given the nature of the structure which is in a state of disrepair and is structurally unsound, the potential impacts of vibration on the fence cannot be accurately predicted. It is acknowledged that impacts to the fence could occur and therefore archival recording and an interpretation strategy are proposed. These impacts are discussed in **Section 6.11**.

6.7.5.5 Livestock

An assessment of potential ground vibration, airblast overpressure and flyrock exposure was completed for surrounding private grazing land. In the absence of accepted vibration criteria for livestock, potential impacts on livestock have been considered in a conservative manner in the context of the criteria for human comfort. The assessment concluded that based on predicted ground vibration and airblast overpressure, there were no concerns for the wellbeing of livestock surrounding the Project Area. Given the significant distances from any potential blasting to private grazing land (at least 1.2 kilometres), the risk of injury to livestock from flyrock was negligible.

6.7.5.6 Cumulative Impacts

Due to the Project's proximity to adjoining mining operations, without appropriate management, there is a possibility of concurrent blasting with nearby mining operations (e.g. HVO and MTW) which may result in cumulative airblast and vibration impacts on nearby residences and structures. As discussed above, all blasting undertaken as part of the Project will be managed to meet the relevant criteria except where an agreement is in place with the land owner.

United will liaise with the operators of these mining operations regarding the coordination of blasting activities so as to minimise the possibility of concurrent blasting and therefore cumulative airblast and vibration impacts. Procedures for liaison with the operators of other mining operations will be set out in the Blast Management Plan to be prepared for the Project.

6.7.6 Blasting Management and Monitoring

United will implement the blast management controls necessary to meet the relevant criteria for private residences (except where an agreement is in place with the land owner), infrastructure, heritage sites and other sensitive receivers.

Blasting activities will be undertaken in accordance with a Blast Management Plan to be prepared and implemented for the Project. This Blast Management Plan will be prepared in consideration of the relevant aspects of the existing Wambo Open Cut Blast Management Plan (Peabody Energy 2014) and the Blast Fume Management Strategy, which is currently being implemented at Wambo. The Blast Management Plan will include the following management and monitoring measures to minimise the potential impacts of blasting activities:

- a pre-blast assessment protocol that outlines the process for designing blasts to meet the relevant criteria, which may include limiting the charge mass of blasts close to potentially affected locations or other blast vibration management controls (e.g. optimisation of initiation design)
- blasting will be undertaken between 9.00 am and 5.00 pm Monday to Saturday
- a maximum of 15 blasts per week and three blasts per day, with an allowance for additional blasts where there are low vibration blasts or misfires
- blasting related closures of the Golden Highway associated with the Project will be limited to one per day
- continued operation of the existing multi-station blast monitoring system for the Wambo Open Cut and installation of one additional monitoring station located to the northeast in the Maison Dieu area
- access to weather monitoring data to allow for the assessment of pre-blast meteorological conditions as part of the pre-blast assessment protocol
- development of a road closure management plan in consultation with RMS and Singleton Council
- implementation of appropriate exclusion zones to manage the risk of flyrock
- coordination of blasting times between the two Project mining areas to avoid blasting occurring simultaneously
- liaison with the operators of nearby mines in relation to the coordination of blasts to avoid concurrent blasting and therefore cumulative airblast and vibration impacts
- liaison with HVO regarding blasting within 500 metres of the Riverview Pit Dam wall.

In addition to the measures outlined above, United will offer all private residential landholders located within 2 kilometres of the Project extraction areas a property inspection prior to the commencement of blasting for the Project in order to establish the condition of private structures. A condition assessment will also be completed of all historical sites located within 2 kilometres of the extraction areas that are proposed to be retained or that have not been subject to archival recording, prior to the commencement of blasting for the Project.

6.8 Water Resources

The Project will interact with both surface waters and groundwater, and the effective management of this valuable natural resource was a key consideration in Project planning. To assess the potential impact of the Project on water resources, comprehensive assessments of the potential surface water impacts and groundwater impacts were undertaken by Umwelt and AGE and are provided in **Appendices 11** and **12** respectively. These assessments were prepared in accordance with the SEARs issued for the Project (refer to **Table 4.3**) and have also had regard to the specific issues raised by DPI Water, EPA and DoE. An

overview of the key findings of the surface water and groundwater assessments is provided in **Sections 6.8.1** and **6.8.2** respectively.

Potential water related impacts were raised by a small number of community members as an issue of concern during the extensive stakeholder engagement process undertaken for the Project. Relevant government agencies (DPI Water, EPA and DRE) were also consulted during the preparation of the EIS on the potential impacts on water resources, and their comments considered in the preparation of the EIS. The key issues raised for consideration by these agencies were generally consistent with the assessment requirements in the SEARs and issues identified by various agencies in correspondence provided with the SEARs, along with commentary on the design of the final voids from DRE.

6.8.1 Surface Water Assessment

Any large scale open cut mining project will affect and interact with surface waters. This includes potential changes to flows, water quality and uses of water as part of the operations. The key features of the Project that have the potential to impact on surface water include:

- landform changes as a result of open cut mining operations, including
    - open cut mining
    - overburden emplacement areas
    - clean water management
    - flood protection works
- infrastructure upgrades including
    - relocation of the Golden Highway
    - relocation of electrical transmission lines
- changes to the water balance associated with the Project, including any changes to the import of water to the site or discharge of water from the site
- ongoing rehabilitation of mine areas.

Some minor potential impacts may also result from proposed mining support infrastructure and associated services.

The potential impacts of the Project on surface water resources are discussed further in the following sections.

6.8.1.1 Regulatory Context

The Project exists within a well-regulated system that has been designed to provide for the sustainable management of the State's water resources. This includes licensing of allowable water take with consideration of environmental flow requirements of watercourses and the needs of other water users; control of water pollution, including management of sustainable salt loads associated with all water sources, including mine water discharges; and guidelines that govern the appropriate design of water management systems for mines to provide for appropriate water quality in accordance with EPL requirements.

There are two key acts that provide the regulatory framework for water management in NSW. These acts are the *Water Management Act 2000* (WM Act) and the *Water Act 1912*. The *Protection of the Environment Operations Act 1997* (POEO Act) is the key piece of environment protection legislation that regulates pollution control (including water pollution) in NSW and is administered by the EPA.

6.8.1.2 Existing Surface Water Environment

Catchment Areas and Watercourses

The Project Area is located within the catchments of Wollombi Brook and Waterfall Creek, both tributaries of the Hunter River. Wollombi Brook is located to the east of the Project Area and flows into the Hunter River approximately 5 kilometres northeast of the Project Area (refer to **Section 1.6**). Waterfall Creek is a minor tributary of the Hunter River and flows into the Hunter River approximately 4 kilometres northwest of the Project Area.

The Hunter River is a regulated river with releases from Glenbawn Dam and Glennies Creek Dam managed by WaterNSW under a Water Sharing Plan. Glenbawn Dam is located in the upper reaches of the Hunter River upstream of the Project Area. Glennies Creek Dam is located on Glennies Creek upstream of Singleton. The confluence of Glennies Creek with the Hunter River is located downstream of the Project Area.

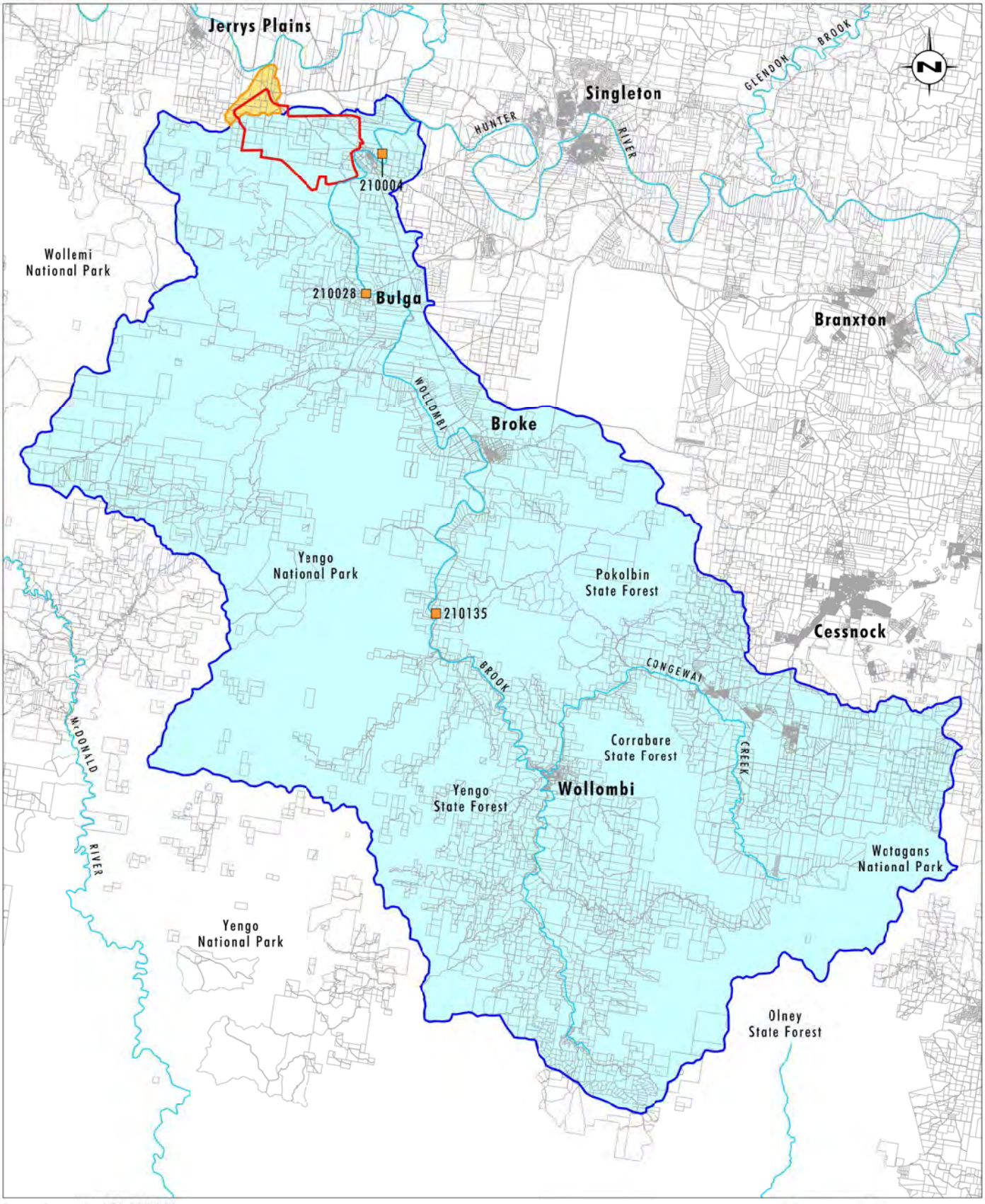
The majority of the Project Area lies within the lower part of the Wollombi Brook catchment. The total catchment area of Wollombi Brook is substantial (approximately 1850 km^2) and approximately 99 per cent of the catchment area lies upstream of the Project Area (refer to **Figure 6.12**). Wollombi Brook catchment in the vicinity of the Project Area includes sub-catchments of Wambo Creek, North Wambo Creek and Redbank Creek (refer to **Figure 1.7**). Waterfall Creek, a sub-catchment of the Hunter River, is located in the north of the Project Area. The existing United and Wambo Water Management Systems (WMSs) are also located within the Project Area. The extent of the existing WMSs is shown on **Figure 1.7**.

Wambo Creek, including its tributary Stony Creek, flows in a northeasterly direction and joins Wollombi Brook approximately 2 kilometres upstream of the Project Area. North Wambo Creek flows in a generally southeasterly direction through and along the southern flank of the Project Area, joining Wollombi Brook approximately 1 kilometre south of the Project Area. A section of North Wambo Creek has previously been diverted as part of the approved Wambo Open Cut mining operations. Redbank Creek's confluence with Wollombi Brook is located to the east of the Project Area, while Waterfall Creek is a minor drainage line that flows away from the Project Area in a northeasterly direction to the Hunter River. Redbank Creek flows through the centre of the United site and into a clean water catch dam, with United holding a licence to use water from this dam for mining operations.

The catchment boundaries for watercourses within and surrounding the Project Area are shown in **Figure 1.7**. Previous mining operations within the Project Area have modified local catchments through the capture of runoff from mining areas within the existing WMSs and diversion of upslope runoff around the mining operations.

Surface Water Flows

Surface water flows are measured locally at several gauging stations. The locations of these gauging stations are shown on **Figure 6.12**. The Warkworth gauge is located adjacent to the Project Area, upstream of the confluence of Redbank Creek and Wollombi Brook. The data recorded at the Warkworth gauge is considered to be representative of flows in Wollombi Brook adjacent to and downstream of the Project Area as the majority of the Wollombi Brook catchment area lies upstream of the Project Area. The flow duration curve, which presents the likelihood of the total volume of flow in Wollombi Brook during each day, indicates that flows are typically seasonal. The analysis indicates that flows are typically lower during summer compared to winter.



Legend

- Project Area
- Wollombi Brook Catchment
- Waterfall Creek Catchment
- Stream Gauging Station

FIGURE 6.12

Catchment Context

Wambo operates several continuous flow gauging stations along North Wambo Creek. Monitoring shows that the creek is ephemeral, typically only flowing in response to intense rainfall with multi-year no-flow periods (Peabody Energy 2015b). The flow gauges were installed following the June 2007 flood event. Due to the limited period that the flow gauges have been installed (i.e. under 9 years) and that this creek system is ephemeral, there is insufficient data to accurately discern the flow characteristics of North Wambo Creek.

There are no long term flow gauges on Wambo Creek or Redbank Creek which are also tributaries of Wollombi Brook.

There are no flow gauges on Waterfall Creek. Flows are monitored downstream of the Hunter River and Waterfall Creek confluence in the Hunter River. Long term river flow records are available at the flow gauge at Singleton (since 1891) approximately 28 kilometres downstream of the confluence of Waterfall Creek with the Hunter River. The flow duration curve, which presents the likelihood of the total volume of flow within the river during each day, indicates that flows have limited seasonality. This is likely due to the regulated nature of the river.

Surface Water Quality

Surface water monitoring programs are currently being implemented at United and Wambo with the content of these monitoring programs being approved by the NSW Government. The existing surface water quality monitoring locations for both operations are shown in **Figure 6.13**.

Results of surface water quality monitoring undertaken from 2004 to 2015 for Wollombi Brook, North Wambo Creek, Redbank Creek, and from 2012 to 2015 for Stony Creek and Waterfall Creek, as well as for the WMSs were examined as part of the surface water assessment (refer to **Appendix 11**).

The monitoring data shows that the water quality parameters are highly variable across the monitoring network, as would be expected within ephemeral drainage systems. Wollombi Brook, being more perennial, exhibits notably less variation in its water quality. The water quality in Wollombi Brook shows little variation at monitoring locations upstream and downstream of the existing operations, indicating that Wollombi Brook is not exhibiting any measurable impacts due to the existing operations.

The ephemeral creek systems within and adjacent to the Project Area also generally exhibit similar water quality results upstream and downstream of the existing operations. Again, this suggests little to no measurable impact on the surrounding ephemeral watercourses as a result of the mining operations. Notably, the measured total suspended solids (TSS) load actually decreases downstream of the existing operations in Redbank Creek and Stony Creek, and is similar in North Wambo Creek, indicating that the existing WMS is generally effective at managing TSS within the site.

Analysis of the concentrations of various metals and metalloids reveals a generally wider spread in the concentrations detected in the samples from the existing operations compared with the samples from the surrounding surface water systems. There are several parameters monitored within the existing WMSs for which the mean and median values exceed the ANZECC 95th percentile guideline value for the protection of freshwater ecosystems including cadmium, chromium, copper, lead, nickel and zinc. However, these exceedances are not reflected in downstream receiving waters, supporting the view that the existing WMSs are effective in containing and managing poorer quality water.

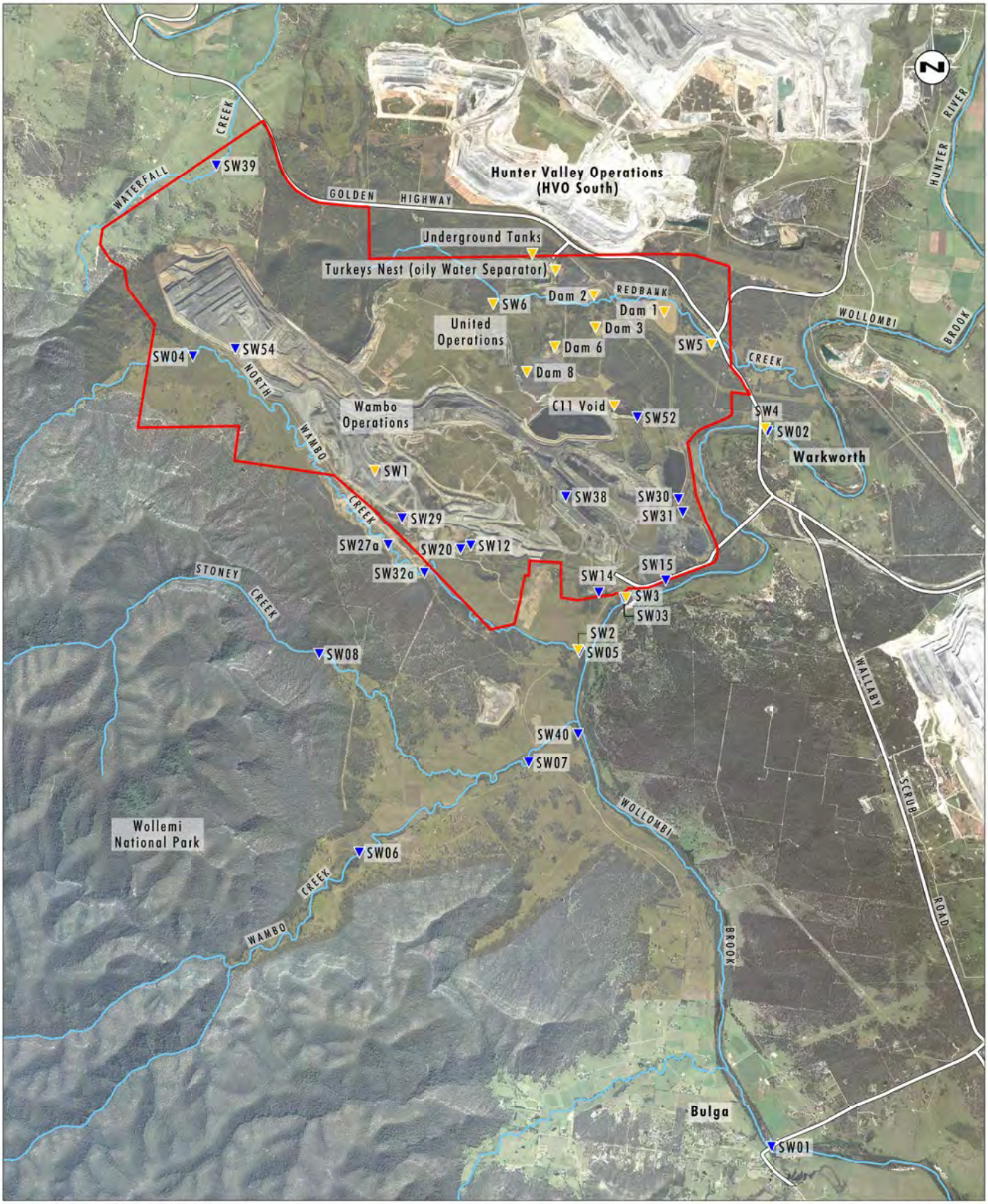


Image Source: United (2015)
Data Source: Glencore (2015), Peabody Energy (2015)

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Legend

- Project Area
- United Surface Water Monitoring Site
- Wambo Surface Water Monitoring Site

FIGURE 6.13

Existing Surface Water Quality Monitoring Locations

Water Users

Water extraction/abstraction both in and surrounding the Project Area is regulated by the NSW Government by water sharing plans (WSP). Water Access Licences (WAL) are held by both United and Wambo under the *Water Sharing Plan for the Hunter Regulated River 2004* and the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009.*

Both United and Wambo periodically extract water under licence from Wollombi Brook/Hunter River.

There are no known water extraction points for other operators on Wollombi Brook downstream of the Project Area. There are no known licensed water users on waterways directly downstream of the Project Area along Wollombi Brook, its tributaries (Wambo Creek, North Wambo Creek and Redbank Creek) or Waterfall Creek.

Water extraction from the Hunter River downstream of the confluence of Waterfall Creek is undertaken by mining operations, irrigators and for stock and domestic purposes. Water supply for townships on the Hunter River downstream of the Project Area is sourced from Glennies Creek Dam.

Under NSW legislation, basic landholder rights allow take of surface water runoff and take of water from rivers, estuaries and lakes from land which has frontage to these sources under harvestable rights provisions and domestic and stock rights respectively. The majority of land adjacent to Wollombi Brook downstream of the Project Area to the Hunter River is owned by mining operations. There are also a number of parcels of Crown land as well as land held by Singleton Council, Wanaruah Local Aboriginal Land Council and private landholders around the township of Warkworth. Similarly the land adjacent to Wambo and North Wambo Creeks is, in majority, owned by mining operations, with all land along Redbank Creek mine owned.

The majority of land adjacent to Waterfall Creek downstream of the Project Area to the Hunter River is also owned by mining operations. There is also a parcel of Crown land adjacent to the Hunter River.

6.8.1.3 Existing Surface Water Management Systems

Both United and Wambo mines have extensive existing WMSs in place which include mine dewatering systems, water storages, sedimentation and retention basins, and water diversions and catch drains. Both WMSs have similar key objectives. The key objectives as listed in the United Water Management Plan are presented below:

- *prevent the contamination of clean water by mining activities*
- *segregate clean waters away from active mining areas to reduce the volume of mine affected water requiring subsequent storage and treatment*
- *minimise the discharge of pollutants from mining affected areas into the environment*
- *quantify the water used, stored and imported/exported, and*
- *maximise recycling and water sharing opportunities.*

The layout and extent of the existing WMSs are shown in **Figure 6.14**.

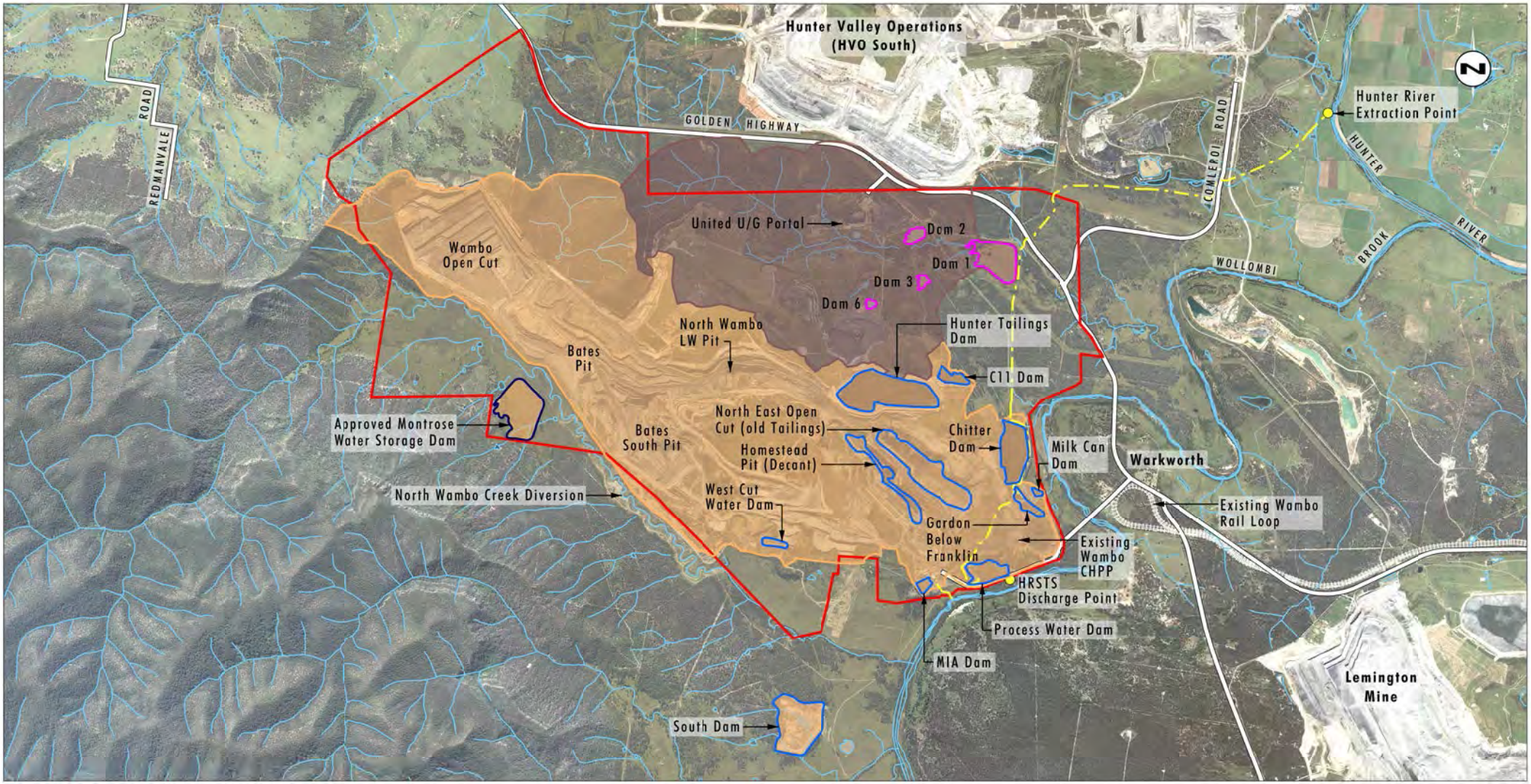


Image Source: AAM (2012), United (2015)
Data Source: Glencore (2014)

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1:60 000

Legend

- Project Area
- Wambo WMS Boundary
- United WMS Boundary
- Wambo Dams
- United Dams
- Approved Montrose Water Storage Dam
- Wambo Hunter River Pipeline

FIGURE 6.14

Existing Water Management System

File Name (A4): R06/3509_372.dgn
20160512 15.10

The water management strategies currently employed at both United and Wambo to avoid, mitigate and manage potential impacts on surface water are outlined in the approved water management plans for the operations. The approved water management and associated plans for the existing operations outline the following:

- current water management systems
- water quality monitoring programs
- water balance, and
- reporting mechanisms.

The Project will have the effect of increasing the disturbance area associated with mining. The existing WMSs will therefore need to be extended and modified as part of the Project.

The quantity and quality of water discharges from mining operations in the Hunter Region is managed in accordance with relevant EPLs and consistent with the provisions of the Hunter River Salinity Trading Scheme (HRSTS). As part of the development of the HRSTS, the NSW Government has determined the sustainable salt load for the Hunter River, considering the impacts on the environment. The HRSTS is managed such that discharges from industrial operations can only occur in suitable conditions. Wambo has a licence and salt credits to discharge water in accordance with the HRSTS into Wollombi Brook. United also holds salt credits under the HRSTS but does not currently have a licence to discharge saline water.

6.8.1.4 Proposed Water Management System

The conceptual water management strategy for the Project has been designed to integrate the water management of the Project with the existing WMSs. The key drivers for the strategy are the separation of clean and dirty water; seeking to prevent the contamination of clean water by mining activities; maximising water recycling and reuse opportunities; effectively managing water across the United and Wambo complex; and managing compliance with statutory obligations. A detailed description of the proposed conceptual WMS for the Project is provided in **Appendix 11**.

For the Project, three categories of water have been identified to be managed:

- Clean water – Runoff from undisturbed areas or rehabilitated areas where vegetation is fully established, and where the water quality is suitable for release/discharge, and raw water imported under licence.
- Dirty water (including sediment laden water) – Runoff from disturbed areas, such as active overburden emplacement areas or overburden emplacement areas where vegetation is not fully established. These areas have the potential for elevated TSS.
- Mine water – Mine water, being water exposed to coal or used in coal processing and runoff within parts of the MIAs, including groundwater that seeps into the open cut pit. This water typically has a higher level of salinity.

The target design criteria for the three categories of water are summarised in **Table 6.24**.

Table 6.24 Design Criteria for Components of the Project WMS

Water Category	Water Description	Target Design Criteria
Clean	Runoff from undisturbed or established rehabilitation areas	Intercept, convey and/or release, where practicable, to downstream environment
Dirty	Runoff from disturbed areas	Managed in line with the Blue Book (Managing Urban Stormwater: Soils and Construction Volumes 1 and 2E)
Mine	Runoff from areas exposed to coal, groundwater inflow, water used in coal processing or from coal stockpile areas	Mine water storages to have sufficient freeboard to contain runoff for events up to and including the 1 per cent 24 hour AEP (annual exceedance probability) storm event.

Wherever practicable dirty water and mine water will be utilised to meet the water needs for the Project and for Wambo to assist in minimising the demand for raw/clean water imports. Excess water that cannot be utilised on site or shared to nearby mining operations will be discharged in accordance with the HRSTS when suitable discharge conditions occur.

The existing clean water management system includes a series of clean water drains and clean water dams around the perimeter of the mining area to minimise the volume of runoff from the upstream catchments entering active mining areas. As mining progresses, the clean water controls will be maintained by the construction of new drains and dams as needed. The existing dirty water management system includes a series of catch drains and sediment dams to capture and manage runoff from disturbed areas. As mining progresses, runoff from disturbed areas will be managed within the WMS and reused, or if water quality meets required guidelines, will be released to downstream waterways. The sediment dams will be emptied into the site WMS using pump and pipe or gravity systems after rainfall events so that the required sediment dam capacity is retained.

Runoff from coal handling, processing and stockpile areas, tailings water reclaim and groundwater inflows into the mine water management system is pumped to the Process Water and CHPP Dams and other dams within the WMS for reuse within the operations.

Flood modelling of Wollombi Brook indicates that the inundation extent of the 1 per cent AEP flood event includes an area of the proposed footprint of the United Open Cut. The flood inundation in this area is due to backwater from Wollombi Brook entering the lower reaches of Redbank Creek during flood events. To protect the United Open Cut from flooding it is proposed to construct a flood levee (refer to **Figure 3.23**). The flood levee will be designed to provide flood protection to the United Open Cut for flood events up to and including the 0.1 per cent AEP flood event (i.e. the 1000 year Average Recurrence Interval (ARI) flood event).

The existing United underground mine (refer to **Figure 2.1**) is currently used as a water storage facility and the WMS plans to continue this use as part of the Project. Excess water will be pumped underground and water extracted from the underground storage as needed for use on the site. Both United and Wambo Mines have been using water extracted from the United underground workings as part of normal mining operations over a number of years.

The layout of the key components of the proposed conceptual WMS for the life of the Project is shown on **Figures 6.15** to **6.19** for key stages during the life of the Project and subsequent mine closure. It is important to note that the stage plans presented in **Figures 6.15** to **6.19** are conceptual only. The WMS will be constructed and modified as and when required to support the infrastructure and mine development. The stage plans indicate only the components of the WMS which are required for a particular stage of the mine, and do not preclude the construction of components as required during the Project.

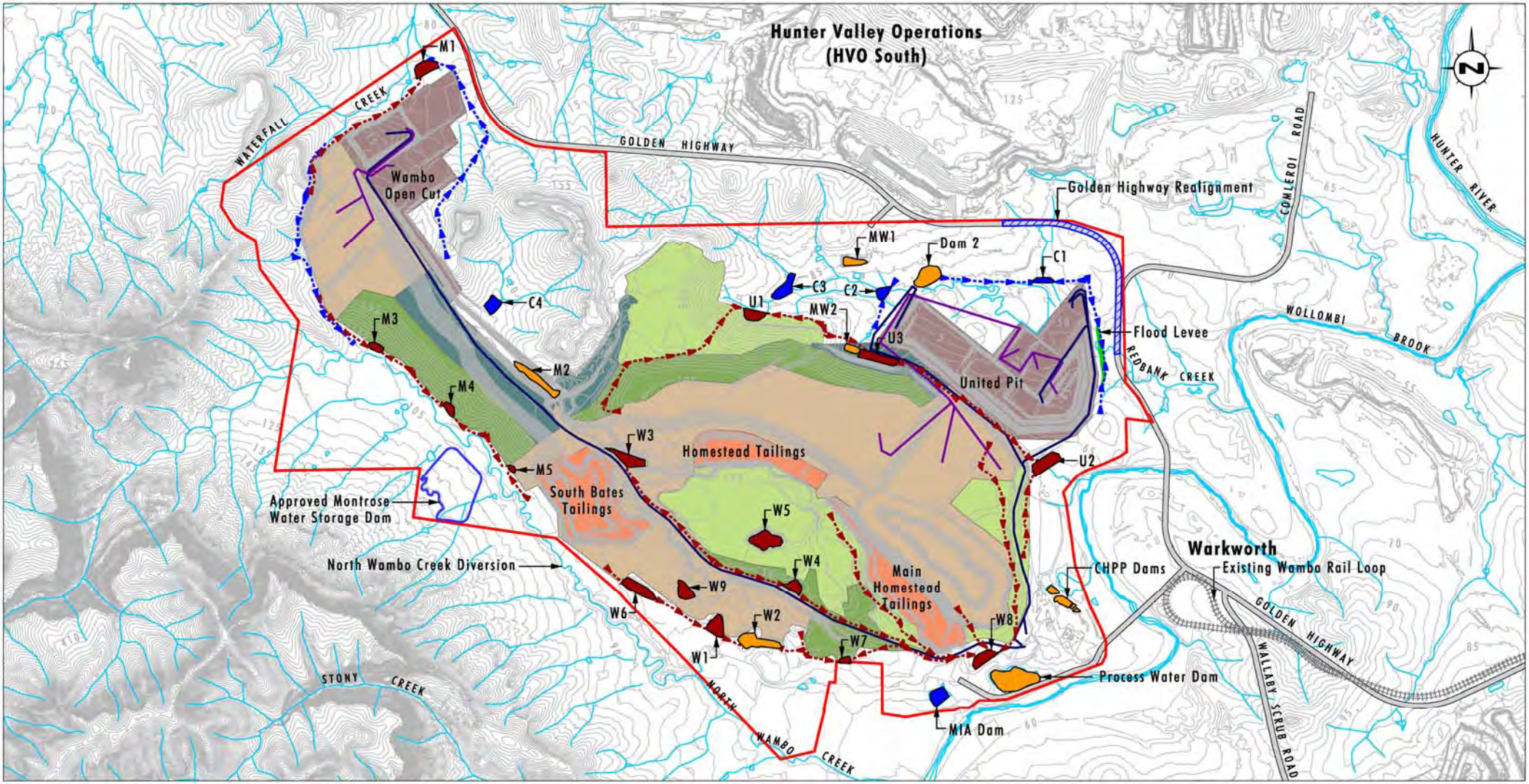
6.8.1.5 Site Water Balance

The WMS for the Project provides for the management of water for the open cut operations and will be integrated with the WMS for Wambo which relates to the Wambo Underground, CHPP and train loading facility. As such, the water balance for the Project has been modelled as an integrated balance including both the Project and Wambo. A detailed water balance assessment has been completed for the Project by Hydro Engineering and Consulting Pty Ltd (HEC) and forms an appendix to the Surface Water Assessment report (refer to **Appendix 11**).

The use and management of water within the Wambo Underground, CHPP and train loading facility will continue to be managed pursuant to the existing development consents. Due to the integrated nature of the WMSs, the overall water balance of the integrated WMS (which includes water make and use at the Wambo Underground, CHPP and train loading facility) has been considered in the water balance assessment.

Inflows to the water balance include site rainfall runoff, tailings water reclaim, groundwater inflows and water extracted under licence from Wollombi Brook and the Hunter River. The primary water source is rainfall and runoff.

The modelled overall site water balance is summarised in **Table 6.25**. During periods of water surplus, water will be discharged via the Wambo discharge point in accordance with the EPL and HRSTS. Water will also be imported as necessary via licensed abstractions from Wollombi Brook and the Hunter River. The modelling indicates that the Project will have a high level of water supply reliability to the Project and the Wambo Underground, CHPP and train loading facility.



Base Data Source: Glencore (2015), LPI (2009)
Note: Contour Interval 5m.

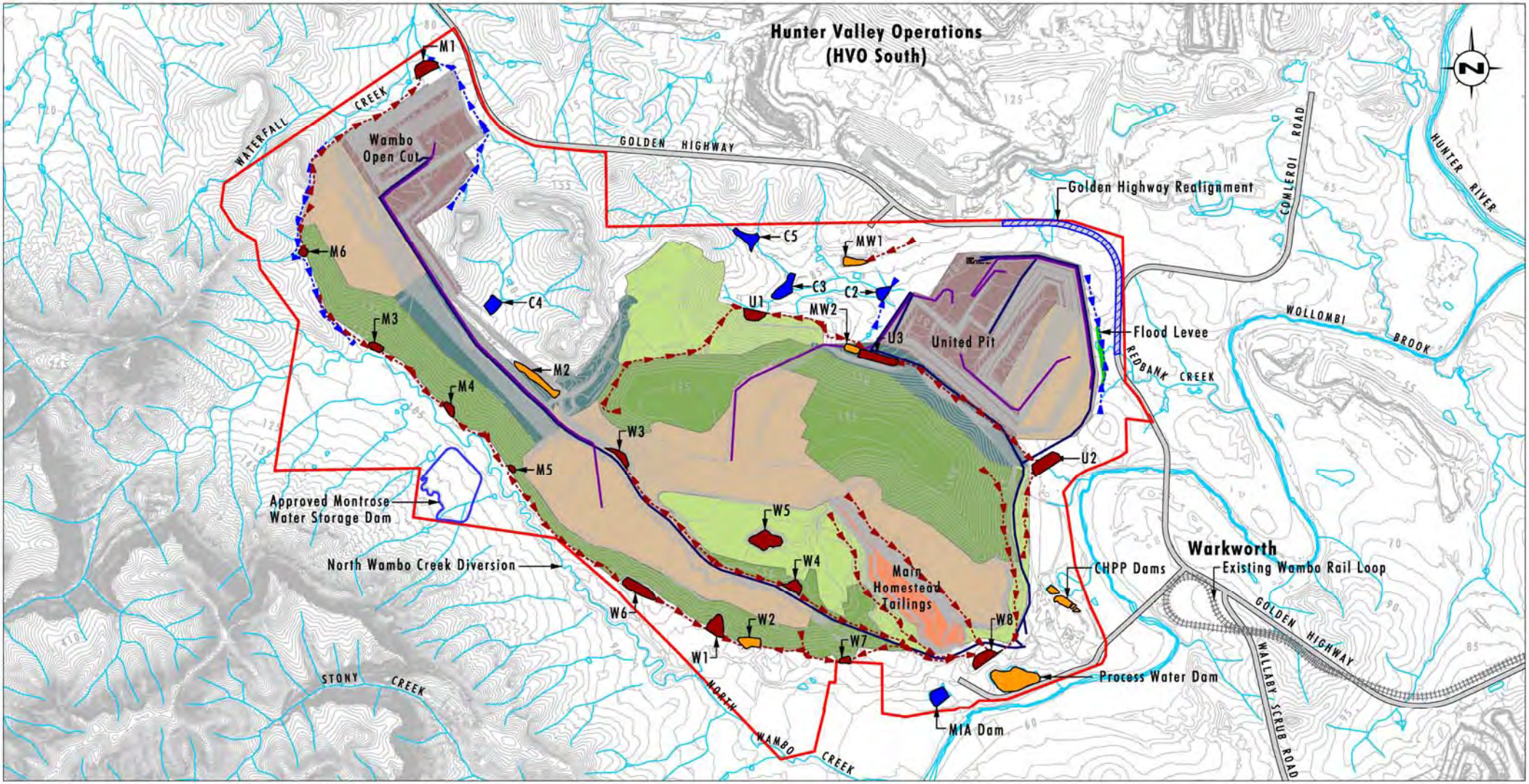
Legend

- Project Area
- Active Dumping Area
- Active Mining Area
- Rehabilitation
- Existing Rehabilitation
- Temporary Rehabilitation
- Tailings Emplacement
- Waste Haul Road
- Coal Haul Road
- Drainage Line
- Clean Dam
- Clean Drain
- Dirty Dam
- Dirty Drain
- Mine Water Dam

FIGURE 6.15

Conceptual Water Management System Year 2

File Name (A4): R06/3509_373.dgn
20160729 11.44



Base Data Source: Glencore (2015), LPI (2009)
Note: Contour Interval 5m.

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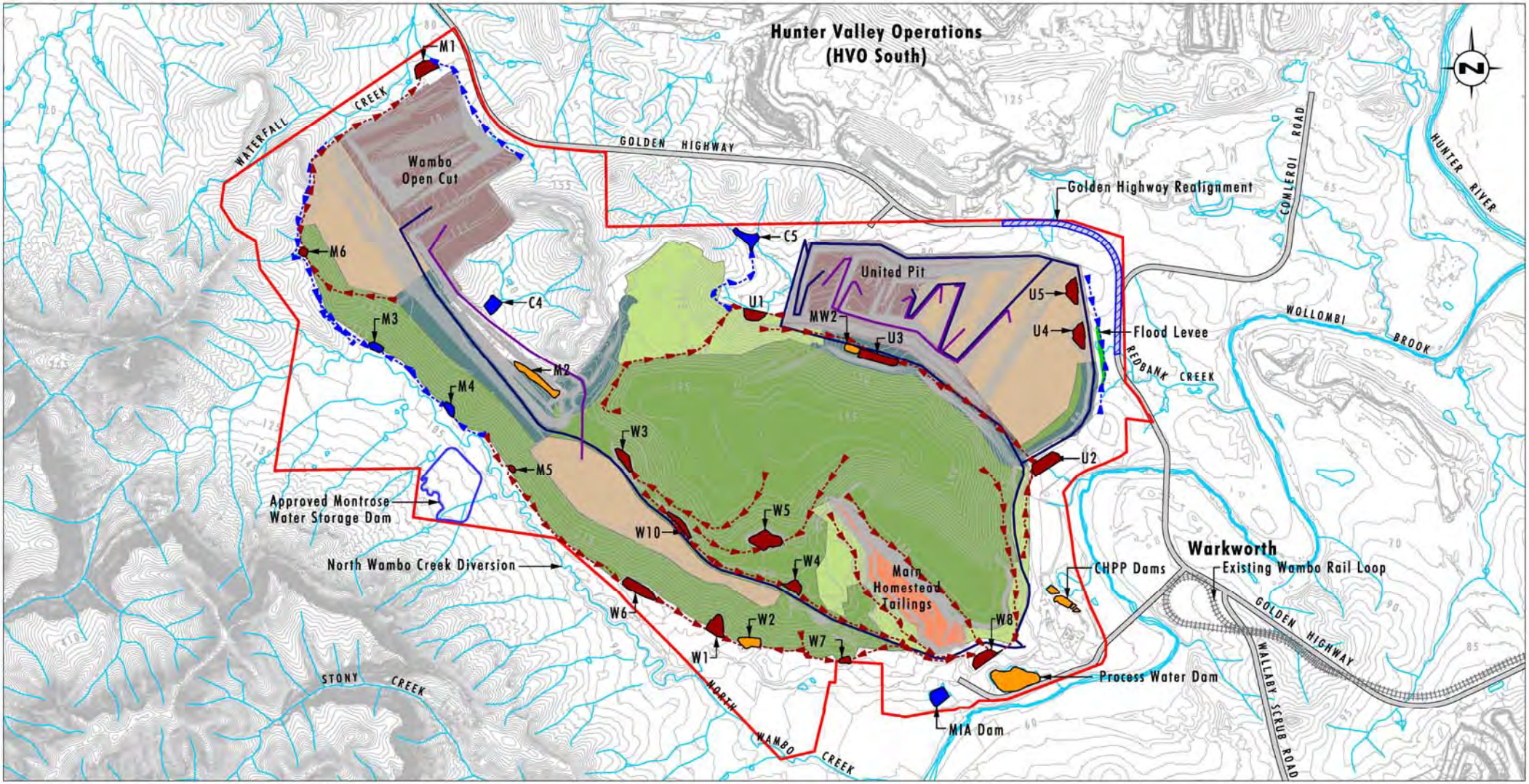
Legend

- Project Area
- Active Dumping Area
- Active Mining Area
- Rehabilitation
- Existing Rehabilitation
- Temporary Rehabilitation
- Tailings Emplacement
- Waste Haul Road
- Coal Haul Road
- Drainage Line
- Clean Dam
- Clean Drain
- Dirty Dam
- Dirty Drain
- Mine Water Dam

FIGURE 6.16

Conceptual Water Management System Year 6

File Name (A4): R06/3509_374.dgn
20160729 11:46



Base Data Source: Glencore (2015), LPI (2009)
Note: Contour Interval 5m.

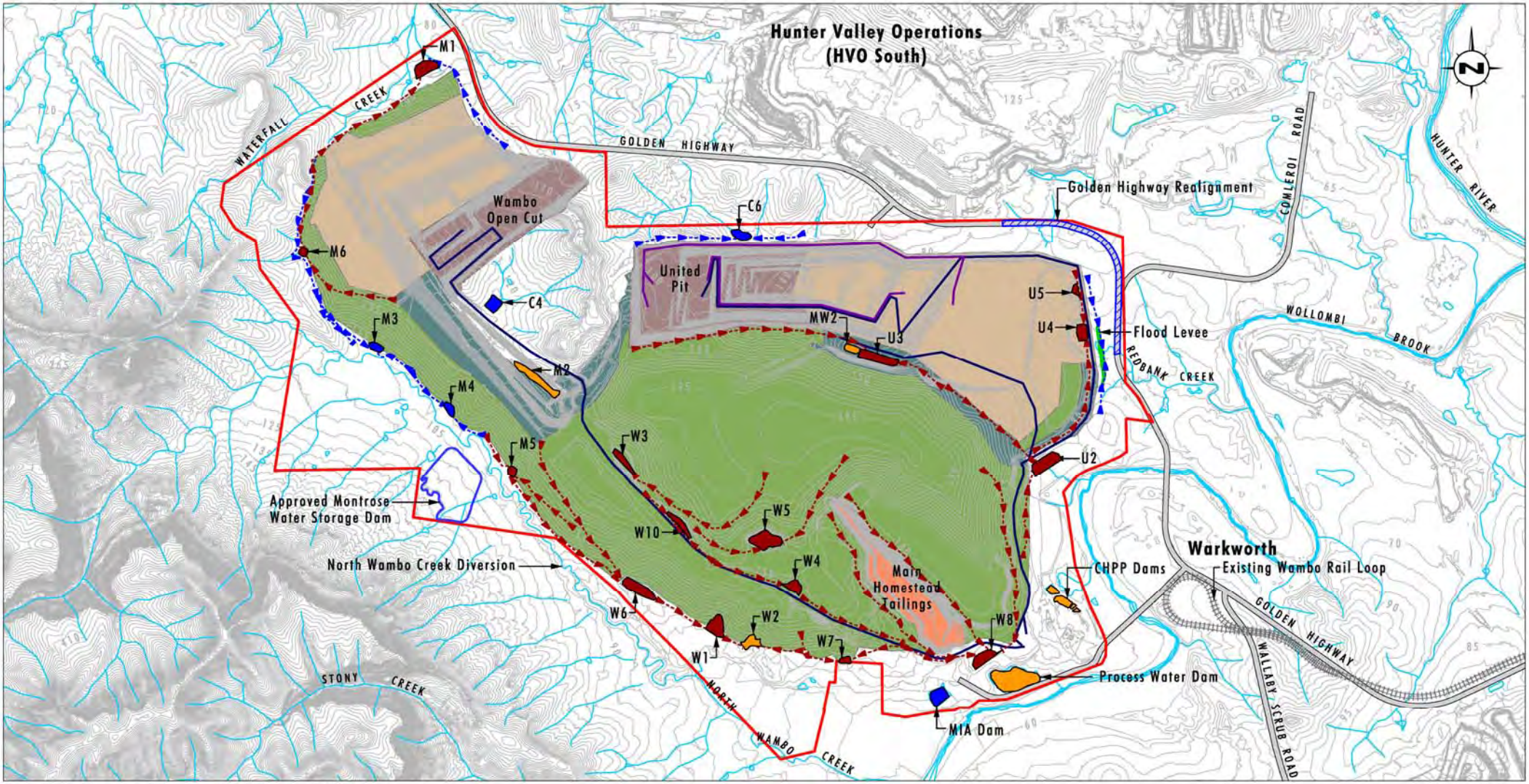
Legend

- Project Area
- Active Dumping Area
- Active Mining Area
- Rehabilitation
- Existing Rehabilitation
- Temporary Rehabilitation
- Tailings Emplacement
- Waste Haul Road
- Coal Haul Road
- Drainage Line
- Clean Dam
- Clean Drain
- Dirty Dam
- Dirty Drain
- Mine Water Dam

FIGURE 6.17

Conceptual Water Management System Year 11

File Name (A4): R06/3509_375.dgn
20160729 11:55



Base Data Source: Glencore (2015), LPI (2009)
Note: Contour Interval 5m.

Legend

- Project Area
- Active Dumping Area
- Active Mining Area
- Rehabilitation
- Temporary Rehabilitation
- Tailings Emplacement
- Waste Haul Road
- Coal Haul Road
- Drainage Line
- Clean Dam
- Clean Drain
- Dirty Dam
- Dirty Drain
- Mine Water Dam

FIGURE 6.18

Conceptual Water Management System Year 16

File Name (A4): R06/3509_376.dgn
20160729 11:56

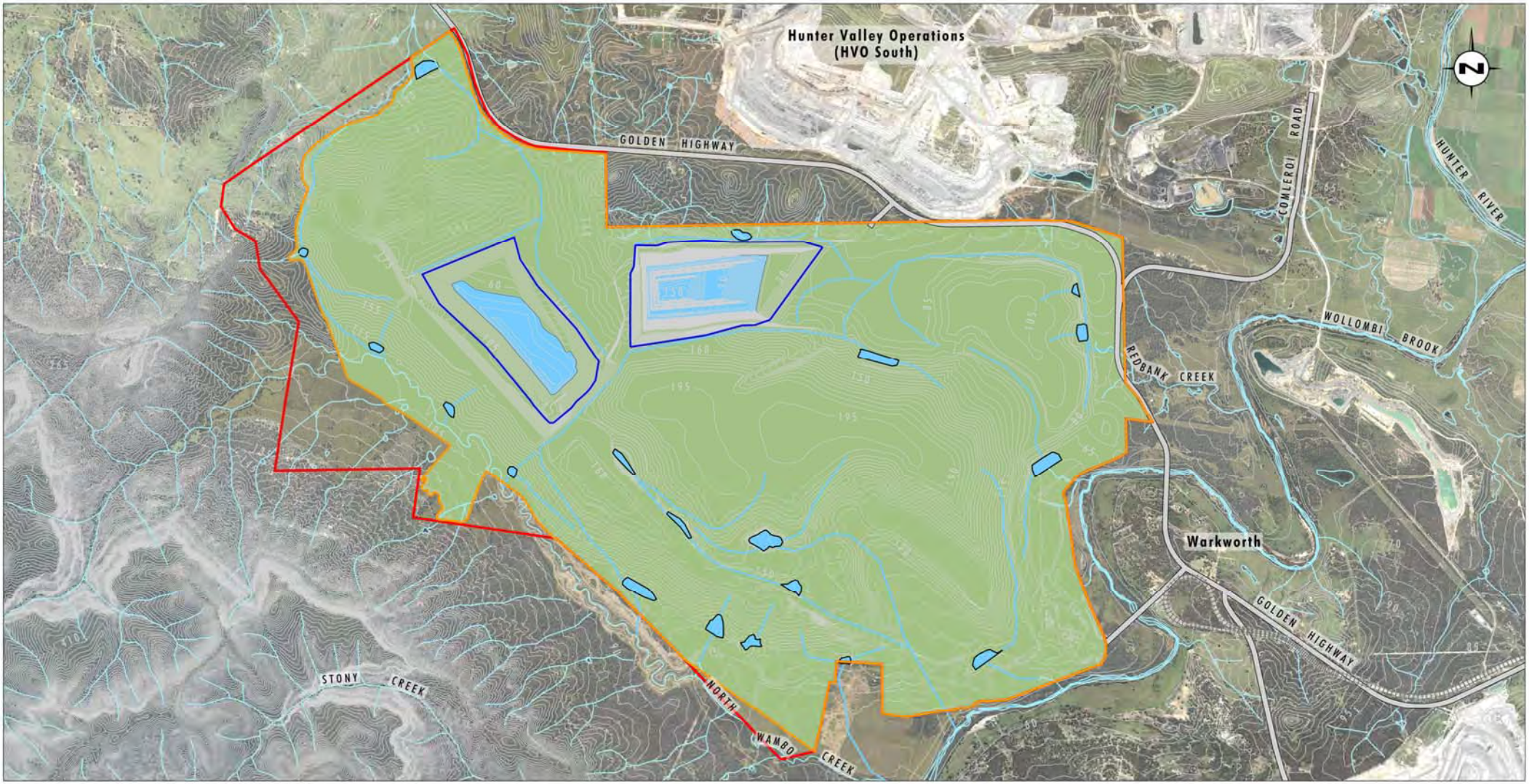


Image Source: AAM (2012), United (2015)
Base Data Source: Glencore (2015), LPI (2009)
Note: Contour Interval 10m

0 1.0 2.0 2.5km
1:50 000

Legend

- Project Area
- Conceptual Rehabilitation Boundary
- Final Void Catchment
- Rehabilitation
- Dam
- Drainage Line

FIGURE 6.19

Conceptual Final Landform

File Name (A4): R06/3509_377.dgn
20160413 16.16

Table 6.25 Predicted Average Water Balance[1]

Component	Project (ML/year)
Inflows	
Site Rainfall Runoff	2391
Tailings Decant Water	2788
Groundwater inflows (open cuts)	175
Groundwater inflows (underground)	575
Hunter River extraction	64
Wollombi Brook extraction	323
Total inflows	**6316**
Outflows	
Evaporation	360
Storage Spill	5
CHPP Supply	4286
Haul Road Dust Suppression Supply	1210
Total outflows	**5861**
HRSTS Discharge	550
Total average predicted balance	**-96**

Note: the data presented above is the average over all realizations. As such the data presented indicates the average conditions and not a specific water balance scenario.

Average inflows are predicted to total 6316 ML per year, while average outflows total 5861 ML per year combined with an average HRSTS discharge of 550 ML per year indicating a net average inventory reduction of approximately 96 ML per year.

The water balance model predicts that the volume of water stored on site will be approximately 4,500 ML at the commencement of the Project. After Year 2 of the Project, the volume of water stored on site will decrease to approximately 2000 ML for median rainfall conditions over the life of the Project, however, total water stored on site is predicted to remain within the available storage capacity for the life of the Project.

The water balance modelling also indicates that the existing WALs held by United and Wambo are sufficient to meet the future predicted water abstraction requirements.

6.8.1.6 Surface Water Impacts

A detailed assessment of the potential surface water impacts of the Project is provided in the Surface Water Assessment included as **Appendix 11**, with a summary of the key assessment findings included below. The Project and associated WMS has the potential to impact on natural and existing surface water systems. This includes the potential to impact on:

- catchment areas and flow volumes in downstream watercourses
- flooding, including flow rates, velocities and depths
- water quality in downstream watercourses
- geomorphological and hydrological values of watercourses, including environmental flows
- riparian and ecological values of watercourses
- water users, both in the vicinity and downstream of the Project.

Catchment Areas

Table 6.26 summarises the predicted impacts of the Project on the catchment areas for each of the watercourses for the following scenarios:

- prior to any mining
- current (as at 2015) conditions
- currently approved final landform (for approved United and Wambo)
- Project final landform.

For the assessment, the Project final landform has been compared to the currently approved final landform (refer to **Table 6.26**) to provide an indication of the final post mining catchments with the Project compared to the currently approved post mining catchments.

Table 6.26 Predicted Impacts on Catchment Areas

Catchment	Pre-Mining (ha)	Current Area (2015) (ha)[1]	Current Approved Final Landform[2] (ha)	Project Final Landform[3]	
				Area (ha)	per cent[5]
Wollombi Brook[4]	**187,175**	**184,860**	**187,180**	**186,560**	**99.7**
Wambo Creek	5,575	5,550	5,575	5,575	100
North Wambo Creek	5,260	3,830	4,605	4,290	93.1
Redbank Creek	1,285	440	1,300	860	66.1
Waterfall Creek[4]	**705**	**705**	**695**	**880**	**126.6**

Notes: 1) Catchment area is as existing and does not include areas that report to WMS

2) Based on the current Wambo approval.

3) Final Landform is completion of both the decommissioning of infrastructure and the rehabilitation of the post mining landform.

4) Catchment areas modified to reflect changes due to the Project and approved operations. This does not include impacts from other modifications (such as other mining operations) downstream of the Project Area.

5) Project final landform catchment area as a percentage of the current approved final landform.

As shown in **Table 6.26**, substantial changes have occurred to date to the catchment areas of North Wambo Creek and Redbank Creek (i.e. when comparing pre-mining to the current area) as a result of approved mining operations within these catchment areas. In addition, the Wollombi Brook catchments have been further impacted by both these and other mining operations.

In summary, the Project will result in the following changes to the catchment areas:

- The Project will result in a reduction in the area of the Wollombi Brook catchment of 0.3 per cent from the current approved final landform due to more water flowing to the Hunter River via Waterfall Creek to the north of the Project Area and the loss associated with the larger catchments of the proposed final voids.

- The Project will not impact on the catchment area of Wambo Creek compared to the currently approved final landform catchment area.

- The North Wambo Creek catchment will be reduced by 7 per cent compared to the current approved final landform catchment area, primarily as a result of drainage of the rehabilitated overburden emplacement areas directly to Wollombi Brook. The management of runoff from the overburden emplacement area will return flows to downstream watercourses over the life of the Project. This is an increase of the catchment area relative to the current catchment area reporting to North Wambo Creek.

- The Project will reduce the Redbank Creek catchment compared to the current approved final landform catchment area by approximately 440 hectares (approximately 34 per cent), primarily due to changes to the landform as a result of the United Open Cut final void and rehabilitated overburden emplacement areas. Of this reduction approximately 260 hectares forms part of the final void catchment, approximately 45 hectares will flow to Waterfall Creek and the net remaining loss of catchment (approximately 135 hectares) flows via the final landform drainage systems directly to Wollombi Brook. As such the net loss to Wollombi Brook is approximately 260 hectares (i.e. the catchment area of the United Final Void).

- The Project will increase the catchment area of Waterfall Creek by approximately 185 hectares (27 per cent) compared to the current approved final landform, primarily as a result of changes to drainage around the Wambo Open Cut final void, rehabilitated overburden emplacement areas and changes in catchment boundaries associated with Redbank Creek and North Wambo Creek.

Surface Flows

In order to assess the impact of changes to catchment areas and baseflows on flows in Wollombi Brook and the Hunter River, flows measured at gauging stations were modified by an amount proportionate to the change in upstream catchment area as a result of the Project and reduced by the predicted baseflow reduction determined by the groundwater assessment for the Project (refer to **Section 6.8.2**).

The analysis of regional flow impacts was undertaken for both the greatest predicted change in net leakage from each watercourse associated with the Project and the potential impacts at the end of the Project life. For the assessment it was assumed that the rate of leakage from both Wollombi Brook and the Hunter River to the alluvium will be in full translated to a loss of surface water flows. This is considered to be a conservative (i.e. worst case) analysis of the potential impacts.

The cumulative impacts associated with changes to baseflow and upstream catchment areas were assessed. The assessment indicates that the Project is likely to reduce the frequency of very low flows (< 1 ML per day) in Wollombi Brook by approximately 0.1 per cent (i.e. increase occurrence of no flow days by 0.1 per cent), while having a negligible impact on the frequency of flows above this magnitude. The Project is likely to have a negligible impact on the frequency of flows for all durations in the Hunter River.

As the Project will result in changes to the catchment areas associated with the final landform, annual flow volumes in the tributaries of Wollombi Brook and in Waterfall Creek are expected to be impacted as a result of the Project. However, these changes in annual flow volumes are considered to be small within the broader context specific to each catchment. For the ephemeral streams, the change in flows will be less than the seasonal and annual variations in flow volumes.

Flooding

Potential impacts on flood behaviour were assessed for Wollombi Brook and Waterfall Creek. A Flood Assessment Report is included as an appendix to the Surface Water Assessment (refer to **Appendix 11**).

<u>Wollombi Brook</u>

The majority of the Project Area lies outside of land classified as flood prone. The areas within the Project Area where flooding along Wollombi Brook intersects the Project Area include the land adjacent to the banks of Wollombi Brook and a first order tributary flowing into Wollombi Brook to the north of the Wambo CHPP area, North Wambo Creek, and Redbank Creek.

As discussed above, a flood levee is proposed to be constructed on Redbank Creek upstream of the Golden Highway to protect the United Open Cut from flood inundation during major flood events in Wollombi Brook (refer to **Section 3.9.3**).

The results of the modelled impacts on flood depths in Wollombi Brook for the 1 per cent AEP flood event and the Probable Maximum Flood (PMF) event are shown on **Figures 6.20** and **6.21**.

The flood modelling predicts that the potential impacts of flooding associated with the Project on Wollombi Brook are generally limited to localised changes in the downstream reaches of North Wambo Creek and in the upstream reaches of Redbank Creek. The modelling indicates negligible impact on flooding in Wollombi Brook. A detailed description of the outcomes of the flooding assessment is included in **Appendix 11** including the modelled impacts on flood depths, flow velocities and flood hazard categories.

The flooding assessment for Wollombi Brook indicates that the Project will have negligible impact on the flood depths, flow velocities or flood hazard categories within Wollombi Brook or on adjacent private land, including the township of Warkworth.

The modelling indicates that the Project is unlikely to modify the flood planning controls or flood prone land within the Project Area, the surrounding area or in the township of Warkworth.

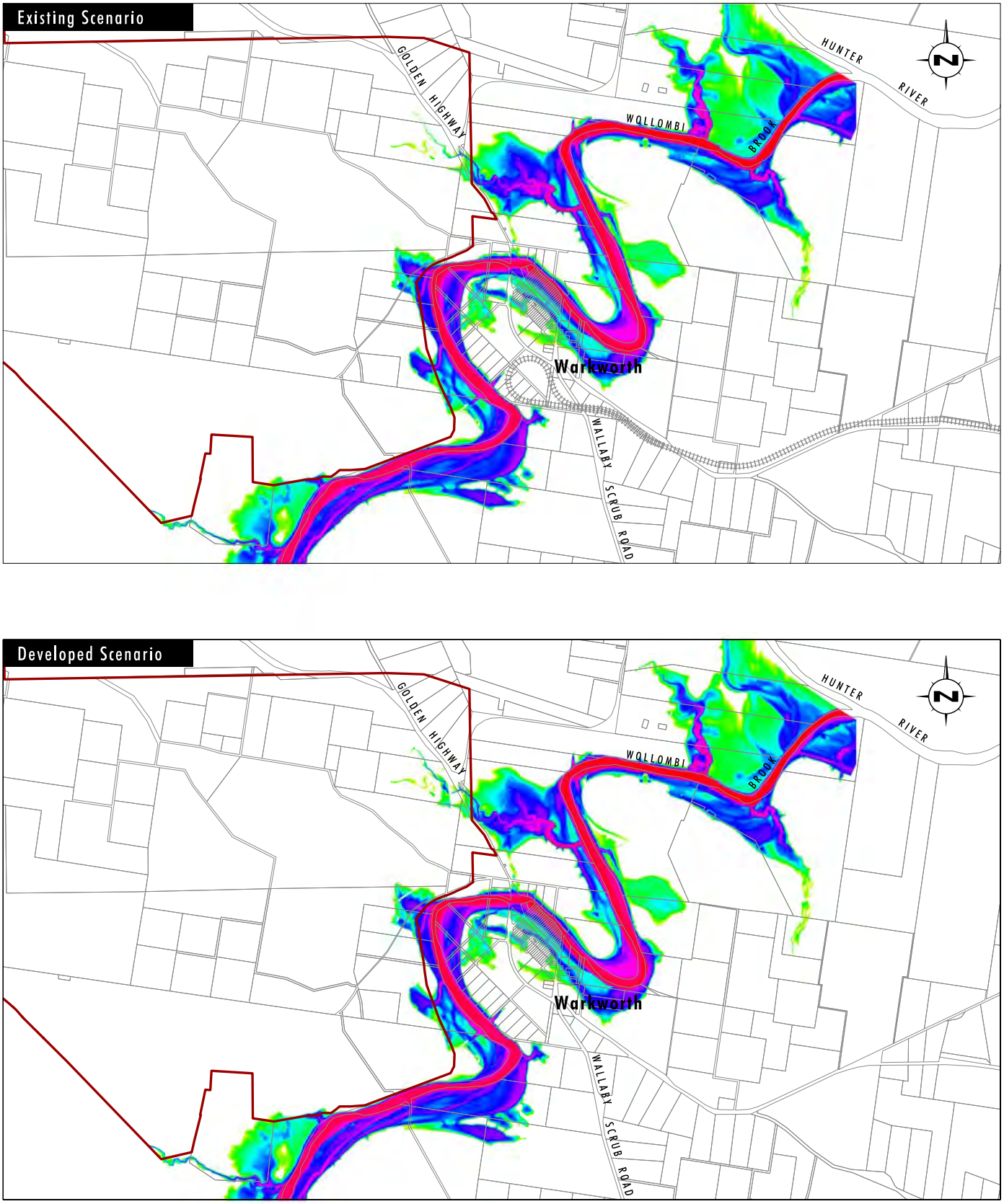
Similarly the modelling has determined the Project is unlikely to impact on flood hazard categories and associated accessibility along either the Golden Highway or private access roads/driveways during flood events.

Waterfall Creek

The land adjacent to Waterfall Creek is owned by mining companies and as such the primary risks associated with the Project are around changes to access along the Golden Highway during flood events and changes to the flow velocities and associated erosion/scour.

As discussed above, the Project will result in an increase in the catchment area of Waterfall Creek due to landform changes. The modelling indicates that this increase in catchment area results in minor increases in flood flows and related flood elevations and velocities during the 10 per cent, 5 per cent and 1 per cent AEP flood events (sometimes referred to as the 1 in 10, 20 and 100 year Average Recurrence Interval (ARI) flood events) and the PMF event. The changes in peak elevations all occur on land owned by mining operations and are considered to be acceptable. Similarly the increases in flow velocities are considered minor and are not expected to impact on erosion and/or scouring of the creek bed or banks.

An assessment of flooding impact at the Golden Highway crossing over Waterfall Creek indicates that the highway will remain flood free up to and including the 1 per cent AEP flood event. The modelling indicates that the road is impassable to vehicles and pedestrians during the PMF event and is also likely to be subject to structural damage during this event. The modelling indicates that the flood access on the Golden Highway over Waterfall Creek during the PMF event will remain in the current flood hazard category of 'structural damage likely' (as described by the NSW Floodplain Development Manual, 2005). The modelling indicates an increase in duration of flooding over the Golden Highway during a PMF event with water over the road increasing from approximately 2 hours and 5 minutes to approximately 2 hours and 30 minutes due to the proposed catchment change associated with the Project. This change in flood duration is considered negligible compared to the potential impacts of a PMF; that is, that the existing crossing will most likely be washed out based on the analysis of the flood hazard category. This change in flood duration is considered negligible compared to the potential impacts of a PMF (i.e. a flood event of between 0.01 per cent and 0.0001 per cent AEP, or 10,000 years and 100,000 years ARI).



Legend

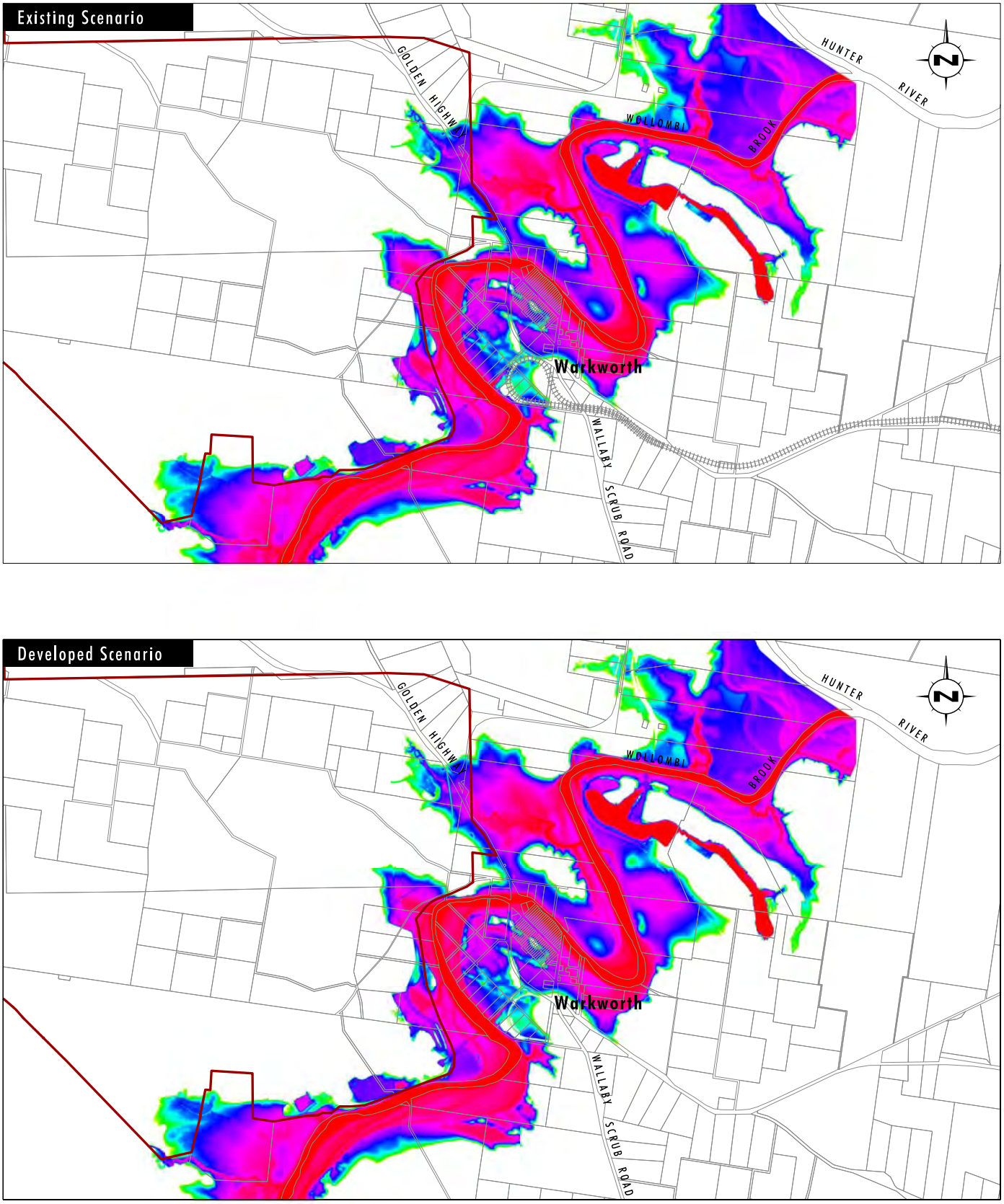
Project Area

Water Depth (metres)

12 8 6 4 3 2 1.5 1 0.5 0.2 0.001

FIGURE 6.20

1% AEP Flood Event - Maximum Modelled Flood Depths



Legend

Project Area

Water Depth (metres)

12 2 0.001
8 1.5
6 1
4 0.5
3 0.2

FIGURE 6.21

PMF Event -
Maximum Modelled Flood Depths

Water Quality

Background water quality data indicates that Wollombi Brook historically has relatively low pH, EC or TSS concentrations. Tributaries of Wollombi Brook (including Wambo Creek, North Wambo Creek and Redbank Creek) historically have elevated concentrations of EC and TDS during periods of reduced flow, and elevated TSS concentrations during rainfall events, due to their ephemeral nature.

The highest risks to downstream surface water quality as a result of the Project are summarised in **Table 6.27**. **Table 6.27** identifies the water management control category which is proposed to manage the risk.

Table 6.27 Preliminary Risk Surface Water Quality Assessment of the Project

Aspect	Water Management Control Category	Risk to Environment	Comment
Discharge of mine water	Mine	Low	Mine water storages to have sufficient freeboard to contain runoff for events up to and including the 1 per cent 24 hour AEP (annual exceedance probability) storm event. Surplus water used in mining operations, stored in the United underground or the open cut pits or discharged via EPL and HRSTS.
Overflow/failure of sediment pond (dirty water)	Dirty	Low – Medium	Numerous sediment dams are required due to complexity of mine site. Elevated TSS is primary risk. Sediment dams are managed in line with the Blue Book and designed to manage runoff from the 5 day, 95th percentile rainfall event. Some sediment dams have secondary containment measures downstream.
Spillage of tailings	Mine	Low	Tailings are disposed of on site within in pit tailings storages. Risk only arises as a result of tailings storages filling in extreme rainfall events and overtopping, however management procedures are in place which limit water volume (e.g. freeboard allowances on pits) making this very unlikely to occur.

The higher risks (low to medium level) outlined in **Table 6.27** are associated with the dirty water management system where the risk is associated with overflow from sediment dams during rainfall events above the design criteria specified in the Blue Book. These design criteria have been established by the NSW Government specifically for sediment control at mining and quarry operations.

If required, controlled discharges from the Process Water Dam to Wollombi Brook will occur in accordance with Wambo's EPL and the HRSTS. There are specific requirements for discharge under the HRSTS including specific limits relating to flow volumes and water quality that must be followed to reduce potential impact during discharge events.

The licensed discharge point to Wollombi Brook currently has the following limits:

- Wollombi Brook flowing at >500 ML/day at the Bulga gauging station
- Water quality criteria of:
    - pH of 6.5 to 9.5
    - TSS < 120 mg/L.
- Discharge volumes in any 24 hour period shall not be greater than 250 ML.

Any mine water discharges will be controlled to meet the requirements of Wambo's EPL and the associated discharge limits (refer above) that are set by the EPA, designed to minimise potential impacts on the downstream environment.

The proposed final landform has been designed to minimise the catchment contributing to the proposed final voids. The water balance for the final voids indicates that the equilibrium water levels will be approximately 55 mAHD in the Wambo Open Cut final void and approximately 25 mAHD in the United Open Cut final void, well below the level at which these voids could spill to the surrounding environment. The final voids are therefore predicted to remain self-contained systems with no surface spills predicted to downstream watercourses. As such, it is considered that the final voids will have no impact on surface water quality in downstream watercourses.

Geomorphological and Hydrological Values

The Project is not expected to result in a significant impact on the geomorphological and hydrological values of local surface water systems.

As part of the Project, Redbank Creek upstream of the Golden Highway and United Dam 1 will be removed. Redbank Creek is ephemeral and frequently dry. In the downstream portion of Redbank Creek, the riparian zone of the creek banks is lightly to moderately vegetated and existing erosion is minimal. The Project will result in decreased peak flows in Redbank Creek with associated decreases in flood levels and flow velocities along Redbank Creek due to a reduction in catchment area associated with the proposed final landform. Potential impacts on stability, such as scour, are therefore predicted to be reduced in comparison with the current approved final landform.

Waterfall Creek is ephemeral and frequently dry. Its channel is generally shallow and poorly defined along its length as its catchment is predominantly drained by overland sheet flow. As such, Waterfall Creek's riparian zone is also poorly defined. The proposed final landform will increase the catchment area drained by Waterfall Creek by approximately 185 hectares, resulting in minor increases in the peak flood levels and velocities within Waterfall Creek. However, since the increases in peak flood levels and flow velocities are minor, the channel is poorly defined and the catchment is drained predominantly by overland flow, this

increase in runoff is considered unlikely to have a significant impact on the geomorphological values of Waterfall Creek.

Riparian and Ecological Values

The Upper Hunter Strategic Assessment Statement of Consistency Report (refer to **Appendix 13**) identifies the potential groundwater dependent ecosystems (GDEs) and vegetation types that have the potential to be at least partially groundwater-dependent, occurring both within and outside of the Project Area.

The majority of the GDEs identified are associated with the floodplain and associated alluvial areas of Wollombi Brook and the Hunter River. GDEs have been identified along the downstream reaches of Redbank Creek adjacent to the confluence with Wollombi Brook and located within the flood prone lands associated with Wollombi Brook. As such potential impacts on GDEs will primarily be influenced by changes in flows in Wollombi Brook and the Hunter River as opposed to their ephemeral tributaries.

Analysis of the flow duration curve for Wollombi Brook indicates that the predicted changes to annual flow volumes are small on a regional scale. On this basis, no significant impacts on GDEs associated with changes to surface water flows within Wollombi Brook are predicted.

Analysis of the flow duration curve for the Hunter River indicates that the predicted changes to annual flow volumes are negligible on a regional scale in the Hunter River. The Project is consequently considered unlikely to result in impacts on ecosystems (including GDEs) or downstream users within the Hunter Regulated River system.

In regard to the tributaries to Wollombi Brook and Hunter River, the changes in annual flow volumes associated with changes to catchment areas within North Wambo Creek and Waterfall Creek from the current approved final landform to the proposed final landform are considered to be small within the context of ephemeral streams (i.e. a maximum predicted decrease in catchment area of approximately 7 per cent in North Wambo Creek, while Waterfall Creek increases in catchment) and unlikely to impact on riparian or ecological values. The predicted changes to the catchment area of Redbank Creek (i.e. a reduction of approximately 34 per cent) when considered in the context that the key areas of GDEs identified along Redbank Creek are located within the floodplain and associated flood prone land of Wollombi Brook, are not considered likely to result in significant impacts on riparian and ecological values in Redbank Creek. The Project is predicted to have minimal impact on the surface waters of riparian ecosystems as the predicted impacts are within the natural variation of the existing surface water system and are small to negligible on a regional scale.

Water Users

No adverse impacts are predicted on downstream water users as a result of the Project.

The majority of land adjacent to Wambo Creek, North Wambo Creek, Redbank Creek and Wollombi Brook immediately downstream of the Project Area is owned by mining operations. There are two small privately owned vacant lots on Wollombi Brook downstream of the Project Area that retain basic landholder rights for domestic and stock use. There are no known licensed water users on waterways directly downstream of the Project Area along Wollombi Brook.

The Project will have minimal impact on annual flow volumes in Wollombi Brook compared to the currently approved landform conditions. Water take from clean water catchments will be either managed under Harvestable Rights Provisions or licensed. As such it is considered that neither basic landholder rights nor licensed extraction volumes on Wollombi Brook will be affected by the Project.

There are no known water users downstream of the Project on Waterfall Creek. As a result of the predicted increase in catchment area no decreases in water availability to downstream systems or future water users is expected.

The predicted impacts on flows in the Hunter River are negligible and in addition, due to the regulated nature of the river, it is considered there will be no impacts on downstream water users in the Hunter River.

Cumulative Impacts

The surface water assessment indicates that the Project is expected to have minor to negligible impacts on flows, water quality and water users relative to the existing approved impacts on Wollombi Brook, Waterfall Creek and on the Hunter River with the proposed WMS in place.

The Project will result in changes to the catchment areas for Wollombi Brook, Wambo Creek, North Wambo Creek, Redbank Creek and Waterfall Creek compared to the catchment areas of the currently approved final landform at United and Wambo operations.

The reductions in catchment areas for North Wambo Creek and Redbank Creek from the approved final landform are considered to be small within the context of ephemeral streams and in consideration of the existing licensed extraction rights. That is, the change in flows is less than the seasonal and annual variations in flow volumes comparing dry years to wet years. The Project is consequently considered likely to have limited impact on waterway stability and scour potential, ecosystems and downstream users in these systems and therefore has limited potential to contribute to cumulative impacts in these systems.

The change in total catchment contributing to the downstream watercourses of Wollombi Brook, when the Project is compared to the approved final landform is negligible, with the reduction in total catchment less than 0.3 per cent. The Project is therefore predicted to make a negligible contribution to cumulative impacts to Wollombi Brook.

Due to the large catchment area and highly regulated nature of the Hunter River, the assessment indicates that the Project will have no impact on flows in the Hunter River and therefore will not contribute to cumulative impacts in this system.

To manage potential water quality impacts throughout the life of the Project, it is proposed to integrate water management for the Project with the existing WMSs. Through management of dirty water and mine water within the WMS over the life of the Project, and based on flood assessment indicating no changes to velocities and associated scour potential in Wollombi Brook, it is not anticipated that water quality in downstream waterways will be adversely impacted by the Project. All discharges of saline water will be undertaken in accordance with the HRSTS, ensuring that they remain within the sustainable salt level for the Hunter River determined by the NSW Government. The Project is therefore considered to have a low potential to contribute to cumulative impacts to water quality in downstream watercourses.

Landowners downstream of the Project Area along Wollombi Brook have little potential to be impacted by the Project beyond the impacts of the currently approved final landform. As discussed above, downstream water quality is not anticipated to be adversely impacted by the Project. The Project is therefore considered to have negligible potential to contribute to cumulative impacts on downstream water users.

Similarly, analysis indicates that the Project will have negligible impacts on flows in the Hunter River and as such it is considered that there will be no cumulative impacts on downstream water users in the Hunter River.

In addition, all water take for the Project will be managed under the *Water Management Act 2000* either under harvestable rights provisions or water access licences, ensuring that all water take is within the sustainable yield volume for the catchments and watercourses determined by the NSW government.

6.8.1.7 Surface Water Monitoring and Management Measures

A Project Water Management Plan (WMP) will be prepared to guide the overall management of water as part of the Project. This plan will also consider the integration of the water management of the Project with Wambo. The Project WMP and associated sub plans will be developed in consultation with DPI Water and DPE. Subject to the requirements of the conditions of consent, the WMP will include:

- a water balance including details of water supply, use, management and transfers
- an Erosion and Sediment Control Plan that is consistent with the requirements of Managing Urban Stormwater: Soils and Construction – Volume 1 and Volume 2E Mines and Quarries, or its latest version
- a Surface Water Management Plan, including:
    - relevant baseline data on channel stability and water quality
    - a description of the water management system on site including design objectives and performance criteria
    - trigger levels for investigating any potentially adverse impacts
    - a surface water monitoring program.
- a Groundwater Management Plan.

The WMP for the Project, which will address the management of the open cut operations, will be integrated with the WMP for Wambo which addresses the Wambo Underground, CHPP and train loading facility.

The existing monitoring programs at the operations will be updated as part of the implementation of the Project, including development of specific triggers around pH and associated monitoring of metals/metalloids. These programs will be documented in the Project Surface Water and Groundwater Monitoring Program.

The key management measures for the Project in regard to surface water are the Project WMS which includes the flood levee to protect the United Open Cut from flood inundation along Redbank Creek from Wollombi Brook.

In addition, there will be a series of erosion and sediment control measures utilised during the construction and operation phases of the Project. These measures will be undertaken in accordance with the relevant volumes of the Blue Book (Volumes 1 and 2) including:

- Landcom 2004. Managing Urban Stormwater – Soils and Construction, Volume 1, 4th Edition.
- Department of Environment and Climate Change (DECCa) 2008. Managing Urban Stormwater – Soils and Construction, Volume 2A – Installation of Services.
- Department of Environment and Climate Change (DECCb) 2008. Managing Urban Stormwater – Soils and Construction, 2C – Unsealed Roads.

- Department of Environment and Climate Change (DECCc) 2008. Managing Urban Stormwater – Soils and Construction, 2D – Main Road Construction.

- Department of Environment and Climate Change (DECCd) 2008. Managing Urban Stormwater – Soils and Construction, Volume 2E – Mines and Quarries.

Further details of the proposed approach to ongoing surface water monitoring and management are provided in **Appendix 11**.

6.8.1.8 Water Licensing Requirements

All water take for the Project beyond that which is in accordance with harvestable rights provisions (i.e. basic landholder rights) will be licensed. Water take from water abstraction points on the Hunter River and Wollombi Brook will occur in accordance with WALs held under the *Hunter Regulated River Water Sharing Plan 2004* and the *Hunter Unregulated and Alluvials Water Sharing Plan 2009* respectively.

United and Wambo both hold licences for the abovementioned water sources. The calculated harvestable rights provisions based on the landholdings of United and Wambo and the water access licences held for these water sources are summarised in **Tables 6.28** and **6.29**.

Table 6.28 Summary of Total Water Take Allowed with Current Landholdings/Licences

Aspect	Lower Wollombi Water Source	Jerrys Water Source
Total Landholding (ha)	5311	925
Total Harvestable Rights Volume (ML)*	372	65
WAL (unit shares)	1050	0
Maximum Allocation volume (ML)	1050	0
Total Water Take Allowed with Current Landholdings/Licences (ML)	1422	65

*Based on 10 per cent of average regional runoff rate of 0.7 ML/ha/year (NSW Farm Dams Calculator)

Table 6.29 Existing Water Access Licenses for the Hunter Regulated River

Licence No.	Source	Holder	Type	Volume (ML)
WAL10541	Hunter River	United	High Security	300
WAL718	Hunter River	Wambo	High Security	1000

Water take from undisturbed clean water catchments upslope of the mining operations during the life of the Project will be accounted for under either harvestable rights provisions or water access licences. The existing and proposed WMS include a series of drains and clean water dams around the perimeter of the mining areas in order to minimise the inflow of upslope catchment into the mining areas. As such, the capture of upslope clean water runoff from undisturbed/natural areas is limited.

The largest total area during the Project, based on the concept WMS, identified as clean water runoff capture is approximately 231 hectares in Year 16 from the Lower Wollombi Water Source and approximately 11 hectares in Year 2 from the Jerrys Water Source. Based on 100 per cent capture of runoff at the regional runoff rates (refer to www.farmdamscalculator.dnr.nsw.gov.au) of 0.7 ML/hectare/year, this equates to capture of approximately 161 ML during Year 16 from the Lower Wollombi Water Source and approximately 8 ML from the Jerrys Water Source.

The capture of clean water runoff (i.e. approximately 161 ML from the lower Wollombi Water Source and approximately 8 ML from the Jerrys Water Source) is within the harvestable rights provisions for United and Wambo (refer to **Table 6.28**).

The water balance modelling predicts that on average approximately 560 ML per year will be abstracted from the Hunter River and Wollombi Brook water sources for use at the site. This average take is well within the capacity of the existing licences held for these water sources and provides capacity for increased take during dry periods. These licensed abstractions modelled as part of the water balance assessment were based on the currently held WALs and modelled available water determinations (AWDs) for the water sources.

In regard to water licensing for the final landform, should all of the dams shown on the conceptual final landform (refer to **Figure 6.19**) be retained in the final landform, United (and Wambo) propose to reduce the volumes of the dams to be within the Harvestable Rights Provisions of the landholdings.

Both the United Open Cut final void and the Wambo Open Cut final void are located within the pre-mining catchment area of Wollombi Brook. Surface water take associated with the final voids will be licensed using WALs from the Lower Wollombi Water Source of the *Hunter Unregulated and Alluvial Water Sharing Plan 2009.*

Based on an average regional runoff rate of 0.7 ML/ha/year, WALs amounting to 319 ML will be required to account for surface water take in the final voids. This is within the existing WALs held by United and Wambo.

6.8.2 Groundwater

A comprehensive assessment of potential groundwater impacts has been undertaken for the Project by Australasian Groundwater and Environmental Consultants (AGE) and is provided in **Appendix 12**. The assessment was prepared in accordance with the SEARs (refer to **Table 4.3**) and relevant water planning policies and guidelines, in particular the NSW Aquifer Interference Policy (AIP). This section provides a summary of the key findings of the groundwater assessment.

The groundwater modelling was peer reviewed by Dr Noel Merrick in accordance with national groundwater modelling guidelines, with a focus on compliance with the AIP and addressing the requirements of the Independent Expert Scientific Committee (IESC) on Coal Seam Gas and Large Coal Mining Development. Overall, the peer review found that:

- there were no matters of concern in the Groundwater Impact Assessment as to report structure or depth of coverage
- there is a clear focus on the SEARs, including those associated with the AIP, as well as Federal Government and Local Government requirements
- the objectives expressed in terms of State Government, Federal Government and Local Government requirements have been addressed satisfactorily

- the model underpinning the groundwater impact assessment is robust and "fit for purpose", where the primary purpose of the model is the prediction of environmental impacts in the context of the AIP, and estimation of water takes for licensing.

Further details are provided in **Appendix 12**.

6.8.2.1 Groundwater Resource

The key features of the groundwater resource within and surrounding the Project Area are outlined below.

Aquifers

Two broad types of aquifers occur in the vicinity of the Project Area:

- **Quaternary alluvium (including 'highly productive' and 'less productive' alluvium)** – the Quaternary alluvium in the vicinity of the Project Area occurs along Wollombi Brook and parts of its tributaries, and along the Hunter River to the north (refer to **Figure 6.22**). The Hunter River alluvium flows in an easterly direction, while groundwater within the Wollombi Brook alluvium flows in a north to northeasterly direction towards the Hunter River. Recharge to the Quaternary alluvium occurs via 'diffuse' recharge from rainfall and 'focussed' recharge through the stream bed. The alluvium can also be recharged by upward leakage from the underlying stratigraphy, particularly along Wollombi Brook. The available data for the alluvium indicates that it is largely unsaturated within the more elevated tributaries, with the alluvial groundwater largely restricted to the thicker sequences of sand and gravel (highly productive alluvium) along the Hunter River and Wollombi Brook. While the alluvium is an unconfined unit, the upper sequences of the alluvium (approximately upper 8 metres) are largely clay rich and less permeable than the basal sands and gravels. Groundwater levels within the Quaternary alluvium along Wollombi Brook and Hunter River in the vicinity of active mining are generally 4 metres and 10 metres below surface, respectively. It is likely that localised downward leakage (losing conditions) occur from the Quaternary alluvium, particularly where the more permeable coal seams subcrop beneath the alluvium and where active mining is present.

- **Permian coal measures** – the Permian coal measures comprise coal seams interbedded with low permeability sandstone and siltstone. The majority of groundwater is present within the more permeable coal seams, which is due to secondary porosity through cleats and fractures. The Wittingham Coal Measures are saturated across their extent with groundwater levels generally 30 metres below the surface, ranging between 80 mAHD to the southwest beneath the escarpment, down to 50 mAHD near the Hunter River. The measures are recharged by downward leakage from overlying strata, which includes the Quaternary alluvium. The coal measures are also recharged from rainfall where the coal measures outcrop (i.e. reach the surface) to the north and east of the Project Area.

United and Wambo have a combined groundwater monitoring network that comprises 77 bores and 24 vibrating wire piezometers (VWPs), of which 27 bores and 11 VWPs (55 sensors) are currently monitored as part of ongoing groundwater monitoring programs (refer to **Figure 6.22**). This extensive network combined with data from the past and current mining operations provide a sound understanding of the local groundwater environment.

Groundwater Quality

The groundwater monitoring results show that groundwater within 'highly productive' alluvium generally has fresh water quality. The 'less productive' alluvium generally has brackish water quality, with results ranging from fresh to saline. Based on the available data, the 5^{th} and 95^{th} percentile for TDS is 363 mg/L and 6702 mg/L, respectively. The higher salinity 'less productive' alluvium likely relates to reduced recharge to these areas of alluvium.

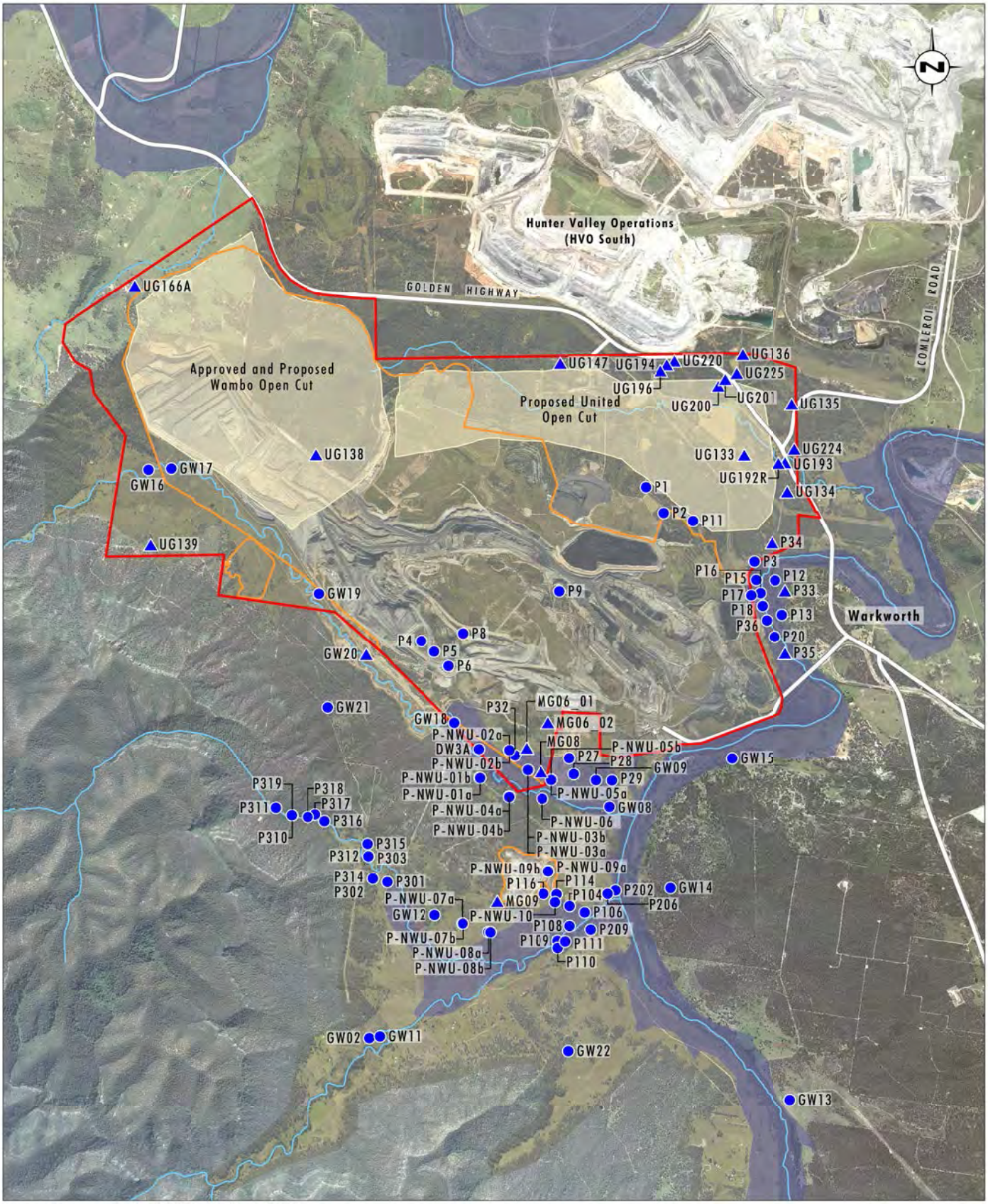


Image Source: AAM (2012), United (2015)
Data Source: Glencore (2014)

0 1.0 2.0 3.0km
1:60 000

Legend

- Project Area
- Approved Wambo Surface Development Area
- Proposed Conceptual Extraction Area
- Quaternary Alluvium (1:25k AEG)
- Monitoring Bore
- VWP

FIGURE 6.22

Groundwater Monitoring Bores and Extent of Alluvium

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The water quality results for the Permian coal measures indicate that groundwater within the coal is generally moderately saline, with results ranging from fresh to saline. The interburden units are also generally moderately saline, with results ranging from fresh to highly saline. Similar to the Permian coal measures, the groundwater quality within spoil (emplaced overburden associated with past mining) is generally moderately saline and ranges between brackish and saline water quality.

The results for the alluvium ('highly productive' and 'less productive') indicate that groundwater is not suitable for long-term irrigation according to the ANZECC (2000) guideline levels for total manganese. The results indicate that groundwater within the 'highly productive' alluvium is suitable for stock water supply. Overall, the results indicate that groundwater within the 'less productive' alluvium is not suitable for stock water supply (excluding sheep) in accordance with the ANZECC (2000) guidelines. However, alluvial groundwater is occasionally used for stock (cattle) water supply and some domestic applications (i.e. gardens) within the region.

The results for the Permian coal measures (and interburden) indicate that the groundwater is not suitable for stock water supply due to elevated salinity levels and total aluminium concentrations. Groundwater within the Permian coal measures also records total manganese concentrations above the ANZECC (2000) long term irrigation trigger. Total selenium and concentrations above the ANZECC (2000) guideline level for short-term irrigation is recorded for the groundwater occurring in the coal seams. The results also indicate that groundwater within the Permian coal measures and spoil is not suitable for stock water supply or irrigation according to the ANZECC (2000) guidelines.

Existing Bores, Wells and Water Users in the Area

A search of the National Groundwater Information System (NGIS) database identified 66 registered bores within 4 kilometres of the proposed extraction area associated with the Project (refer to **Figure 6.23**). A bore census was undertaken to determine the status of these bores including consultation with private landholders. Two unregistered water supply bores were also identified in the bore census. Of the 68 bores, 23 have been abandoned and destroyed, and nine have been abandoned but are in a usable condition. Of the remaining 36 existing bores, 18 are located on land owned by the Joint Venture, and two are used for groundwater monitoring on Coal & Allied land (GW30740 and GW080963) (refer to **Figure 6.23**). The remaining 16 are private bores largely used for stock water supply, with some also used for irrigation and domestic use (garden and toilets). The majority of private bores take water from the Quaternary alluvium.

6.8.2.2 Groundwater Impact Assessment

Potential groundwater impacts associated with the Project were assessed through a 3D numerical groundwater flow model using MODFLOW-USG over an area of approximately 640 square kilometres. The numerical model was based on the existing Wambo mine (including the Wambo Open Cut) numerical flow model and updated with data from the United and Wambo geological models, as well as publicly available data (i.e. geological maps and groundwater studies for the surrounding region). The model extended north and northeast to include the HVO and Ravensworth operations, and east and south to include MTW.

A detailed assessment of the potential groundwater impacts of the Project is provided in the Groundwater Impact Assessment included as **Appendix 12**, with a summary of the key assessment findings included below. This includes the potential to impact on:

- groundwater interception by mining within the Project Area
- drawdown in groundwater levels in the alluvium and coal measures as a result of the Project
- changes in alluvial water resources availability

- changes to surface water flow
- water licensing requirements
- impact on supplies from private bores
- drawdown at potential GDEs.

Both the Project Area and the surrounding areas have been subject to open cut and underground mining operations for over 55 years. This existing mining has already significantly altered the groundwater environment within the vicinity of the Project Area, with some of the coal seams proposed for mining currently being significantly depressurised.

The Project design incorporates offset distances to Wollombi Brook (approximately 370 metres) and the Hunter River (approximately 1.7 kilometres) which exceed the 200 metre offsets recommended in the NSW Aquifer Interference Policy (AIP) so that impacts to the alluvial system are minimised as far as possible.

Groundwater Intercepted by Mining

Groundwater intercepted from the Permian coal measures due to the Project at United Open Cut is predicted to peak in Year 4 with 333.9 ML/year; while groundwater intercepted at the Wambo Open Cut peaks in Year 8 at 75.9 ML/year. Overall, the additional take of groundwater due to the Project is predicted to peak in Year 9 at 359.3 ML/year, and will average 110.2 ML/year.

Drawdown in Groundwater Levels

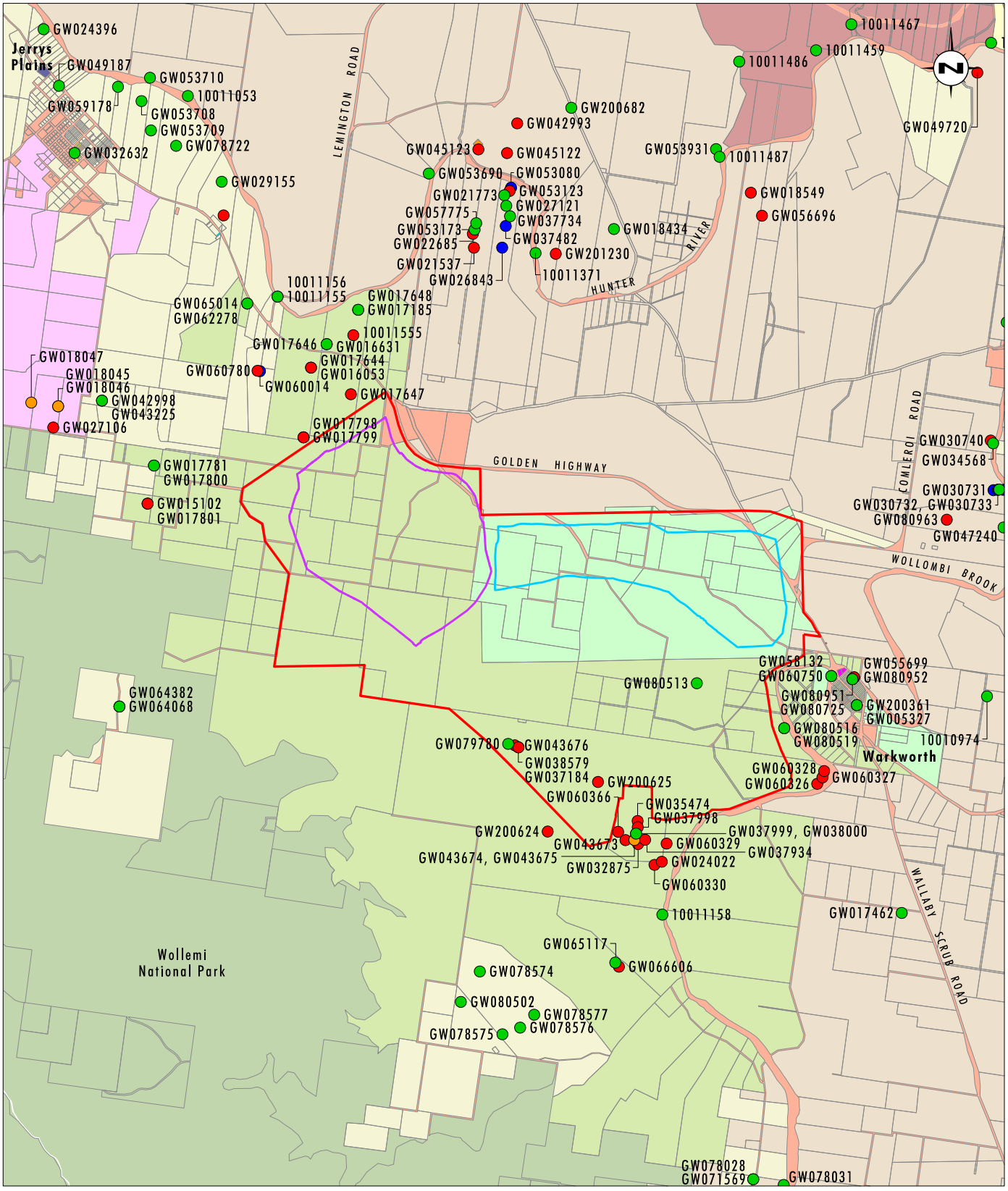
The open cut mine will intercept groundwater and will consequently change the water pressure in the surrounding aquifers as groundwater from the Permian stratigraphy seeps into the mining void. This change in pressure will result in a drawdown in the Permian aquifer (more specifically, within each water bearing zone, e.g. each coal seam) and will result in consequential changes in water level in sections of the alluvial aquifers where they are connected to the Permian. These changes in pressure and level are shown by the groundwater model as drawdowns.

The predicted maximum drawdown due only to the Project within the Quaternary alluvium is shown on **Figure 6.24** and in the Permian coal measures (Wambo Seam, Glen Munro Seam, Arrowfield Seam and Vaux Seam) is shown on **Figure 6.25**.

The most significant modelled drawdowns within the Quaternary alluvium are predicted to occur east of United Open Cut, along relatively small sections of Wollombi Brook and Redbank Creek, as well as north along the edge of the Hunter River alluvium (refer to **Figure 6.24**). The model shows the theoretical potential extent of drawdown assuming a largely homogeneous alluvial zone, however, as the alluvial zones have variable properties (including clay zones with low permeability and areas with limited groundwater) the actual drawdown may be less than predicted by the model.

The zone of depressurisation in the Wambo Seam due to the Project is predicted to extend up to 2.5 kilometres southwest of the proposed extraction area. Groundwater level drawdown within the Glen Munro Seam extends up to 2.5 kilometres west of the proposed extraction area, and up to 2 kilometres south (refer to **Figure 6.25**). The zone of depressurisation in the Arrowfield Seam is predicted to extend up to 3.5 kilometres from the edge of the proposed extraction area (refer to **Figure 6.25**).

In all coal seam layers, the magnitude of the depressurisation is generally less than 10 metres at a distance of 1.5 kilometres from the edge of the extraction area.



Data Source: LPMA (2009), United (2015)

0 1.0 2.0 4.0km
1:80 000

Legend

- Project Area
- Proposed Conceptual United Open Cut Pit
- Proposed Conceptual Wambo Open Cut Realignment
- Abandoned but Usable Registered Bore
- Existing Bore
- Proposed Registered Bore
- Registered Bore (not inspected)
- Mine Owned (Ashton)
- Mine Owned (Bulga)
- Mine Owned (Coal and Allied)
- Mine Owned (Doyles Creek)
- Mine Owned (Glencore)
- Mine Owned (Integra)
- Mine Owned (Peabody)
- Mine Owned (Ravensworth)
- Mine Owned (Wambo)
- AGL Energy
- Ausgrid
- Bulga Community Centre
- Government Authority (Federal, State or Local)
- Department of Education and Communities
- Diocese of Newcastle
- National Parks and Wildlife Service
- Private
- Redbank Energy
- Singleton Council
- Telstra
- Wanaruah Local Aboriginal Land Council

FIGURE 6.23

Registered Bores within 4 km of Project Area

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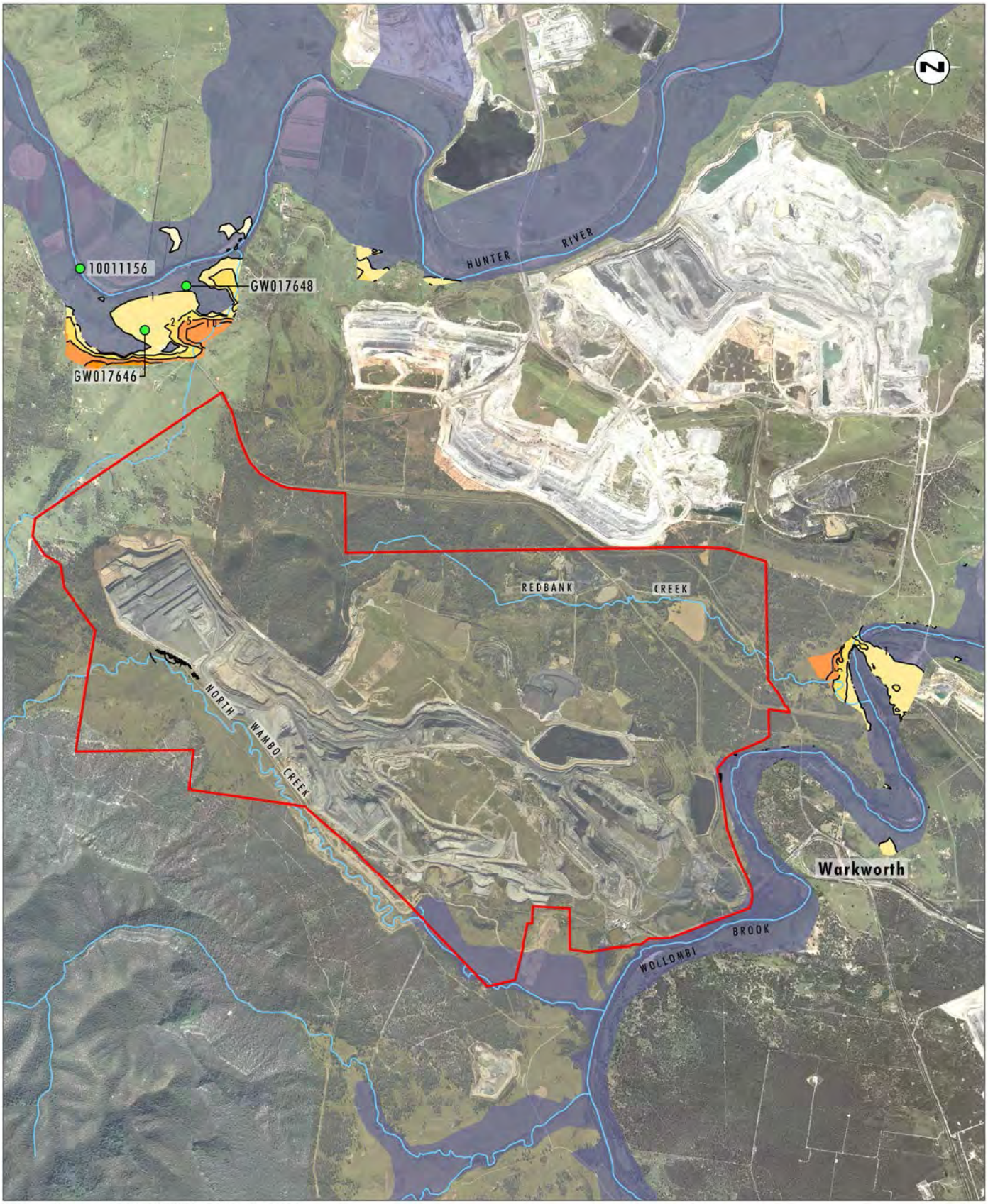


Image Source: AAM (2012), United (2015)
Data Source: United (2015), AGE (2016)

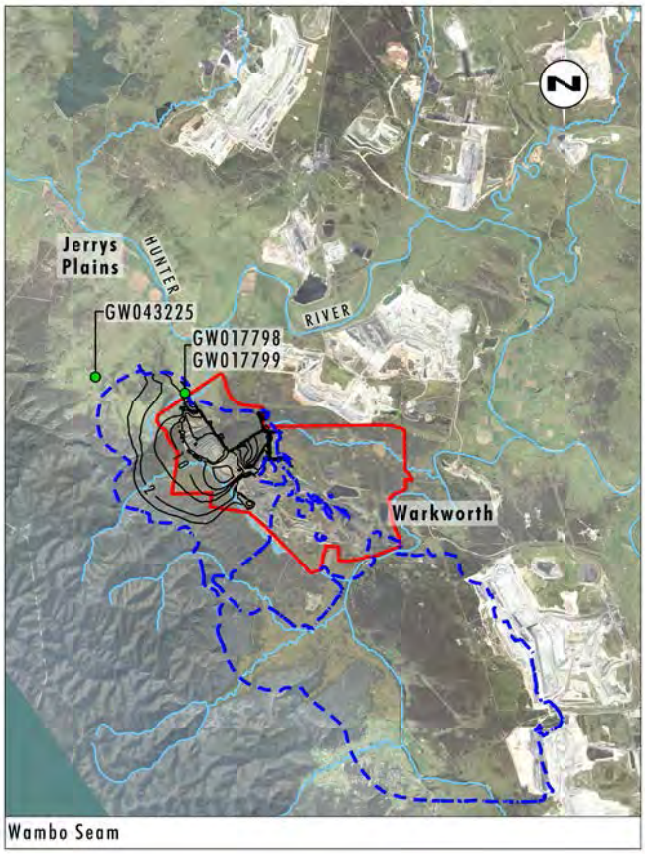
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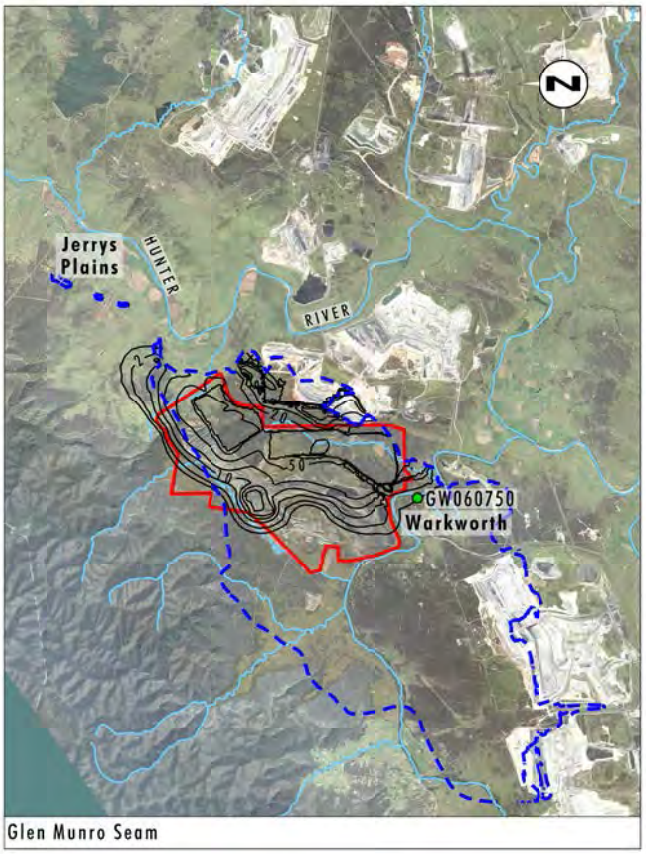
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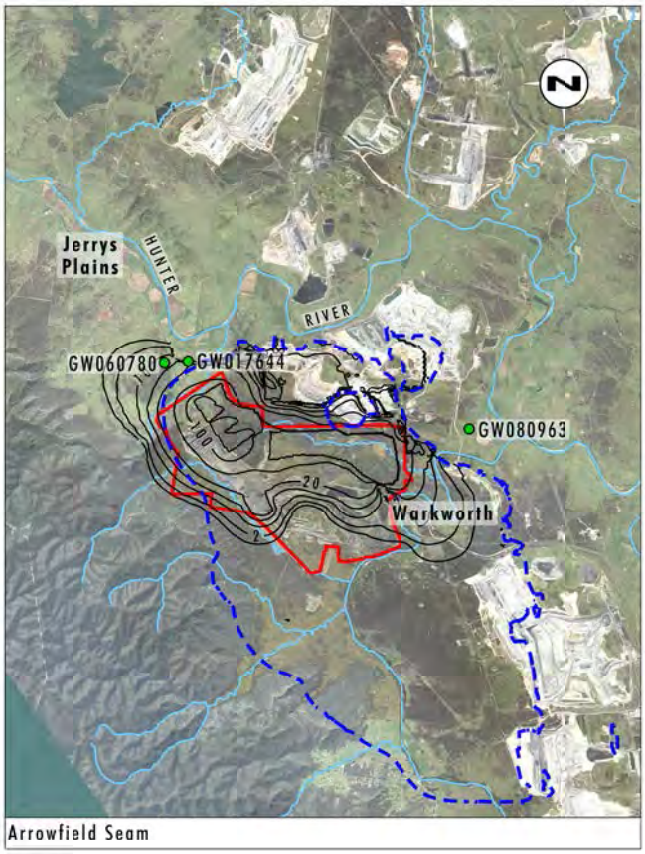
- Project Area
- Drawdown Contour (m)
- Quaternary Alluvium (1:25k AGE)
- Private and Mine Owned Bores

FIGURE 6.24

Predicted Project Groundwater Drawdown - Quaternary Alluvium







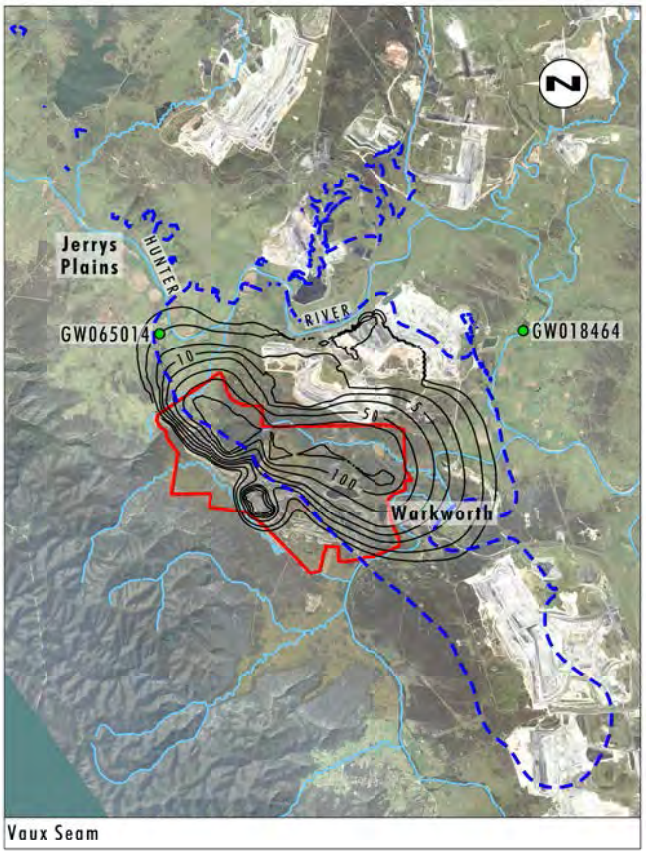


Image Source: AAM (2012), United (2015)
Data Source: AEG (2016)

0 5.0 10.0 12.5km
1:250 000

Legend

- Project Area
- Drawdown Contour
- 1m Approved Cumulative Drawdown Extent
- Private and Mine Owned Bore

FIGURE 6.25

Predicted Project Groundwater Drawdown - Permian Coal Measures

The extent of drawdown due to the Project is generally within the extent of the drawdown from currently approved mining to the north, east and south of the Project Area. Increased drawdown extent due to the Project is largely restricted to the west of the Project Area, extending up to 2 kilometres from approved and proposed (by other mines) cumulative drawdown extents. Drawdown is not predicted within the Triassic Narrabeen Group, which is the main stratum across the Wollemi National Park. The lack of drawdown is due to the strata being largely absent across the proposed mining area, as well as the relatively low vertical hydraulic conductivity of the coal measures.

Alluvial Water Resources Availability

The change in alluvial water resources was determined by comparing water budgets for alluvial zones using versions of the numerical model that contained and excluded the Project. The two main alluvial resources are alluvium associated with Wollombi Brook and alluvium associated with the Hunter River.

In accordance with the AIP, the groundwater model was used to determine the mining interference on the groundwater system. As the Permian strata becomes depressurised, flow from the Permian to the alluvium within the zone of depressurisation will progressively decrease. This can be considered beneficial as it reduces the inflow rate of higher salinity groundwater from the Permian to the overlying alluvium.

The modelling assessed the potential change in flow from the Permian to the Wollombi Brook alluvium for the currently approved mine plans with and without the Project. The assessment indicates that the Wollombi Brook alluvium is overall gaining flow from the Permian.

The results show the Project reduces flow from Permian to the alluvium along Wollombi Brook by up to 39.8 ML/year. The assessment found that this is a relatively small additional impact on top of the cumulative impacts for currently approved mines.

In regard to the Hunter River, the assessment indicates that the Hunter River alluvium is overall leaking into the underlying Permian coal measures. The model predicts that with the Project, the rate of alluvial groundwater leaking into the Permian will increase by up to 58.2 ML/year, due to depressurisation of the Permian strata.

The assessment indicates the Project will require up to 96.4 ML of water licences to account for the predicted interception of water from the Hunter River and Wollombi Brook alluvium. It should be noted that while the reduction in flow from Permian to the alluvium along Wollombi Brook by up to 39.8 ML/year may reduce water levels within the alluvium, the reduction will also improve water quality within the alluvium.

Surface Water Flow

Loss of groundwater from the alluvium will also induce some loss of surface water from both the Wollombi Brook and Hunter River. Overall the Wollombi Brook is a net gaining system, with water flowing from the alluvium to the Wollombi Brook (baseflow). Cumulative impacts from approved mining (i.e. HVO South, MTW and approved mining at Wambo) reduce the net baseflow to Wollombi Brook by 1450 ML/year to 1000 ML/year. The Project accounts for a minor contribution of between 0.5 ML/year and 37.4 ML/year of the cumulative impacts on baseflow in Wollombi Brook (around 3 per cent reduction in baseflow contribution).

The assessment indicated that there would be a gradual reduction of flow from 3500 ML/year to 2800 ML/year in the Hunter River over the life of the Project due to cumulative impacts. The Project accounts for up to 57.7 ML/year of the cumulative impact on the Hunter River baseflow (around 2 per cent reduction in baseflow contribution).

When considering the river budgets it is important to note the underlying assumptions in the model. The model assumes direct hydraulic connection between the river and the aquifer, and no limit on the volume of water that can leak from the river into the underlying aquifer. In reality 'losing zones' in the river can be physically separated from the underlying water table in the aquifer by unsaturated zones. In this case drawdown within the alluvium or Permian strata does not increase the rate of flux from the river as it does in the model. Therefore, the model predictions are considered conservative worst case and are likely over predictions of the actual impact that will be experienced. Where the river and the aquifer are directly connected through the saturated zone, the 'water take' from the alluvium directly accounts for 'water take' from the river.

Water Licensing Requirements

The Joint Venture has a combined total entitlement of up to 920 ML/year assuming full allocation under the Hunter Unregulated WSP (Lower Wollombi Water Source), and up to 1300 ML/year high security under the Hunter Regulated WSP.

Based on modelling, the Project will need to licence the following water take:

- 359 ML/year from the Permian groundwater system under the *Water Act 1912* (scheduled by DPI Water to be included in the North Coast Fractured and Porous Rock Groundwater Sources WSP as from 1 July 2016)
- 58 ML/year from the Hunter Regulated WSP
- 40 ML/year from the Hunter Unregulated WSP (Lower Wollombi Water Source).

Based on the approved United and Wambo operations combined with the Project, the groundwater model predicts that the maximum take from alluvium under the Hunter Unregulated WSP (Lower Wollombi Water Source) is 260 ML/year, which is within the currently held entitlement. The predicted take associated with baseflow impacts from the Hunter Regulated WSP for the approved mining operations combined with the Project is up to 84 ML/year, which is within the currently held entitlement.

The combined entitlements held by United and Wambo for take from the Permian aquifer under the *Water Act 1912* is 1947 ML/year. The groundwater model predicts that up to 633 ML/year of groundwater within the Permian coal measures will be intercepted with the Project and currently approved operations at Wambo. This take is within the currently held entitlement.

It is noted that there is an Embargo Order on water licences within the area of the proposed WSP for the North Coast Fractured and Porous Rock Groundwater Source (which covers the Permian aquifer within the Project Area) currently for Part 5 water licences under the *Water Act 1912*. However, the water licensing requirements for the Project and approved operations combined are within the current entitlements and therefore the embargo does not affect the Project. It is understood from discussions with DPI Water that this Embargo Order will be lifted with the commencement of the WSP, scheduled for 1 July 2016.

Private Bores

The model results indicate that the Project will contribute to drawdown at one private bore (GW060780) on land not owned by the Joint Venture that will result in a cumulative drawdown that will exceed 2 metres during mining (refer to **Figure 6.23**). This bore is not currently operable but it is understood to have been installed within the shallow weathered coal measures. The model predicts the bore would experience a maximum 6.7 metres decline in groundwater levels, with the Project predicted to account for 6.1 metres of drawdown during active mining. Currently groundwater levels at GW060780 are 6.9 metres above the base of the bore, therefore drawdown during mining is likely to impair the capacity of the bore. Following

mining, the groundwater levels are predicted to recover and the maximum drawdown post-mining is predicted to be 3.1 metres below 2015 groundwater levels, of which the Project accounts for 1.8 metres of water level drawdown. It is therefore predicted the bore, if repaired, will remain usable, but with a reduced peak pumping capacity due to the predicted decline in water level.

It is noted that the bore is located on a property within the predicted noise affectation zone for the Project and that this property is likely to have voluntary acquisition rights should the Project be approved. Whilst this property remains in private ownership the bore will be monitored and if there is any material impact on serviceable water supply from this bore, United will consult with the property owner to determine appropriate alternate water supply arrangements.

Drawdown at Potential Groundwater Dependent Ecosystems

Potential GDEs have been identified in proximity to the Project Area, primarily associated with riparian vegetation along the main watercourses. The groundwater impact assessment determined the potential drawdown impacts associated with the Project and other mining operations at GDEs. Impacts on GDEs are discussed in **Section 6.9**.

Cumulative Drawdown

Approved coal mines within the region operate below the water table and therefore extract groundwater and create a cumulative drawdown on the groundwater system. No coal seam gas extraction projects are currently in operation or proposed near the Project Area based on publicly available information.

The numerical groundwater model was used to assess the surrounding mine cumulative drawdown. The surrounding mines included approved and proposed operations at Wambo, HVO South, HVO North, Ravensworth and MTW that mine the economic coal seams of the Wittingham Coal Measures.
The simulation of mining at these sites using the numerical model was derived from publicly available approved mine plans and knowledge of mining in the region.

Due to the long history of mining within the region, the cumulative drawdown was determined by comparing predicted changes to 2015 groundwater levels. The cumulative drawdown within the Quaternary alluvium extends along Wollombi Brook and Hunter River, adjacent to mining operations (i.e. Wambo, HVO South, HVO North, Ravensworth and MTW) (refer to **Figure 6.26**). It should be noted that the model predicted drawdown in certain areas exceeds the saturated thickness of the alluvium. The most significant modelled drawdowns within the Quaternary alluvium are visible east of United Open Cut, along Wollombi Brook and Redbank Creek.

In regard to the cumulative drawdowns in the key coal seams relevant to the Project (refer to **Figure 6.27**):

- Cumulative drawdowns within the Wambo Seam are largely within the extent of currently approved cumulative drawdowns for the Wambo Seam.

- Cumulative drawdowns within the Glen Munro Seam extend up to 1 kilometre west of the extent of currently approved cumulative drawdown extent, but are within the extent elsewhere.

- Cumulative drawdowns extend up to 2.5 kilometres west of the extent of currently approved cumulative drawdown for the Arrowfield Seam but are within the extent elsewhere.

- Cumulative drawdowns extend up to 2 kilometres southwest of the extent of currently approved cumulative drawdown for the Vaux Seam but are within the extent elsewhere.

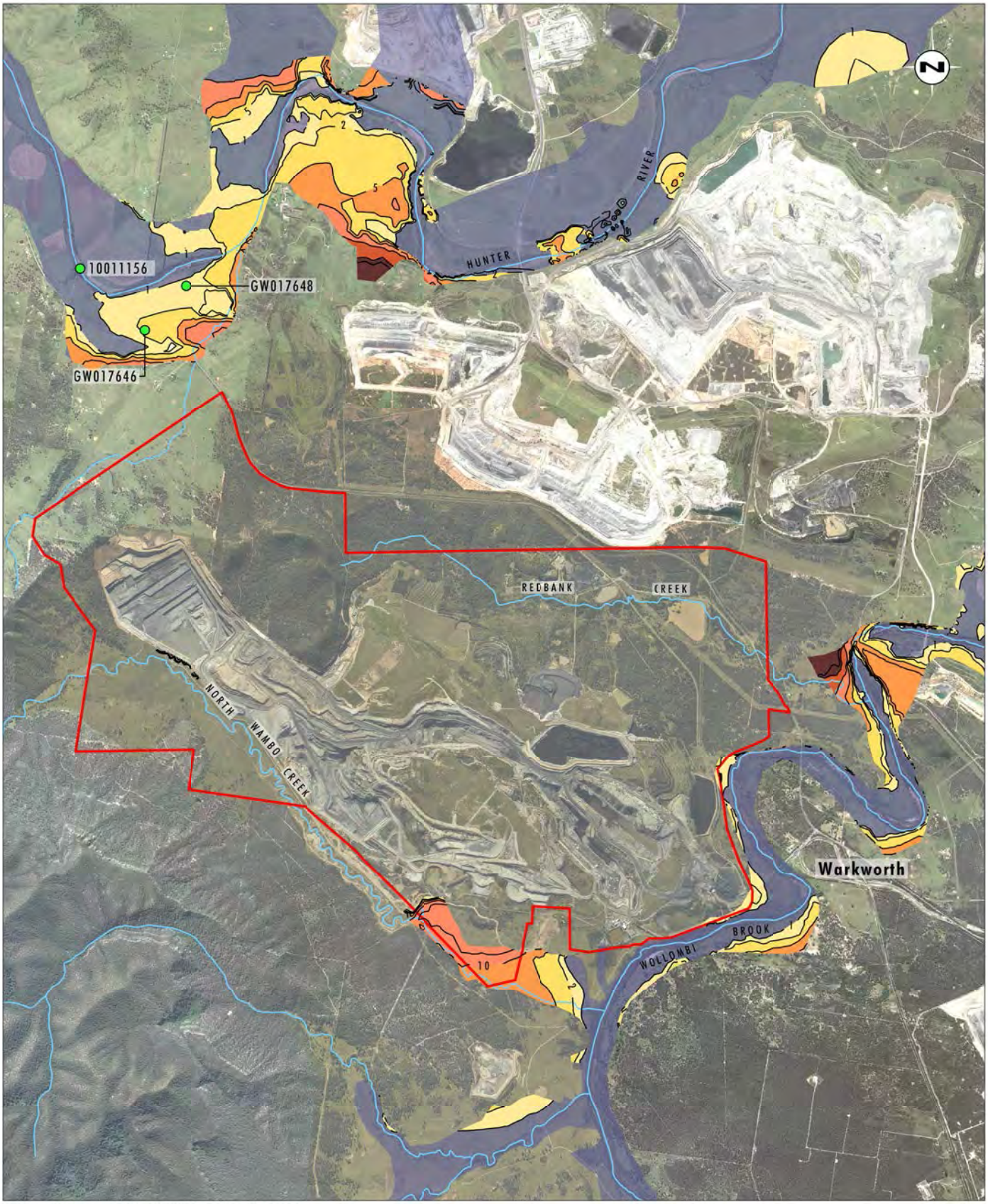


Image Source: AAM (2012), United (2015)
Data Source: United (2015), AGE (2016)

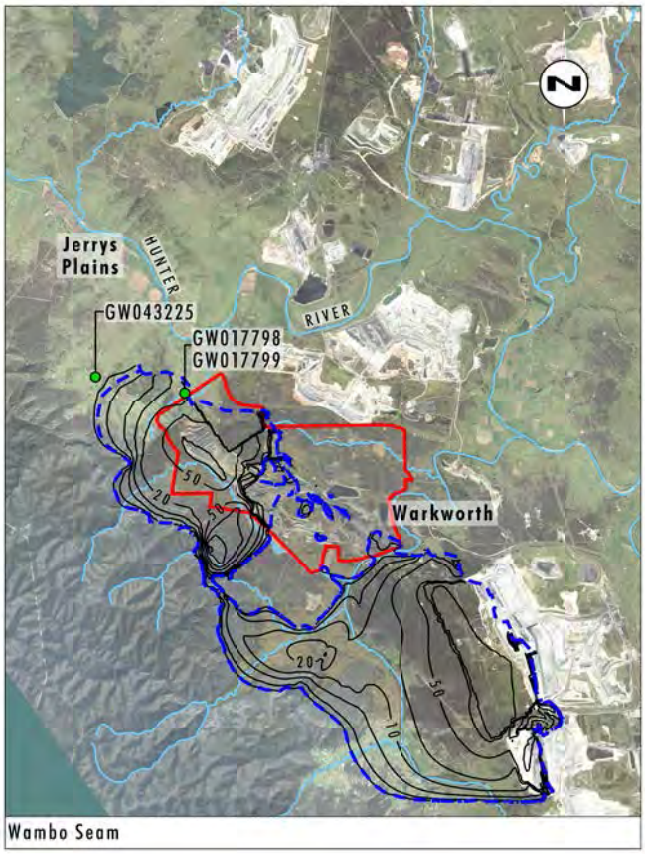
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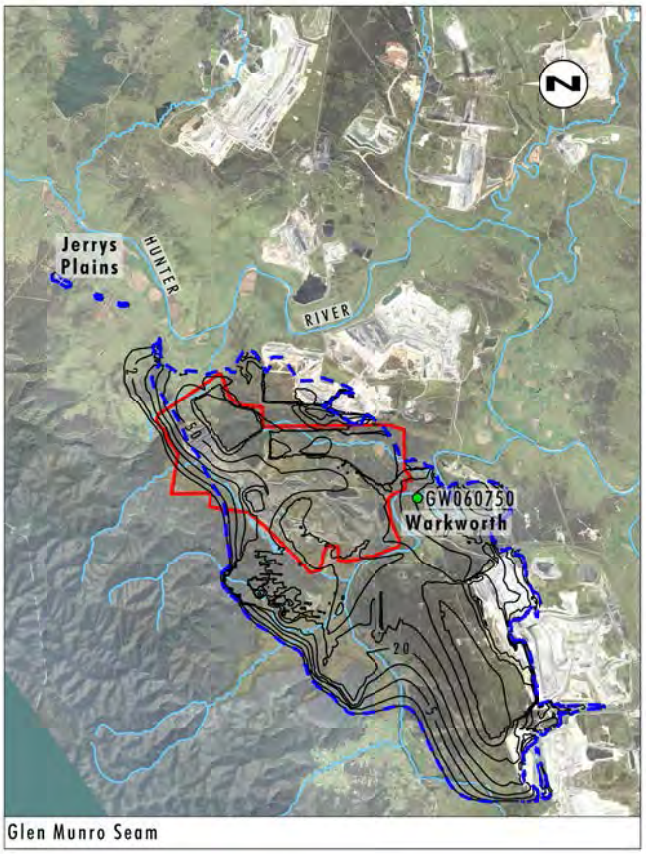
- Project Area
- Drawdown Contour (m)
- Quaternary Alluvium (1:25k AGE)
- Private and Mine Owned Bores

FIGURE 6.26

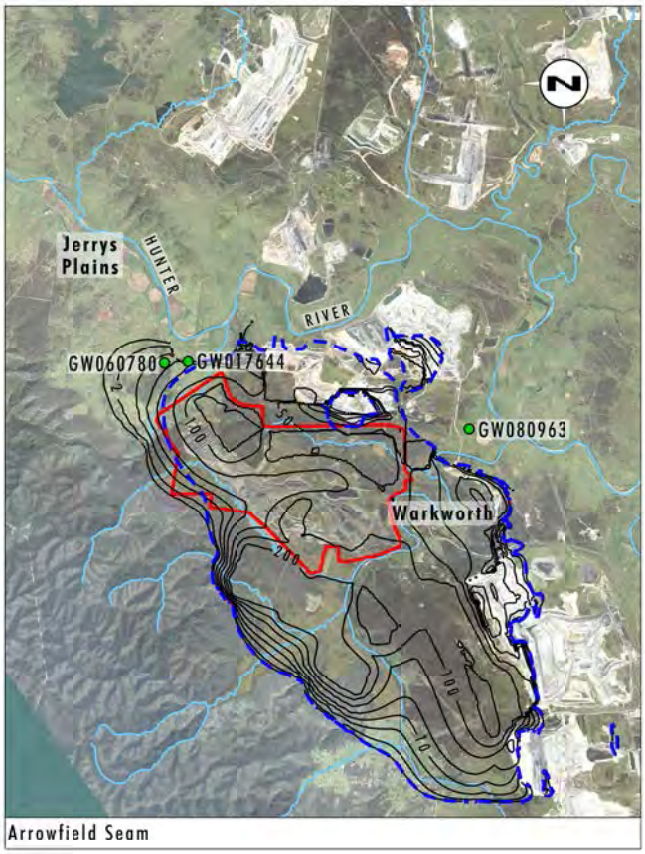
Predicted Cumulative Groundwater Drawdown - Quaternary Alluvium



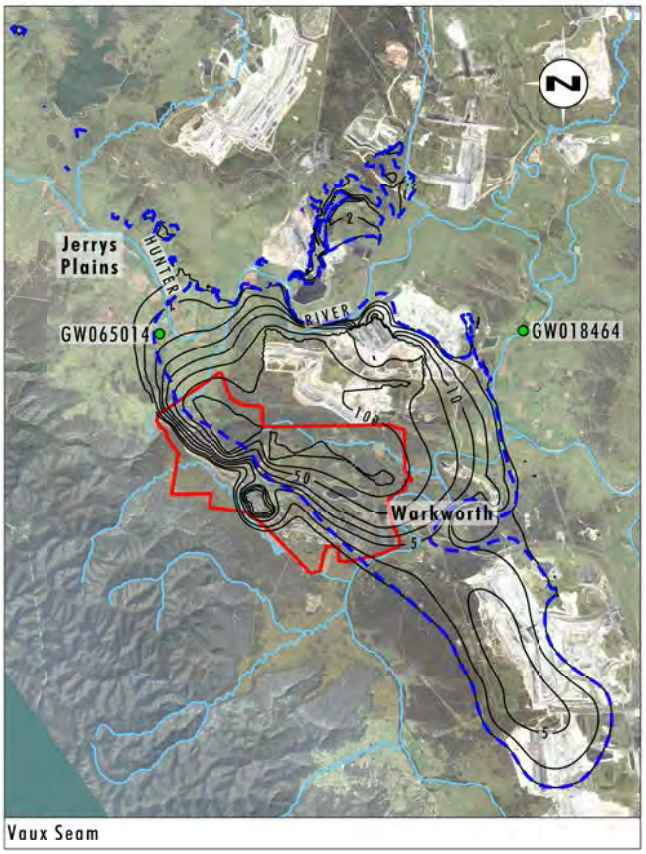
Wambo Seam



Glen Munro Seam



Arrowfield Seam



Vaux Seam

Image Source: AAM (2012), United (2015)
Data Source: AEG (2016)

0 5.0 10.0 12.5km
1:250 000

Legend

- Project Area
- Drawdown Contour
- 1m Approved Cumulative Drawdown Extent
- Private and Mine Owned Bore

FIGURE 6.27

Predicted Cumulative Groundwater Drawdown - Permian Coal Measures

6.8.2.3 Summary of Assessment against Aquifer Interference Policy

Predicted groundwater impacts associated with mining have been assessed in relation to the AIP which states that any mining activity must consider 'Minimal Harm Criteria' with respect to groundwater sources. Key criteria to demonstrate minimal harm include:

- less than 10 per cent variation in the water table within the alluvial lands
- a maximum 2 metre decline at any water supply work
- no mining activity to be within 200 metres laterally from the high bank of a connected stream or 100 metres vertically.

There are two levels of minimal impact considerations specified in the AIP. If the predicted impacts are less than the Level 1 minimal impact considerations, then these impacts will be considered as acceptable. Where the predicted impacts are greater than the Level 1 minimal impact considerations then the AIP requires additional studies to fully assess these predicted impacts. If this assessment shows that the predicted impacts do not prevent the long-term viability of the relevant water-dependent asset, then the impacts will be considered to be acceptable.

Table 6.30 below compares the groundwater impact predictions for the Project against the requirements under the AIP.

Table 6.30 Summary of Assessment of Minimal Harm Criteria

AIP Requirement	Alluvium	Coal Measures
Water table	• Risk of drawdown at identified GDEs at two locations (GDE1 and GDE2 – refer to **Section 6.9**). • The alluvium within these areas has a maximum saturated thickness of up to 10 metres. • Approximately 1m in groundwater level decline is predicted at GDE2 due to cumulative impacts from mining (approved mining and the Project). • The alluvium near GDE1 becomes largely unsaturated due to cumulative impacts from approved mining. The Project only influences the timing of the impact, not the magnitude.	• There are no known GDEs or culturally significant sites dependent on groundwater from the Permian coal measures within the vicinity of the Project Area. • The model results indicate that the Project will contribute to drawdown at one private bore on land not owned by the proponent, causing cumulative drawdown to exceed 2 metres during mining. Following mining the groundwater levels are predicted to recover and the maximum drawdown post-mining is predicted to be 1.7 metres below 2015 groundwater levels, of which the Project accounts for 1.6 metres of water level drawdown.

AIP Requirement	Alluvium	Coal Measures
Water pressure	• Hunter River and Wollombi Brook alluvium are considered a highly productive aquifer as yields >5L/sec are considered achievable and salinity <1,500 mg/L occurs. • Project design incorporates offset distances to Wollombi Brook (approximately 370 metres) and the Hunter River (approximately 1.7 kilometres) which exceed the 200 metre offsets recommended in the NSW Aquifer Interference Policy so that impacts to the alluvial system are minimised as far as possible. • Gradual recovery to pre-mining conditions, and no greater water takes than that predicted during mining operations.	• Water quality and yields for the coal measures and Permian coal measures is considered a less productive aquifer according to the AIP because yields >5 L/sec are considered unlikely and salinity <1500 mg/L is not common. • The model results indicate that the Project will contribute to drawdown at one private bore on land not owned by the proponent, causing cumulative drawdown to exceed 2 metres during mining.
Water quality	• The Project is not predicted to adversely affect groundwater quality within alluvial aquifers.	• Study identified the potential for the Project to increase salt loads post mining within the final void. However, as the final void will be a long-term sink, the risk of impacting surrounding groundwater is low and the risk of changing the beneficial use of the water source was considered improbable.

Based on the groundwater modelling, predicted impacts are considered less than the Level 1 minimal impact considerations except for the impact on one private bore (refer to **Table 6.30**). The modelling indicates that the Project could cause a cumulative drawdown of more than 2 metres at one private bore, which will exceed the Level 1 minimal impact considerations during mining. Following mining the groundwater levels are predicted to recover and the maximum drawdown post mining is predicted to be 1.7 metres below 2015 groundwater levels, of which the Project accounts for 1.6 metres of water level drawdown. The impacted bore is located on a property within the predicted noise affectation zone for the Project and is likely to have voluntary acquisition rights should the Project be approved.

Further details of the assessment against the Aquifer Interference Policy minimal harm criteria are contained in **Appendix 12**. An assessment against the Commonwealth Significant Impact Guidelines 1.3: Coal seam gas and large coal mining developments – impacts on water resources (DoE 2013) is provided in **Section 7.0** and **Appendix 12**.

6.8.2.4 Groundwater Management and Monitoring Commitments

Management of groundwater beneath and adjacent to the Project Area will involve the ongoing implementation of a robust groundwater level and quality monitoring program. Operational reporting will occur at frequencies suited to the mine development and be part of the basis of annual reporting to key stakeholders.

As outlined in **Section 6.8.1.7**, a Project WMP will be prepared to guide the overall management of water as part of the Project, including a Groundwater Management Plan, in consultation with DPI Water.

The WMP will include details on how and when groundwater will be monitored across the Project Area and surrounds. It is proposed the existing groundwater monitoring programs will be continued and revised as required throughout the life of the Project. Additional monitoring bores will also be installed as required in order to ensure a long-term groundwater monitoring network in all key groundwater bearing units. The proposed bore locations are detailed in **Appendix 12** and shown on **Figure 6.28**. Groundwater monitoring will include:

- monthly to bi-monthly water levels
- monthly to bi-monthly field water quality
- annual comprehensive water quality analysis at selected bores, including pH, electrical conductivity (EC), total dissolved solids (TDS), major ions (Ca, Cl, K, Na, Mg and SO_4), hardness, bicarbonate and nitrate
- monitoring of water levels and flows from key private bores within, and adjacent to, the zone of depressurisation, in consultation with adjacent landholders.

The monitoring program will also include a program of periodically sampling stygofauna in consideration of the recommendations of the Stygofauna Assessment completed for the Project (included as an appendix to **Appendix 12**).

The WMP will include trigger levels for water quality and water levels. The aim of the trigger levels is to provide mine management with an early warning mechanism that identifies water quality trends departing from historical values. The trigger levels will be derived for water quality parameters as part of the development of the WMP.

Should monitoring indicate that changes in groundwater levels and quality, or changes in surface waters, are more extensive or significant than predicted, mitigation measures will be considered in consultation with relevant government agencies.

If mitigation measures are not feasible, 'make good' measures with affected land owners will be carried out, potentially including:

- ensuring the bore owner has access to a similar quantity and quality of water for the water bore's authorised purpose for example by:
    - bore enhancement by deepening the bore or improving its pumping capacity
    - constructing a new water bore
    - providing a supply of an equivalent amount of water of a suitable quality by piping it from an alternative source.
- carry out a plan to monitor the water bore, for example, by undertaking periodic bore assessments.

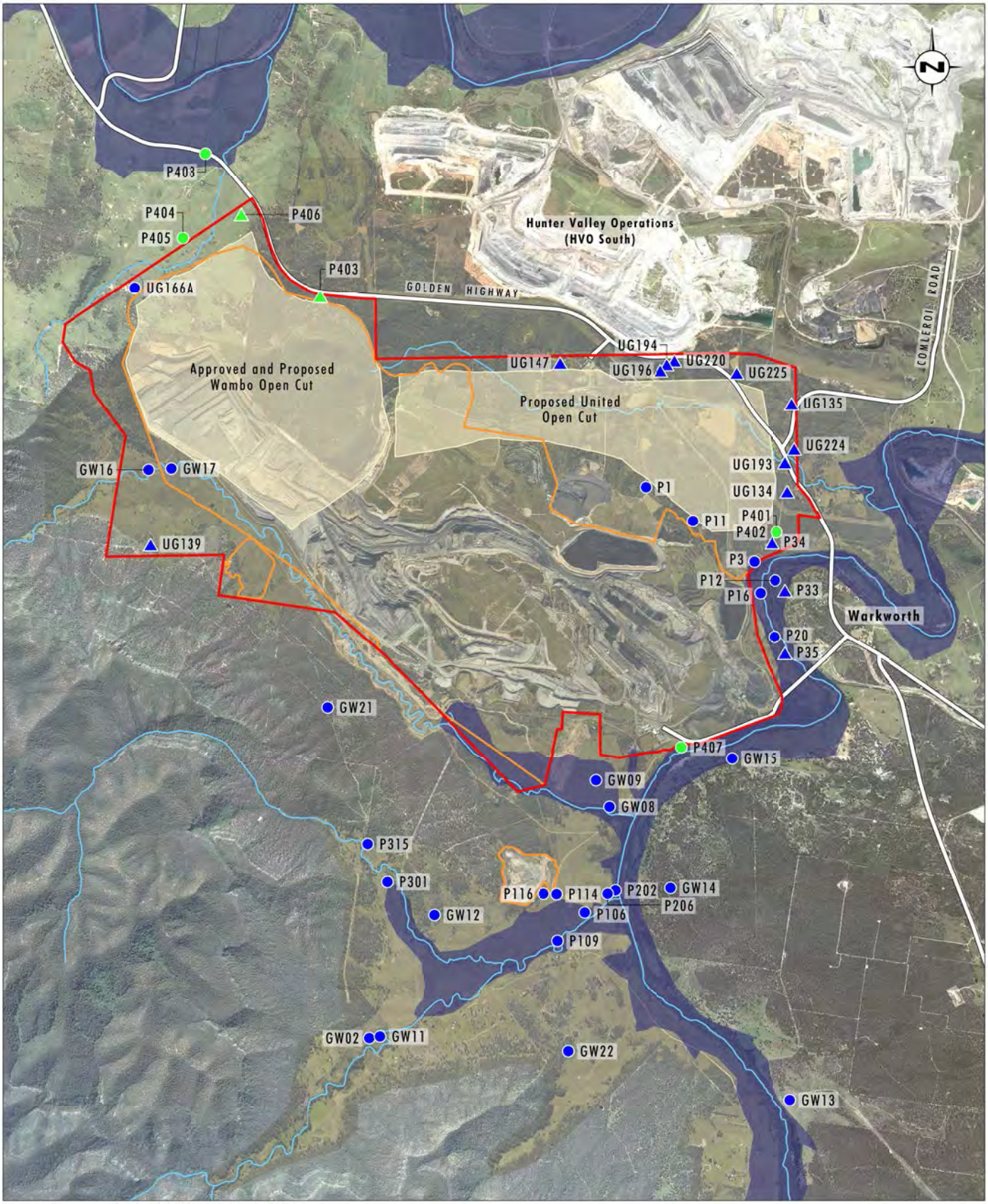


Image Source: AAM (2012), United (2015)
Data Source: Glencore (2014)

0 1.0 2.0 3.0km
1:60 000

Legend

- Project Area
- Approved Wambo Surface Development Area
- Proposed Conceptual Extraction Area
- Quaternary Alluvium (1:25k AEG)
- Monitoring Bore (Existing)
- VWP (Existing)
- Monitoring Bore (Proposed)
- VWP (Proposed)

FIGURE 6.28

Proposed Monitoring Bore Locations

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20160512 16.48

Further details of the proposed approach to ongoing groundwater monitoring and management are provided in **Appendix 12**.

6.9 Biodiversity

As discussed in **Section 4.1.1**, the Commonwealth and NSW Governments have entered into an agreement to undertake a strategic assessment of a Biodiversity Plan for Coal Mining in the Upper Hunter Valley, NSW. This assessment is referred to as the Upper Hunter Strategic Assessment (UHSA). The UHSA is being undertaken in accordance with the relevant provisions of the EPBC Act and the NSW EP&A Act. The NSW Biodiversity Certification Assessment Methodology (BCAM) (DECCW 2011a) is being used to assess the impacts.

The Upper Hunter Valley has been identified for a strategic assessment because there are a number of prospective and existing mining and exploration areas for which applications to mine, or to expand existing mines, are expected over the next two decades. There has been extensive historical land clearing in the region for a variety of land uses and the Commonwealth and NSW Governments have identified benefit in taking a proactive approach to identify priority biodiversity conservation outcomes in advance of inevitable project-by-project applications for future coal mining.

The Biodiversity Plan, once finalised, will meet both State and Commonwealth biodiversity assessment requirements. On the approval of this Plan, projects that demonstrate compliance with the expected outcomes of the Biodiversity Plan will be approved and conditioned in accordance with the plan requirements in regard to biodiversity. The biodiversity impacts associated with future development of both United and Wambo are included in the UHSA process, with the biodiversity impacts associated with this Project falling within the area covered by the United UHSA. A UHSA Biodiversity Certification Assessment Report has been prepared for United in consultation with OEH and the final report was submitted to OEH in September 2015 (Umwelt 2015).

The UHSA process is a credit driven system where calculator tools provided by government are input with ecological data about a site to generate biodiversity 'credits' (credits generated by impacts are referred to as the credit requirements for the project). The project is then required to offset these credits through a biodiversity offset strategy which is also a credit based system (offset credits are also calculated for the proposed offsets using government supplied credit calculators). The credit requirements for the Project are discussed in **Section 6.9.4**.

It was expected that the Biodiversity Plan would be in place at the time of public exhibition of this Project, however, due to delays in the UHSA process the Biodiversity Plan is not yet finalised. To allow projects to be assessed while the UHSA Biodiversity Plan is being finalised, the NSW and Commonwealth Governments developed the UHSA Interim Policy (DP&I 2012). This Project has been assessed in accordance with the Interim Policy under the direction of DPE and DoE.

As a Project fitting under this strategic assessment framework, a UHSA Statement of Consistency report has been prepared to identify how the Project fits within the UHSA process. The assessment of biodiversity impacts has been prepared in accordance with the SEARs (refer to **Table 4.3**) and OEH's requirements (dated 17 December 2015).

The Statement of Consistency report is provided in **Appendix 13** with a summary included in this section.

6.9.1 Project Disturbance Area

The Project will require the disturbance of an area of approximately 714 hectares from within the 1087 hectares of the United UHSA Project Area as shown in **Figure 6.29**.

The approved Wambo Surface Development Area shown on **Figure 6.29** is currently approved for disturbance and ongoing surface disturbance works will occur within this area over the life of the Project. As this area has previously been assessed and approved for disturbance (under both NSW and Commonwealth legislation), and as much of it has been or will be disturbed prior to the determination of the Project, no further assessment of the disturbance of this area is required as part of this EIS. The ongoing management of disturbance activities in this area will be undertaken in accordance with the approved management controls under the Wambo mine development consent and EPBC Approval.

6.9.2 Key Biodiversity Values of the Project Area

The UHSA process requires a specific approach to be undertaken for biodiversity field surveys to identify the vegetation communities, flora species and fauna species that occur within the Project Area. The required surveys were completed and a summary of the key biodiversity values found in the Project Area is provided in the following sections.

6.9.2.1 Vegetation Communities

Under the UHSA process all vegetation within the Project Area is required to be classified into vegetation zones. A total of 12 vegetation zones were identified across the additional disturbance area (refer to **Table 6.31**).

Table 6.31 Additional Disturbance Area Vegetation Zones

Veg Zone No.	Vegetation Type	Area (ha)	Site Value Score[#]	Threatened Ecological Community
2	HU812 – Moderate to Good Condition Forest Red Gum grassy open forest on floodplains of the lower Hunter	0.29	81	Hunter Floodplain Red Gum Woodland EEC (TSC Act)
3	HU816 – Moderate to Good Condition – Plantation/Rehabilitation Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	29.42	60	Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC (TSC Act) 1.17 ha Central Hunter Valley Eucalypt Forest and Woodland CEEC (EPBC Act)

Veg Zone No.	Vegetation Type	Area (ha)	Site Value Score[#]	Threatened Ecological Community
4	HU869 – Moderate to Good Condition Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin	1.56	68	Hunter Valley Footslopes Slaty Gum Woodland VEC (TSC Act) 1.13 ha Central Hunter Valley Eucalypt Forest and Woodland CEEC (EPBC Act)
5	HU905 – Moderate to Good Condition Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter	175.06	72	Central Hunter Grey Box – Ironbark Woodland EEC (TSC Act) 169.40 ha Central Hunter Valley Eucalypt Forest and Woodland CEEC (EPBC Act)
6	HU905 –- Moderate to Good Condition - Thinned Canopy	0.08	57	Central Hunter Grey Box – Ironbark Woodland EEC (TSC Act) 0.08 ha Central Hunter Valley Eucalypt Forest and Woodland CEEC (EPBC Act)
7	HU905 – Moderate to Good Condition – Regeneration	26.77	64	Central Hunter Grey Box – Ironbark Woodland EEC (TSC Act) 23.01 ha Central Hunter Valley Eucalypt Forest and Woodland CEEC (EPBC Act)
8	HU905 – Moderate to Good Condition – Cooba Open Shrubland	80.89	35	NA
9	HU905 – Low Condition – Derived Native Grassland	101.69	17	20.71 ha Central Hunter Valley Eucalypt Forest and Woodland CEEC (EPBC Act)
10	HU906 – Moderate to Good Condition Bull Oak grassy woodland of the central Hunter Valley	118.62	74	3.1 ha Central Hunter Grey Box – Ironbark Woodland EEC (TSC Act) 8.02 ha Central Hunter Valley Eucalypt Forest and Woodland CEEC (EPBC Act)

Veg Zone No.	Vegetation Type	Area (ha)	Site Value Score[#]	Threatened Ecological Community
11	HU945 – Moderate to Good Condition Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley	31.61	71	NA
12	Cleared land (including disturbed land, mixed species revegetation plantation and water bodies)	147.97	NA	NA
Total		**714**		

[#] Site Value is the condition of each native vegetation zone calculated against the benchmark (determined by OEH for each BVT. The site value score is a quantitative measure of vegetation condition calculated in accordance with BCAM Equation 1 (DECCW 2011a).
CEEC = Critically Endangered Ecological Community
EEC = Endangered Ecological Community
EPBC Act = Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
HU### = Hunter Biometric Vegetation Type Number
TSC Act = NSW *Threatened Species Conservation Act 1995*
VEC = Vulnerable Ecological Community

Table 6.31 lists the area of each vegetation type together with the Site Value Score, which is a measure of the condition of the biodiversity within each vegetation zone.

The additional disturbance area of approximately 714 hectares includes one critically endangered ecological community (CEEC) listed under the EPBC Act and four threatened ecological communities listed under the *Threatened Species Conservation Act 1995* (TSC Act), being:

- Central Hunter Valley Eucalypt Forest and Woodland CEEC (223.5 ha) (EPBC Act)
- Hunter Floodplain Red Gum Woodland EEC (0.29 ha) (TSC Act)
- Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC (29.4 ha) (TSC Act)
- Hunter Valley Footslopes Slaty Gum Woodland Vulnerable Ecological Community (VEC) (1.6 ha) (TSC Act)
- Central Hunter Grey Box – Ironbark Woodland EEC (205 ha) (TSC Act).

6.9.2.2 Key Species

The UHSA methodology categorises species as either ecosystem-credit species or species-credit species which are defined as:

- Ecosystem-credit species – species that can be reliably predicted to occur in Plant Community Types (PCTs) and have a high likelihood of occurring on the site. Therefore, targeted surveys for ecosystem-credit species are not required

- Species-credit Species – species that cannot be reliably predicted based on a PCT, distribution or habitat criteria. These species require targeted survey effort to determine their presence or otherwise on the site.

All non-threatened species and some threatened species are ecosystem species and therefore do not require further detailed assessment under the methodology. The remaining threatened species are species-credit species and require further assessment and the calculation of impact species-credits under the UHSA methodology.

Ecosystem Credit Species

Six ecosystem credit species were recorded during field surveys of the Project Area, being:

- east coast freetail bat (*Mormopterus norfolkensis*)
- spotted-tailed quoll (*Dasyurus maculatus maculatus*)
- grey-crowned babbler (*Pomatostomus temporalis temporalis*)
- speckled warbler (*Chthonicola sagittata*)
- eastern bentwing-bat (*Miniopterus schreibersii oceanensis*) – foraging habitat only
- eastern cave bat (*Vespadelus troughtoni*) – foraging habitat only.

For the eastern bentwing-bat (*Miniopterus schreibersii oceanensis*) and eastern cave bat (*Vespadelus troughtoni*), only foraging habitat is covered by ecosystem credits whilst their breeding habitat is covered by species credits. There is no breeding habitat in the Project Area for these species.

A single spotted-tailed quoll (*Dasyurus maculatus maculatus*) was recorded by a remote camera in 2013 during pest management surveys by United environmental staff. Despite targeted surveys undertaken in Feb-March 2013 and March 2014 the species was not re-recorded on the site.

Species Credit Species

Four species credit species were recorded during field surveys of the Project Area, being:

- population of weeping myall (*Acacia pendula*)
- eastern osprey (*Pandion cristatus*)
- large-eared pied bat (*Chalinolobus dwyeri*)
- southern myotis (*Myotis macropus*) (breeding habitat).

Due to the absence of potential breeding habitat (sandstone caves) within the additional disturbance area, no credits are required for the large-eared pied bat (Umwelt 2015). The single record of the eastern osprey in the additional disturbance area was considered a vagrant record due to the lack of habitat in this area and no credits are required for the eastern osprey (Umwelt 2015). No breeding habitat of the eastern bentwing-bat or eastern cave bat was recorded in the additional disturbance area and therefore no species credits are required for either species (only the breeding habitat component is a species credit).

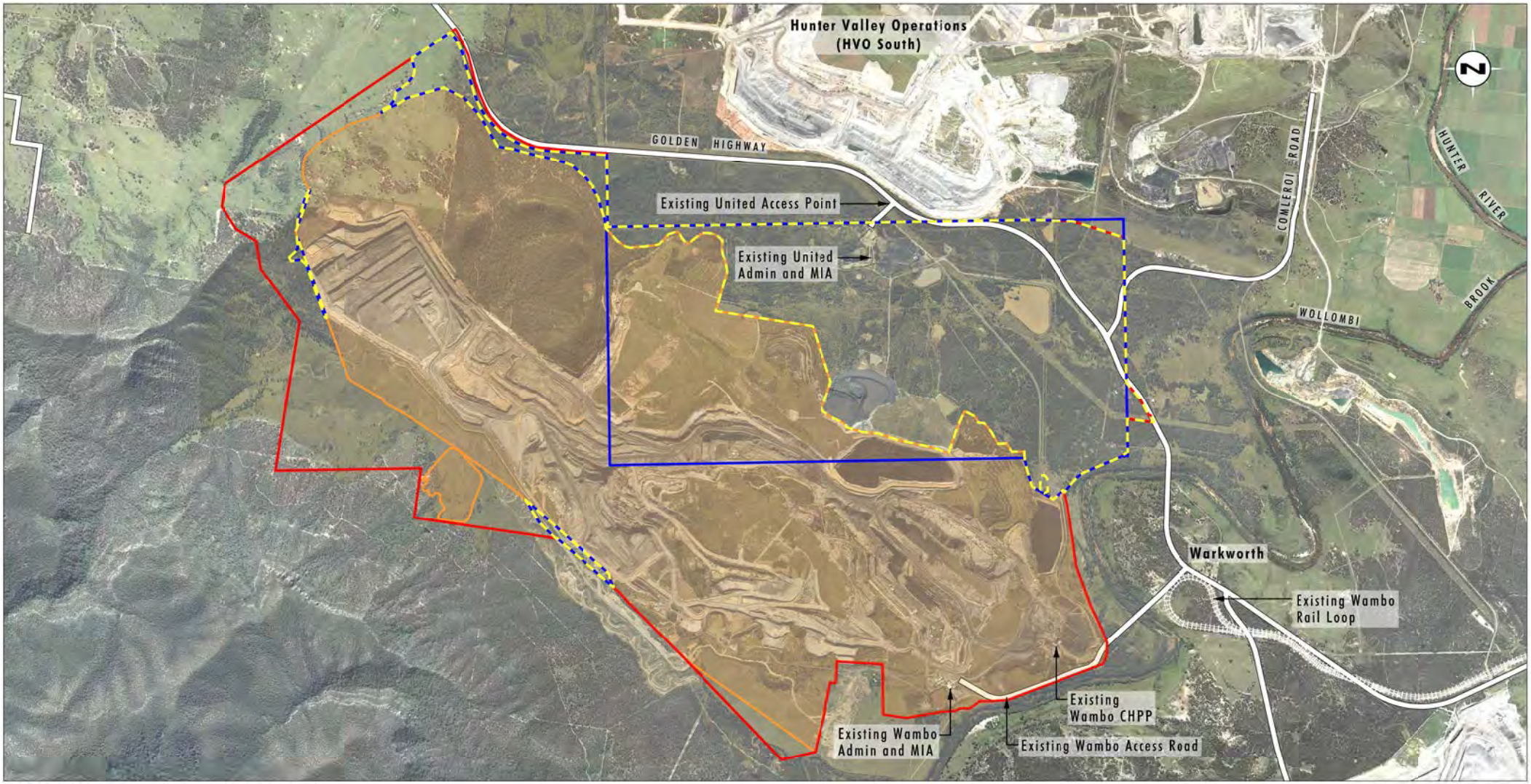


Image Source: AAM (2012), United (2015)
Data Source: Glencore (2014)

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Legend

- Project Area
- Approved Wambo Surface Development Area
- UHSA Project Area
- Conceptual Additional Disturbance Area

FIGURE 6.29

UHSA Study Area and Proposed Disturbance Area

6.9.3 Avoidance and Mitigation Measures

Avoidance

A number of design changes were implemented during the early stages of designing the Project that ameliorated the impacts of the Project on biodiversity, including threatened species, endangered ecological communities, and/or their habitats. As discussed in **Section 3.4**, United has undertaken detailed studies which considered alternative mine and infrastructure plans. A key alternative considered was to develop the United Open Cut as a standalone mining operation which would have resulted in more disturbance to biodiversity than the proposed Project (approximately 148 hectares of additional disturbance) due to the need to develop standalone coal processing facilities, mine infrastructure (workshops, etc) and transportation infrastructure (rail line, rail loop and train loading facility). The decision to proceed with the Joint Venture and therefore make available the Wambo infrastructure for the Project, negating the need to build new mining infrastructure, substantially decreased the potential biodiversity impacts of the Project (refer to **Section 3.4.1**).

As part of the ongoing concept design of the Project, United has sought to further minimise the impact of the Project on biodiversity through seeking to reduce the disturbance footprint where practicable and incorporating controls to mitigate impacts as discussed in the following section.

The initial additional disturbance area boundary included a 0.1 hectare stand of Hunter Valley Weeping Myall Woodland of the Sydney Basin Bioregion (HU652 – Weeping Myall – Coobah – Scrub Wilga Shrubland of the Hunter Valley) (refer to **Figure 6.30**) which falls into the very high risk category under the UHSA. It is also listed as an endangered population and an endangered ecological community under the TSC Act. The additional disturbance area boundary was modified to avoid impacting on this stand. The stand will be managed for the recovery of the community and will be fenced to exclude grazing stock and unauthorised intrusions (with a 20 metre buffer between the stand and the fence).

Mitigation Measures

United has committed to the design and implementation of a comprehensive ecological mitigation strategy to mitigate the unavoidable impacts of the Project. During the preparation of the mitigation strategy, the UHSA Guidelines for the Mitigation of Coal Mining Impacts on Biodiversity (OEH 2015b) (UHSA Mitigation Guidelines) were consulted. The mitigation guidelines provide guidance for proponents on how to reduce significant local impacts on biodiversity while undertaking vegetation clearance, mining operations and related activities. The proposed mitigation measures for the Project are described generally in accordance with those included in the UHSA Mitigation Guidelines.

The following specific control measures are considered to be integral to the protection and preservation of the ecological features of the Project Area:

- landform establishment
- implementation of clearing procedures to minimise the impacts of the clearing process and maximise the recovery of any valuable biodiversity resources (e.g. seed collection, re-use of hollow logs and tree hollows where appropriate)
- feral animal and noxious weed control
- fencing and access control
- management of domestic stock

- pathogen management
- bushfire management
- ensuring appropriate environmental management measures are in place as part of the mining operations to minimise the potential for indirect impacts including:
    - water management systems that seek to minimise the potential for damage to flora and fauna and their habitats from erosion and unnatural flooding events
    - noise control systems to minimise noise impacts
    - dust control measures to minimise dust impacts
    - lighting controls to minimise night light impacts
    - blasting controls to minimise blast overpressure and vibration impacts.
- training of key employees regarding the key biodiversity mitigation and management measures relevant to the work they undertake.

Each of these control measures will contribute to the maintenance of habitat quality across the Project Area, including the habitat in the additional disturbance area prior to it being impacted. Specific details on these measures and how they are consistent with the *Mitigation Guidelines* is outlined in **Appendix 13**.

United will prepare an appropriate biodiversity management plan for the Project in accordance with any relevant development consent requirements. The project-specific Biodiversity Management Plan will guide the implementation of the mitigation steps. The outcomes from the ecological monitoring program will also be used to provide for the management plan to be reviewed and adapted in response to new information.

Monitoring is a tool that can be used to assess and inform the ongoing improvement of management actions. The effectiveness and long-term success of biodiversity mitigation actions will be evaluated through regular and appropriately targeted monitoring. This will be achieved by using formal monitoring programs and due diligence assessments that periodically examine measurable changes over time and provide information on impacts and the success or otherwise of mitigation actions.

The biodiversity monitoring program for the Project will be documented in the biodiversity management plan.

6.9.4 Impact Assessment

The construction and operation of the Project will result in a range of direct impacts on biodiversity values within the additional disturbance area. Direct impact includes loss of native vegetation and fauna habitats as a result of direct clearance works and works associated with the construction and operation of the Project. **Table 6.32** outlines the impacts of the Project on vegetation communities and the offset credit requirements.

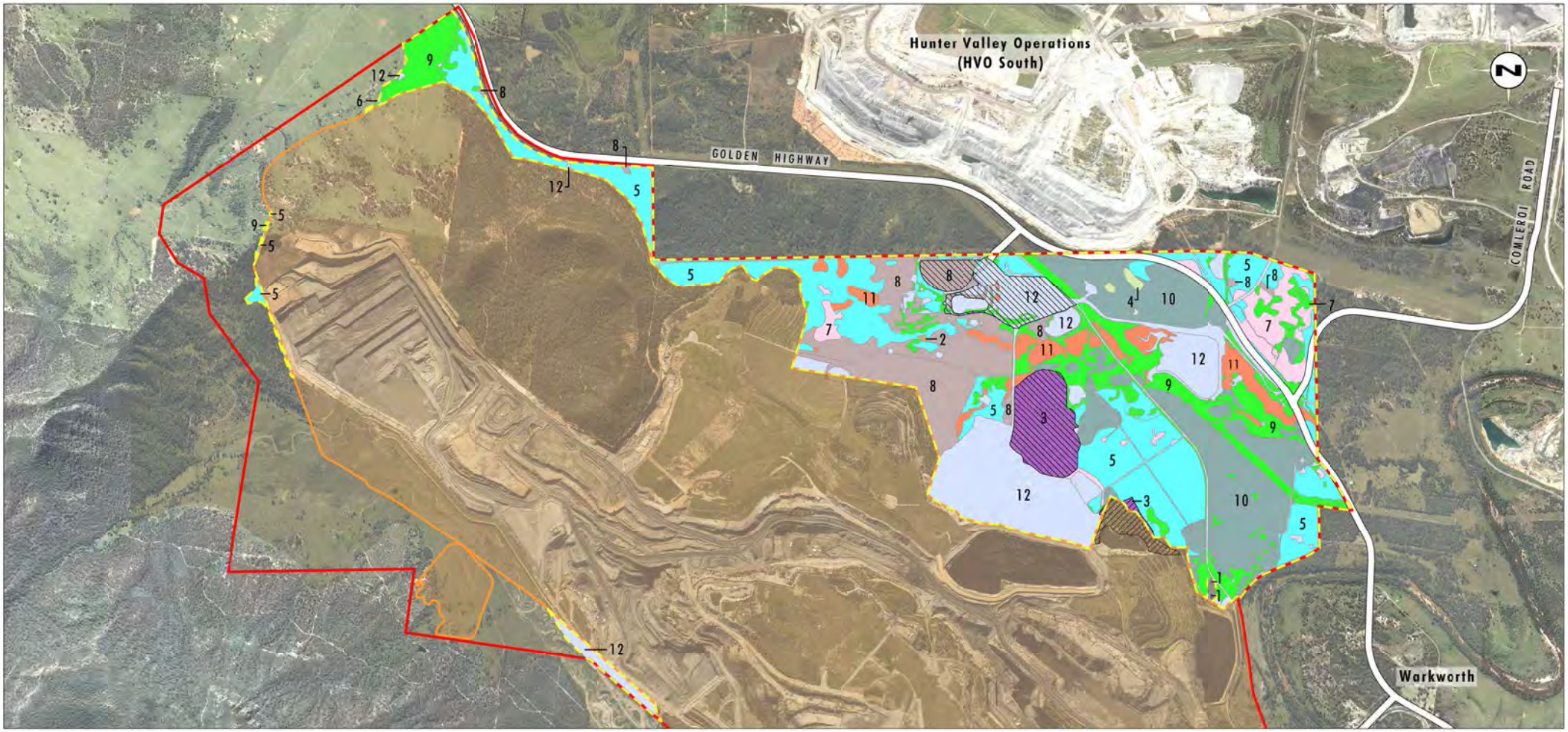


Image Source: AAM (2012), United (2015)
Data Source: Glencore (2014)

Legend

- Project Area
- Conceptual Additional Disturbance Area
- Approved Wambo Surface Development Area
- 1 - HU652 - Weeping Myall - Cooba - Scrub Wilga Shrubland of the Hunter Valley- Moderate to Good Condition
- 2 - HU812 - Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter - Moderate to Good Condition
- 3 - HU816 - Spotted Gum - Narrow-leaved Ironbark Shrub - Grass Open Forest on Slopes of the Upper Hunter and Sydney Basin - Moderate to Good Condition - Plantation/Rehabilitation (CEEC in part)
- 4 - HU869 - Grey Box - Slaty Box Shrub - Grass Woodland on Sandstone Slopes of the Upper Hunter and Sydney Basin - Moderate to Good Condition (CEEC)
- 5 - HU905 - Narrow-leaved Ironbark - Grey Box grassy Woodland of the Central and Upper Hunter - Moderate to Good Condition (CEEC)
- 6 - HU905 - Moderate to Good Condition - Thinned Canopy (CEEC)
- 7 - HU905 - Moderate to Good Condition - Regeneration (CEEC in part)
- 8 - HU905 - Moderate to Good Condition - Cooba Open Shrubland
- 9 - HU905 - Low Condition - Derived Native Grassland (CEEC in part)
- 10 - HU906 - Bull Oak Grassy Woodland of the Central Hunter Valley - Moderate to Good Condition (CEEC in part)
- 11 - HU945 - Swamp Oak - Weeping Grass Grassy Riparian Forest of the Hunter Valley - Moderate to Good Condition
- 12 - Cleared Land
- Approved for Disturbance
- Wambo Mine Rehabilitation

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FIGURE 6.30

Vegetation Types of the Disturbance Area

Table 6.32 Vegetation Impact of the Project and Offset Credit Requirements

Credit Type	Project Impact Area (ha)	Offset Requirement (credits)
Ecosystem Credits		
HU812 – Moderate to Good Condition	0.29	14
HU816 – Moderate to Good Condition – Plantation/Rehabilitation	29.42	1,041
HU869 – Moderate to Good Condition	1.56	59
HU905 – Moderate to Good Condition	175.06	7,080
HU905 – Moderate to Good Condition – Thinned Canopy	0.08	3
HU905 – Moderate to Good Condition – Regeneration	26.77	984
HU905 – Moderate to Good Condition – Cooba Open Shrubland	80.89	1,933
HU905 – Low Condition – Derived Native Grassland	101.69	845[1]
HU906 – Moderate to Good Condition	118.62	4,909
HU945 – Moderate to Good Condition	31.61	1,248
Cleared land (including disturbed land, mixed species revegetation plantation and water bodies)	147.97	Nil
Total	**713.96**	**18,116**

1 = 50 per cent DNG reduction applied where appropriate

Figure 6.30 shows the vegetation communities mapped within the additional disturbance area.

A total of approximately 223.5 hectares of the EPBC listed Central Hunter Valley Eucalypt Forest and Woodland CEEC was identified within the additional disturbance area (refer to **Figure 6.30**). Components of the following biometric vegetation type present in the additional disturbance area conform to the CEEC:

- Zone 3: HU816 Spotted Gum - Narrow-leaved Ironbark Shrub - Grass Open Forest of the Central and Lower Hunter (1.2 hectares)
- Zone 4: HU869 Grey Box - Slaty Box Shrub - Grass Woodland on Sandstone Slopes of the Upper Hunter and Sydney Basin – (1.1 hectares)
- Zones 5, 6, 7 and 9: HU905 Narrow-leaved Ironbark - Grey Box Grassy Woodland of the Central and Upper Hunter (213.2 hectares)
- Zone 10: HU906 Bull Oak Grassy Woodland of the Central Hunter Valley (8.0 hectares).

Table 6.33 details the number of species credits required for all applicable species credit species recorded in the additional disturbance area.

Table 6.33 Number of Species Credits Required for the Additional Disturbance Area

Species Name	T_G Value	Number of Individuals/Area of Habitat	Number of Credits Required
Flora Species			
Population of weeping myall (*Acacia pendula*)	No credits are required as no impact proposed		
Fauna Species			
eastern osprey (*Pandion cristatus*)	No credits are required		
large-eared pied bat (*Chalinolobus dwyeri*)	No credits are required		
southern myotis (*Myotis macropus*) (breeding habitat)	0.13	7.3 hectares	562
Total			**562**

As outlined in **Tables 6.32** and **6.33** the Project requires 18,678 credits.

The Project is not expected to result in any substantial indirect impacts on the biodiversity values of surrounding lands during the construction or operational phases of the Project. Some minor indirect impacts associated with habitat connectivity, fugitive light emissions, dust, noise, surface water flow changes, groundwater changes, weeds and feral animals may occur during the construction and operational phases, however, once the proposed mine rehabilitation has become established, the long-term connectivity of the area will be improved.

6.9.4.1 Groundwater Dependent Ecosystems

Potential groundwater dependent ecosystems (GDEs) within the additional disturbance area comprise the Swamp Oak – Weeping Grass Grassy Riparian Forest and Forest Red Gum Grassy Open Forest on Floodplains vegetation types. Both occur along Redbank Creek, an ephemeral creek line. Both communities have a patchy distribution along Redbank Creek (refer to **Figure 6.31**). The remaining vegetation types within the riparian zone (e.g. grassland communities) are unlikely to be GDEs. These vegetation types are not characteristic vegetation types of riparian zones and extend from lower slopes and beyond, down into the riparian zone where riparian communities are absent.

The following vegetation types occurring outside the additional disturbance area but in proximity to the Project have the potential to be at least partially groundwater-dependent (refer to **Figure 6.31**):

- Central Hunter Swamp Oak Forest
- Hunter Floodplain Red Gum Woodland Complex
- Hunter Valley River Oak Forest
- River Flat Eucalypt Forest

- Stands of individual river red gum trees (*Eucalyptus camaldulensis*)
- Warkworth Sands Woodland.

The groundwater impact assessment (refer to **Appendix 12**) considered these potential GDEs and assessed the potential for groundwater impacts to occur in the areas occupied by these potential GDEs. The assessment identified two areas within the zone of cumulative drawdown that have been labelled for the purpose of the groundwater impact assessment as GDE1 and GDE2 (refer to **Figure 6.31**). The groundwater impact assessment also found that the predicted groundwater drawdown would not affect Wollombi National Park which is located to the west of the Project Area.

Potential GDEs occurring at GDE1 include areas of Central Hunter Swamp Oak Forest and a small number of River Red Gum trees along Redbank Creek, areas of Hunter Valley River Oak Forest, some River Red Gum trees and Hunter Floodplain Redgum Woodland Complex along Wollombi Brook (refer to **Figure 6.31**). Potential GDEs occurring at GDE2 include areas of Hunter Valley River Oak Forest.

Around 1 metre in groundwater level decline is predicted at GDE2 due to cumulative impacts from mining (approved mining and the Project). The decline in groundwater levels at GDE2 is along the fringes of Wollombi Brook. This drawdown is relatively limited in area and impacts upon only a small portion of possible Hunter Valley River Oak Forest and possibly a small number of River Red Gum trees (refer to **Figure 6.31**). Both of these species have a dependency on groundwater, but both also have a high degree of drought tolerance, particularly River Red Gum. The vegetation communities in which they occur are highly disturbed from historical land uses (primarily agricultural practices) and are affected by substantial weed establishment. It is expected that the impacts resulting from the drawdown will be negligible on these species and the vegetation communities in which they occur. Hunter Valley River Oak Forest is not listed under the EPBC or TSC Acts. However, River Red Gums are listed under the TSC Act as an endangered population in the Hunter Catchment. The anticipated potential impact on these trees would not be significant in terms of the impact on the endangered population.

At GDE1 groundwater levels are predicted to decline more significantly with mining (approved mining and the Project). The alluvium near GDE1 is predicted in the groundwater modelling to become largely unsaturated due to cumulative impacts from approved mining at HVO South, Wambo and MTW (refer to **Appendix 13**). This desaturation occurs due to the existing approved mining, without the Project. Based on the conceptual timing of the Project, the Project may result in this effect occurring approximately one year earlier, however, this depends on a range of factors and the timing of any approval for the Project and is highly uncertain. Therefore, the Project is not considered likely to result in impacts beyond those currently approved for GDE1.

In terms of impacts on surface water flows that may impact on GDEs, as discussed in **Section 6.8.1.6**, the changes to surface water flows are not considered likely to significantly impact on the water availability for GDEs.

6.9.4.2 Stygofauna

An assessment of the presence and potential impacts on stygofauna communities within the aquifers surrounding the Project Area was undertaken by Stygoecologia. The assessment was completed in accordance with the *Risk Assessment Guidelines for Groundwater Dependent Ecosystems* (Serov et al. 2012). The assessment showed that stygofauna exists in small isolated populations within the shallow alluvial aquifers in the area surrounding the Project Area, including those associated with Wollombi Brook and North Wambo Creek.

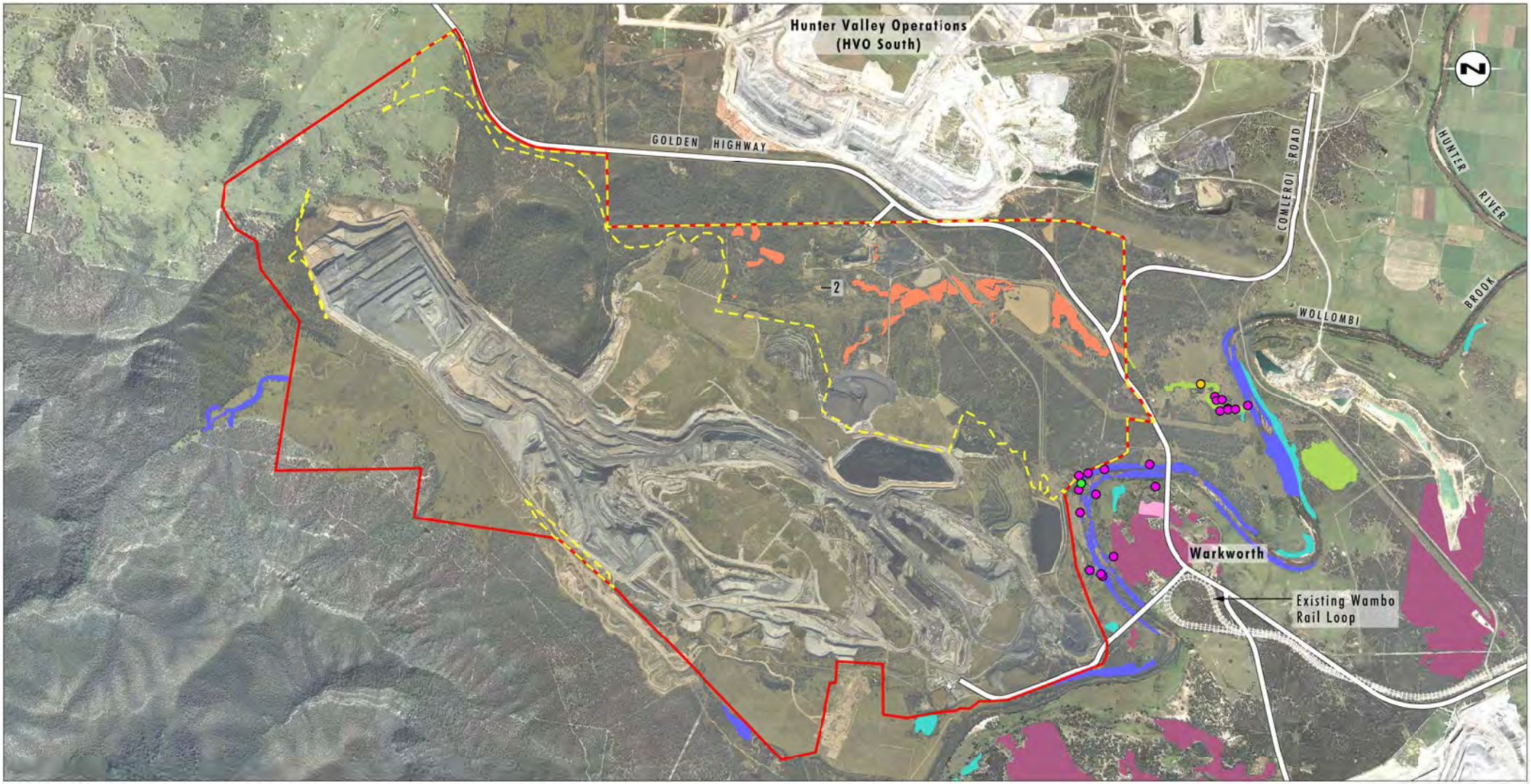


Image Source: AAM (2012), United (2015)
Data Source: Glencore (2014)

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Legend

- Project Area
- Conceptual Additional Disturbance Area
- River Red Gum Location
- Hunter Floodplain Red Gum Woodland Complex
- Central Hunter Swamp Oak Forest
- Hunter Valley River Oak Forest
- River Flat Eucalypt Forest
- Warkworth Sands Woodland
- 2 Moderate to Good Condition - Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter
- 11 Moderate to Good Condition - Swamp Oak - Weeping Grass Grassy Riparian Forest of the Hunter Valley
- GDE 1
- GDE 2

FIGURE 6.31

Potential Groundwater Dependent Ecosystems

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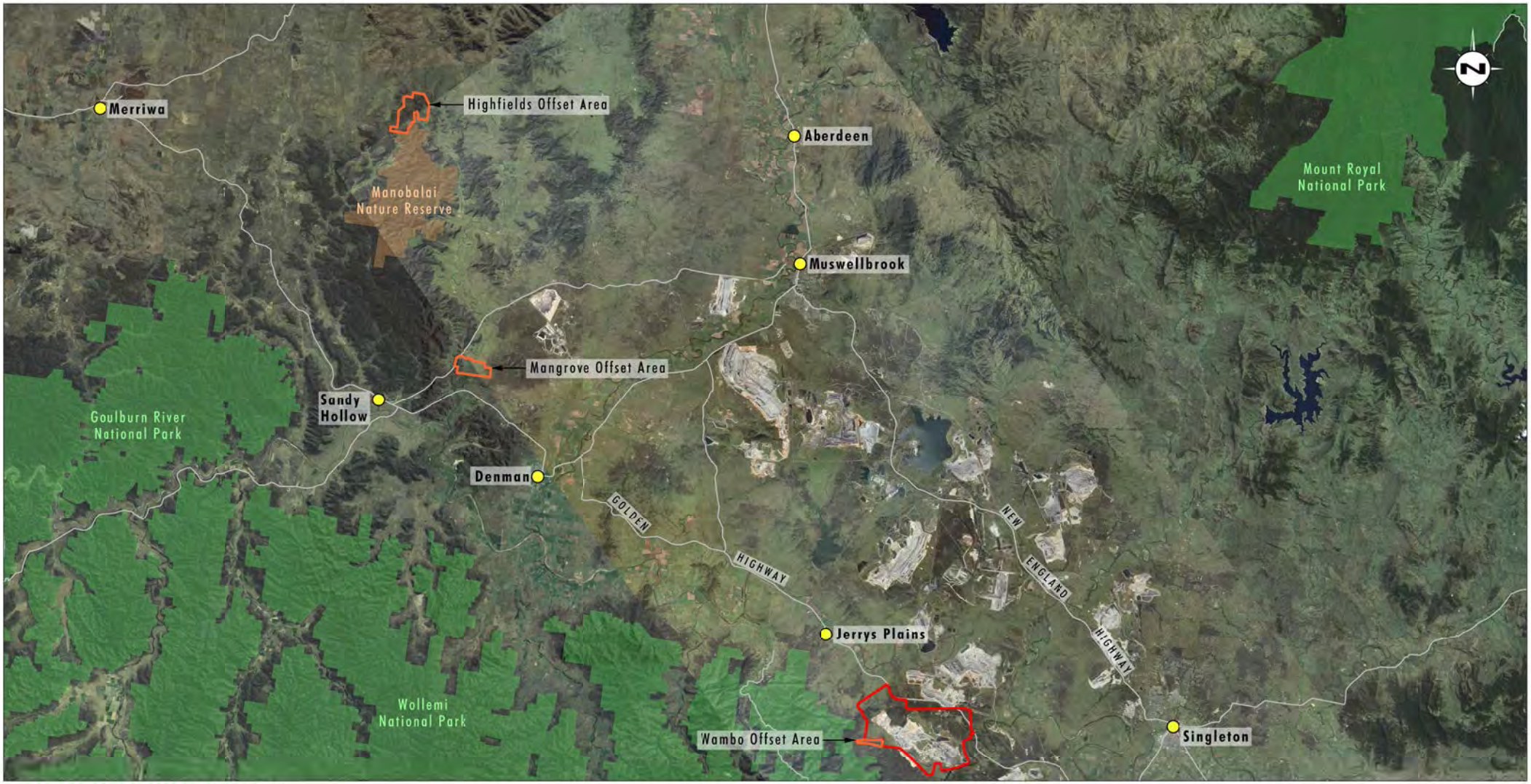


Image Source: Glencore (2008, 2013)
Data Source: Glencore (2016), Department of Lands (2013)

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Legend

- Project Area
- Potential Biodiversity Offset Area
- Nature Reserve
- National Park

FIGURE 6.32

Potential Biodiversity Offset Areas

The relative consistency of the stygofauna community composition between the bores and aquifers surveyed indicates connectivity within the shallow alluvial aquifers and consistency in the environmental conditions of this aquatic ecosystem. The biodiversity of the stygofauna community across the alluvial aquifers was found to be high.

The risk of the Project to the subterranean ecosystem was considered low, based on the potential groundwater drawdown impacts on the alluvium of Wollombi Brook. Due to the consistency of stygofauna composition across the aquifer and the relatively small area of impact in terms of alluvial aquifer drawdown, no adverse impacts on stygofauna are predicted. Ongoing monitoring of groundwater properties and a program of biological surveys were recommended by Stygoecologia to manage this risk, with stygofauna monitoring discussed in **Section 6.8.2.4**.

6.9.5 Matters of National Environmental Significance

As outlined in **Section 4.1.1**, a Referral was submitted to the DoE under the EPBC Act in October 2015. The Project was deemed to be a Controlled Action on 7 December 2015 due to the potential for significant impacts on matters protected under the EPBC Act. The Controlled Action decision was based on DoE's assessment that the Project is likely to have a significant impact on matters of national environmental significance, including the following ecological matters:

- Central Hunter Valley Eucalypt Forest and Woodland CEEC
- regent honeyeater (*Anthochaera phrygia*)
- swift parrot (*Lathamus discolor*)
- spotted-tailed quoll (*Dasyurus maculatus maculatus*).

Potential impacts on these matters are discussed in detail in **Section 7.2**. The assessments conclude that the Project is likely to have a significant impact on the Central Hunter Valley Eucalypt Forest and Woodland CEEC due to the loss of 223.5 hectares of the community. The assessments for the three threatened species identified above conclude that the Project is unlikely to result in a significant impact on these species.

6.9.6 Biodiversity Offset Strategy

United is committed to delivering a biodiversity offset strategy that appropriately compensates for the unavoidable loss of ecological values as a result of the Project, in accordance with the UHSA. United has, where possible, altered the Project to substantially avoid and minimise ecological impacts in the project planning stage, and a range of impact mitigation strategies have been included to mitigate the impact on ecological values prior to the consideration of offsetting requirements. The range of potential offsetting options available to proponents in accordance with the UHSA (OEH 2015b) includes:

- payment into the Upper Hunter Offsets Scheme
- retirement of biodiversity credits
- establishment of proponent-managed offset sites
- funding of supplementary measures
- mine site ecological rehabilitation.

Glencore has a strong record in preparing and implementing biodiversity offset strategies that firmly address significant biodiversity matters and adequately counterbalance impacts on them. United is committed to delivering a biodiversity offset strategy that appropriately compensates for the unavoidable loss of ecological values as a result of the Project. The offset strategy will be implemented following the process outlined in the UHSA and the final composition of the offset strategy may evolve as the Project progresses. It is currently proposed that the biodiversity offset strategy will consist of the following:

- establishment of proponent-managed offset sites, including the following sites (refer to **Figure 6.32**):
    - Highfields Offset Site (428 hectares)
    - Mangrove Offset Site (259 hectares)
    - Wambo Offset Site (56 hectares).
- mine site ecological rehabilitation contributing 25 per cent of the overall biodiversity offset requirement. Currently estimated at approximately 878 hectares of ecological rehabilitation (refer to **Appendix 13**)
- payments into the Upper Hunter Offsets Scheme fund and/or establishment of further offset sites for the residual credits that need to be retired.

The proposed offset sites will be established as BioBank sites under BioBanking Agreements, ensuring in-perpetuity conservation and reporting consistent with the BioBanking scheme.

Consistent with discussions with OEH, it is proposed to stage the retirement of credits in accordance with the progressive development of the Project. This staging will be consistent with the staging of the Mining Operations Plans (MOP) for the Project, as governed by the *Mining Act 1992*.

Table 6.34 below provides a summary of the credits generated from the proponent-managed offset sites and mine site ecological rehabilitation proposed by United.

Table 6.34 Summary of Key Potential Offsetting Outcomes

Additional Disturbance Area			Offset Area Protection			Notes
Attribute	**Hectares**	**Credits**	**Attribute**	**Hectares**	**Credits**	
Critically Endangered Ecological Communities under the EPBC Act						
Central Hunter Valley Eucalypt Forest and Woodland CEEC	223.5	8,403	Central Hunter Valley Eucalypt Forest and Woodland CEEC	56.0	648	Total EPBC Act CEEC credits in the offset strategy equals 8976 ecosystem credits.
			Central Hunter Valley Eucalypt Forest and Woodland CEEC (mine rehabilitation)	878	4755	

Additional Disturbance Area			Offset Area Protection			Notes
Attribute	**Hectares**	**Credits**	**Attribute**	**Hectares**	**Credits**	
			White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC	312.9	3573	
Vegetation Classes						
Coastal Floodplain Wetlands	0.29	14	Coastal Floodplain Wetlands	100.9	1438	
Coastal Swamp Wetlands	31.6	1248	Coastal Swamp Wetlands	0	0	
Eastern Riverine Forests	0	0	Eastern Riverine Forests	6	109	
Hunter-Macleay Dry Sclerophyll Forests	29.4	1041	Hunter-Macleay Dry Sclerophyll Forests	0	0	
Western Slopes Dry Sclerophyll Forests	1.56	59	Western Slopes Dry Sclerophyll Forests	126.4	1730	
North-west Slopes Dry Sclerophyll Woodlands	0	0	North-west Slopes Dry Sclerophyll Woodlands	83.5	902	
Coastal Valley Grassy Woodlands	503.1	15,754	Coastal Valley Grassy Woodlands	1301.2	10,079	Includes 878 hectares and 4755 credits of mine rehabilitation for offsetting
Western Slopes Grassy Woodlands	0	0	Western Slopes Grassy Woodlands	2	21	

Additional Disturbance Area			Offset Area Protection			Notes
Attribute	**Hectares**	**Credits**	**Attribute**	**Hectares**	**Credits**	
Species-credit Species						
pine donkey orchid (*Diuris tricolor*)	0	0	pine donkey orchid (*Diuris tricolor*)	1141 individuals	7909	
southern myotis (*Myotis macropus*)	7.3	562	southern myotis (*Myotis macropus*)	3.0	21	

The offset strategy provides offset sites that are strategically located in proximity to key landscape-scale features. This includes aspects such as adjoining vegetation remnants, National Parks, Crown land, the Great Eastern Ranges Initiative and other existing Glencore offset areas which provide interconnecting high quality habitats with conservation areas and strategic corridor areas.

The UHSA offsetting rules (version dated 26 April 2016) have been used to determine how the ecosystem credits generated by the offset sites relate to the ecosystem credit needs for the Project. **Table 6.35** outlines the outcomes of the ecosystem credit analysis for the three proposed biodiversity offset sites and proposed area of ecological rehabilitation for the Project using the UHSA offsetting rules. As noted above, the retirement of credits will be staged as the Project Area is progressively cleared and United may identify further offset sites that will contribute to meet the biodiversity offset requirements of the Project.

Table 6.35 Summary of Biodiversity Offset Strategy Ecosystem Credit Outcomes

Impacted Biometric Vegetation Type (BVT)	Credits Required (Impact)	Credits Available (Offset)	Credit Allocation Meets Requirements
HU812 – Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter	14	14	✓
HU816 – Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	999	0	-999
HU869 – Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin	16	16	✓
HU905 – Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter	2859	1732	-1127
HU906 – Bull Oak grassy woodland of the central Hunter Valley	4577	3447	-1130

Impacted Biometric Vegetation Type (BVT)	Credits Required (Impact)	Credits Available (Offset)	Credit Allocation Meets Requirements
HU945 – Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley	1248	1248	✓
Central Hunter Valley Eucalypt Forest and Woodland CEEC (comprising portions of HU816, HU869, HU905 and HU906)	8403	5403	-3000
Total			**-6256**

As shown in **Table 3.35**, the three proposed offsets and proposed area of ecological rehabilitation contribute approximately two thirds of the ecosystem credit requirements for the Project using the UHSA rules. In regard to the credit requirements for the southern myotis (*Myotis macropus*), the offset sites provide 21 of the 562 credits required for the species. United proposes that the balance of credits required for the Project will be sourced from either additional offset sites or via payment into the Upper Hunter Offsets Scheme.

It is proposed that the biodiversity offset requirements for the Project is formalised through development consent conditions as per the process outlined in the UHSA Interim Policy (DP&I 2012).

6.10 Aboriginal Archaeology and Cultural Heritage

United, Wambo and Umwelt would like to acknowledge the Traditional Owners of the Project Area – the Wonnarua People – and pay respect to their cultural heritage, beliefs and continuing relationship with the land.

We would also like to acknowledge the post-contact experiences of Aboriginal people who have attachment to the Project Area and surrounds.

We pay respect to the Elders, both past and present, for they hold the memories, traditions, culture and hopes of Aboriginal people in the area.

We thank the Registered Aboriginal Parties, their families and elders for their engagement in this Project. Their willingness to participate in discussions during land visits and to contribute in a meaningful way during workshops is greatly appreciated.

The Project Area is located within the traditional homelands of the Wonnarua (sometimes spelt Wanaruah), whose history extends from the present day back many thousands of years. The Project Area is also within the modern day Wanaruah Local Aboriginal Land Council (WLALC) boundary and within the boundaries of Native Title claims by the Plains Clans of the Wonnarua People (PCWP) and the Wonnarua Traditional Custodians (WTC).

An Aboriginal Cultural Heritage Assessment (ACHA) has been prepared for the Project by Australian Cultural Heritage Management (ACHM) in collaboration with the Registered Aboriginal Parties (RAPs) and Knowledge Holder groups to assess the Aboriginal cultural heritage values of the Project Area and surrounds (refer to **Appendix 14**).

An Aboriginal Archaeological Values Assessment was also prepared by OzArk Environmental and Heritage Management (OzArk) to assess the scientific (archaeological) value of sites and artefacts identified within the Project Area and this report is included as **Appendix 15** of the EIS.

Throughout all stages of the assessment process, the RAPs were invited to identify how they would like to participate in the Project's Aboriginal cultural heritage assessment process, including what cultural information they wanted to share to inform the assessment process, and what information (if any) should remain non-disclosed in the assessment and reporting process.

The three Knowledge Holder groups, the PCWP, Wonnarua Nation Aboriginal Corporation (WNAC) and the WTC were invited to undertake their own Aboriginal cultural heritage values assessment reports for the Project which incorporate the historic, social, spiritual and aesthetic cultural values of their members and Elders. The RAPs not being consulted through the PCWP, WNAC and the WTC are referred to as the Community RAPs, and were consulted by ACHM and United to develop management recommendations and measures relevant to their cultural significance values statements and assessment concerns.

The ACHA process has involved consultation with all 83 RAPs from the four groups. The consultation process has also facilitated the three knowledge holder groups being able to consult with a large number of Aboriginal people who were not RAPs for the Project but are traditional owners of the Hunter Valley area, and therefore constitute important stakeholders. These people were Wonnarua Elders with knowledge and important contributions to the process. Further details of the consultation process are provided in **Section 6.10.2**.

PCWP and WNAC provided their own ACHA reports. The full cultural heritage assessment of the WNAC does not inform the ACHA as key aspects of their assessment have been requested to be kept confidential for cultural and sensitivity reasons. The PCWP report as well as the disclosed summary of values and recommendations from the WNAC identifies the significance of Aboriginal cultural heritage in and around the Project Area. The publicly disclosed documents are included in full in the ACHA (refer to **Appendix 14**).

As the WTC report was not delivered, United provided an opportunity for members of the WTC to attend a cultural values and recommendations workshop in Singleton so as to ensure that an appropriate opportunity was provided for consultation to enable the WTC cultural values and management recommendations to be recorded. The understanding of significance and the management recommendations provided by the WTC and Community RAPs have also informed United in its development of cultural heritage management recommendations.

The full WNAC report will be provided separately to DPE and OEH on a confidential basis for consideration as part of the assessment of the Project. All Knowledge Holder groups have provided general statements of cultural values applicable to the Project Area (alongside the relevant disclosed materials) and have also provided extensive sets of recommendations (either verbally or in their ACHA Report) which have been disclosed to ACHM and included in the ACHA Report (refer to **Appendix 14**).

6.10.1 Assessment Approach

The ACHA and Aboriginal Archaeology Values Assessment have been designed to satisfy the requirements of:

- the SEARs for the Project
- *National Parks and Wildlife Act 1974 (NPW Act)*
- *National Parks and Wildlife Regulation 2009 (NPW Regulation)*
- the principles of The Burra Charter (Australia ICOMOS 1999)
- *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC 2005b)
- *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW 2010a)
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010b)
- *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (DECCW 2010c).

The approach taken acknowledges and respects that Aboriginal people have the right to directly participate in matters that may affect their heritage, and have the right to maintain culture, language, knowledge and identity.

The objective of the ACHA was to ensure that Aboriginal people have the opportunity to participate in and improve the outcomes of the assessment by:

- providing relevant information about the cultural significance and values of the Aboriginal object(s) and/or place(s) within the additional disturbance area
- influencing the design of the method to assess cultural and scientific significance of Aboriginal object(s) and/or place(s) within the additional disturbance area
- actively contributing to the development of cultural heritage management options for the additional disturbance area and the wider Project Area.

6.10.2 Consultation Process

Consultation with the Aboriginal community was undertaken in accordance with the NPW Act and NPW Regulation, with reference to the relevant DEC 2005b and DECCW 2010 guidelines and in consideration of the principles of The Burra Charter (Australia ICOMOS 1999).

In accordance with OEH guidelines, consultation has involved:

- **Stage 1:** United conducted formal notification of the Project and the ACHA Report process, and provided the opportunity for Aboriginal parties to formally register their interest in the Project, in accordance with the NPW Regulation. All RAPs were provided with a copy of the draft Aboriginal Cultural Heritage Assessment and Consultation Methodology, as well as an overview of the Draft Aboriginal Heritage Survey Methodology and 28 days were provided for feedback.

- **Stage 2:** United, OzArk, and ACHM conducted initial Project description consultation, which included presenting information on the Project to all Aboriginal parties (including WLALC) who registered an interest in Stage 1. Initial consultation also presented the draft Aboriginal Cultural Heritage Assessment and Consultation Methodology for review by the RAPs, as well as an overview of the Draft Aboriginal Heritage Survey Methodology. Copies of this information were also shared with all RAPs. Consultation with the RAPs involved a combination of consultation forums including meetings, briefing sessions and Project Area inspections. Stage 2 also included briefings of the PCWP, WTC and WNAC including agreement to scopes of work and contracts for these groups to produce their own cultural values reports. Following the receipt of feedback on the draft assessment and archaeology methodology, the methodology was revised and a program of archaeological fieldwork and cultural heritage assessment was confirmed.

- **Stage 3:** During Stage 3, OzArk conducted extensive archaeological fieldwork with the RAPs and ACHM conducted cultural values consultation with the RAPs.

  As part of the overall assessment approach, United also conducted regular consultation with, and provided support and advice to, the PCWP, WTC and WNAC in relation to the Project, and specifically in relation to the preparation of their separate ACHA reports or targeted workshops. To assist the groups, United provided access to materials and land, to enable these groups to assess their cultural heritage values, the significance of Aboriginal cultural places and artefacts, the likely Project impacts, if approved, and their management measures.

  Elders also provided comment on site specific and cultural, social, historic and aesthetic values, which included the significance of archaeological and cultural sites, and values associated with flora and fauna and landscape features to inform the assessment and management measures. They consisted of organised bus tours and site visits of the cultural sites within the Project Area for the benefit of the Project's RAPs and their Elders.

  United and ACHM conducted further feedback sessions during Stage 3 to review the Community RAPs and the Knowledge Holders' values and recommendations, which provided the opportunity for all RAPs to provide further comment on Aboriginal cultural heritage values and management measures. Separate ACHA reports were received from WNAC and PCWP, and meetings were held with these Knowledge Holder groups to discuss their findings. WTC did not provide a report, however a workshop was held by ACHM with members of this Knowledge Holder group to discuss and record their cultural heritage values and recommendations for management measures.

- **Stage 4:** United provided the RAPs with the 28 day formal review period of the Project draft ACHA to seek feedback, modify reports as appropriate, receive and review submissions and to incorporate any additional input into the finalised ACHA.

Throughout the course of the Project, 83 RAPs registered an interest in the Project. The total of 83 RAPs includes all members of the PCWP, the WTC and the WNAC who registered as well as all RAPs who were not aligned with one of those groups. A full list of all RAPs is contained in **Appendix 14**.

All RAPs were invited to participate in the assessment process from the time of their registration, with extensive consultation undertaken to inform the ACHA of the Project. Participation opportunities have been provided through:

- small and large group workshops

- cultural site visits

- development of independent cultural heritage values assessments
- archaeological investigations including survey and test excavation fieldwork onsite
- walks on Country
- general correspondence via phone and email.

Full details of the consultation process undertaken in relation to the ACHA are contained in **Appendix 14**.

The consultation approach also provided the RAPs with opportunities to decide in what way they wanted their information shared and to identify any restricted access provisions. It allowed the RAPs to contribute their cultural knowledge through ACHM, or through the preparation of independent reports. It also provided opportunities to identify a range of Aboriginal cultural values of the Project Area and levels of attachment. This included social values, historic values, scientific values, aesthetic values and intergenerational values.

United, Wambo, ACHM, OzArk and Umwelt would like to thank the RAPs for the participation in and contribution to this assessment process.

6.10.3 Previous Aboriginal Heritage Studies

An extensive history of Aboriginal cultural heritage and archaeological assessments exists for the Project Area and immediate surrounds. In recent decades, the Upper Hunter Valley has become one of the most intensively studied regions in NSW with numerous archaeological surveys and excavations conducted in advance of proposed mining activity. This body of research has identified numerous archaeological sites, and provides a broad understanding of archaeological site patterning at local and regional levels.

The Aboriginal Archaeological Values Assessment in **Appendix 15** provides an overview of the extensive history of past archaeological research undertaken within the Project Area, a summary of key information on investigation type and area, and number of recorded archaeological sites.

A search of the OEH administered Aboriginal Heritage Information Management System (AHIMS) register identified 108 previously recorded Aboriginal archaeological sites within the archaeological study area. A detailed process of checking the location of many of these sites has been undertaken by OzArk and United as part of the assessment process (refer to **Appendix 15**).

The location of each of these previously recorded sites is shown in **Figure 6.33**. Of the previously recorded sites in the Study Area, 88 sites are registered as artefact scatters, 16 sites are isolated finds, 2 are listed as artefacts scatters with potential archaeological deposits (PAD) and 2 are listed as PADs. A detailed field validation program was undertaken to assess the status and condition of these existing sites as part of the archaeological field survey for the Project. It is also noted that 30 sites are listed with AHIMS as 'destroyed', while the remainder are listed as 'valid' or 'partially destroyed'.

6.10.4 Cultural Heritage Values

The ACHA found that numerous Aboriginal stakeholders who participated in the cultural values assessment process hold values which relate to the wider Hunter Valley region generally and less directly to the Project Area specifically. There was very little information presented in the disclosed material or cultural values workshops which related specifically to the Project Area.

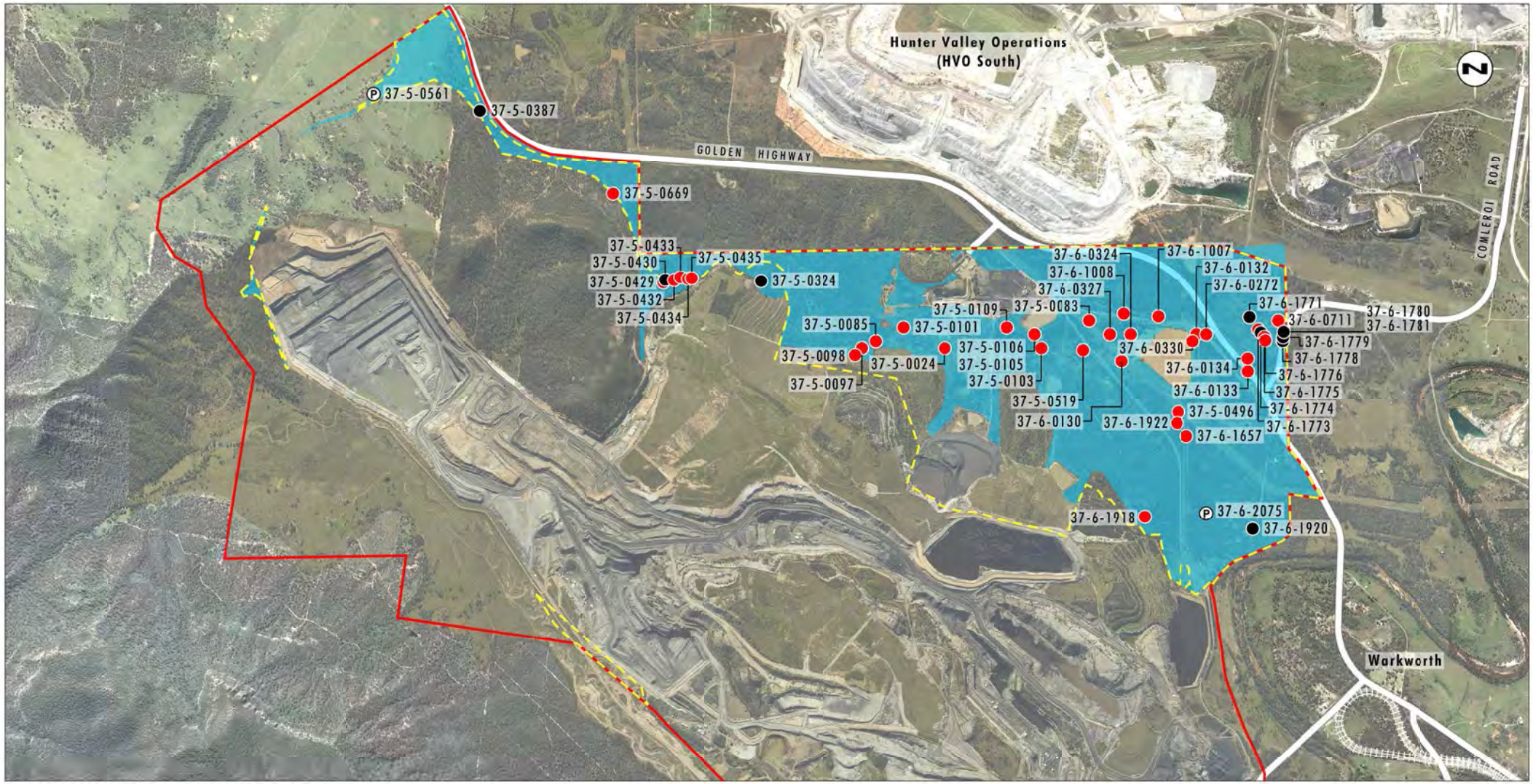


Image Source: AAM (2012), United (2015)
Data Source: Glencore (2014), OzArk (2016)

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Legend

- Project Area
- Conceptual Additional Disturbance Area
- Survey Area
- Artefact Scatter
- Isolated Find
- Potential Archaeological Deposit

FIGURE 6.33

Previously Recorded Aboriginal Archaeological Sites

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The ACHA also found that there are strong ongoing connections to places created and used by ancestors alongside demonstrably strong interests in the manner in which those places are managed or harmed as a result of this Project. The connection to these places was noted as often being relatively unspecific and generally did not appear to ACHM to relate to any surviving traditional knowledge or customary cultural practices, apart from one of the Knowledge Holder groups who expressed a strong connection to ongoing cultural knowledge and customary lore in this location.

The ACHA found that cultural values expressed by the participants have been consistent in voicing an overarching concern for the wider landscape and criticism of the negative impact of mining on that landscape. Consistent in the material disclosed is a sense of 'loss' or 'outrage' and grief at the treatment of Aboriginal people since First Settlement through to more contemporary experiences (i.e. the Stolen Generation).

The ACHA also identified a consistent theme in the submissions of the 'powerlessness' Aboriginal people often feel when confronted by situations where they feel disempowered or unable to exercise influence on decision makers. There is a sense of loss and lament for what once was, but with a very strong expression of 'corporate' ownership of the wider region by the Wonnarua people (regardless of the variety of ways in which those groups represent their own interests). There is also an element of celebrating the survival of those who are now speaking for country. While the entire estate of the Wonnarua people is significant to those concerned, there is little direct evidence (anecdotal or otherwise) of any particular or specific places or values of significance within the Project Area.

ACHM also found that for many of the informants, the contemporary attachment to place appears based on the linkage to archaeological places which were created by 'the ancestors' and thereby constitute a connecting thread to a cultural world from another time.

This general lack of disclosed direct or specific cultural knowledge in no way diminishes the strength of connection to the places within the Project Area. However, the ACHA found that attachment to place is one which is predominantly of contemporary association rather than traditional knowledge, custom, lore or practice.

The ACHA noted that the surrounding area is held to be of higher significance to many members of the Wonnarua community, however, the sites and/or places within the Project Area were considered to be of lower significance.

The ACHA has ascertained that there are only very limited deeper cultural values associated with the Project Area (directly and specifically) held by a limited number of participants in the ACHA process. The landscape within the Project Area is highly disturbed and fragmented, resulting in much of the archaeological record already having been disturbed. Much of the natural landscape no longer exists, as the history of agriculture and coal mining has altered the landscape. The ACHA indicates that the remnant cultural landscape within the Project Area has undergone considerable modification since European settlement and is therefore of lower cultural significance than the surrounding region. This is also consistent with the archaeological assessment, which has determined that the overwhelming majority of archaeological sites are of low scientific significance.

6.10.5 Scientific Archaeological Significance

OzArk prepared a comprehensive Aboriginal Archaeological Values Assessment for the Project as part of the broader ACHA. The principal aims of the Aboriginal Archaeological Values Assessment were to identify and record the Aboriginal archaeological values to be impacted by the Project and to assess the scientific significance of and any potential impacts on these values. The Aboriginal Archaeological Values Assessment report is included as **Appendix 15**.

The Aboriginal Archaeological Values Assessment was undertaken having regard to DEC 2005, DECCW 2010 and OEH 2011 guidelines and the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010b). The Aboriginal archaeological values assessment built on the already comprehensive body of Aboriginal archaeology survey work and research undertaken in much of the Project Area over a period of more than 30 years.

6.10.5.1 Archaeological Assessment Process

The consultation process for the Aboriginal Archaeological Values Assessment was undertaken as part of the consultation for the broader ACHA, as discussed in **Section 6.10.2**, and commenced in March 2015. The RAPs were involved in all facets of the assessment including discussions for the development of the survey strategy, review of survey and test excavation methodology, participation in field survey and test excavation program, and site identification and recording. The RAPs were also provided a draft copy of the Aboriginal Archaeological Values Assessment report for review and comment.

6.10.5.2 Survey Methodology

A comprehensive field survey was undertaken for the Project to build on the extensive previous archaeological record for the area. Fieldwork was undertaken over a period of 19 days commencing in March 2015 and finishing in September 2015. The weeks were arranged through a roster between the RAPs and total team sizes ranged from six to eight people per day.

The archaeological survey area for the Project is shown on **Figure 6.33** and covers the additional disturbance area associated with the Project and excludes areas extensively modified by mining activities and the approved Wambo surface development area.

This intensive survey coverage included:

- Pedestrian field survey to identify and record any Aboriginal archaeological sites within the landscape, and to record any areas that may have potential to have subsurface Aboriginal artefacts present.

- In the northwest and northeast portions of the archaeological study area, field survey, wherever possible, was conducted in transects of 50 metre intervals (with up to ten recorders spaced 5 metres apart). If field conditions did not allow straight transects some areas were investigated more opportunistically where exposures and/or vegetation allowed.

As the survey progressed, variations to the survey methodology were required in order to successfully complete the heritage assessment. The survey methodology was refined in the field in two ways:

- The terrain and vegetation of the landscape did not always allow systematic pedestrian transects of the intensive survey coverage areas. Rather, all areas of archaeological potential were targeted and this was complemented by pedestrian transects of other selected landforms within the area.

- The Project Area in its entirety was not assessed but all areas within the archaeological survey area have been fully assessed.

The intensive survey coverage included all locations of archaeological potential, while a full range of other landforms within the area were more selectively sampled by intensive pedestrian transects. OzArk found that the field methodology was able to achieve the major aims of the survey methodology and that a large and representative sample of the archaeological values from across the archaeological survey area have been recorded.

From 27 July to 11 August 2015 a test excavation and auger program was conducted at locations within the archaeological survey area. Due to the high degree of vegetation regrowth, large areas of the archaeological survey area afforded very low ground surface visibility to the extent that it was impossible to know exactly where a test excavation program (i.e. excavation pits) should be located in order to reveal meaningful information. It was therefore the aim of the test excavation program to employ two programs that were run simultaneously to examine the archaeological potential of the archaeological survey area, being a test excavation program and a geotechnical auger program.

The aim of the auger program was to:

- verify soil depth at areas where the survey assessed shallow soil depth
- verify archaeological potential in areas where low ground surface visibility prevented a full assessment of archaeological potential
- examine landforms away from watercourses to establish archaeological potential across a range of landforms.

6.10.5.3 Survey Results

The assessment of the archaeological survey area recorded 25 artefact scatters, 34 isolated finds and 20 extensions to previously recorded sites (all artefact scatters) (refer to **Figure 6.34**). Within the site extensions are a further nine previously recorded sites that have been subsumed into the larger site area.

In addition, there are a further 49 sites within the archaeological survey area that are listed on AHIMS as valid or partially destroyed. Of these 49 sites, 36 (74 per cent) are listed as artefact scatters, 11 (22 per cent) as isolated finds and 2 (4 per cent) as PADs.

In total, the archaeological assessment considered 128 sites (refer to **Figure 6.34**). All of these sites are stone artefact sites as no other site type was recorded during the survey or remains extant from previous recordings.

Some further observations on the location of recorded artefacts can be made:

- Most artefacts were closely associated to watercourses, primarily Redbank Creek.
- No major concentrations of artefacts were recorded greater than 150 metres from a waterway and most were recorded much closer.
- Most artefacts were assessed to be in secondary contexts, primarily in major erosion scalds alongside Redbank Creek and its anabranches.
- There is a very strong correlation between prior disturbance and the location of surface artefacts. The majority of artefacts were recorded either in areas affected by erosion or in areas affected by mining activities such as bunds, dam walls, tracks and drill pads associated with approved mining activities. In most cases it is assumed that the artefacts recorded in these locations are from the general vicinity but their original deposition location is unknown. There was a lot of evidence of water movement across the archaeological survey area and it is likely artefacts have washed into concentrations within erosion scalds or have been uncovered by deflation on features such as bunds, exposing artefacts that had been bulldozed to that location from nearby.

- The types of artefacts recorded are very representative of other assemblages within the upper Hunter Valley. The percentage of backed artefacts and cores is similar to other investigations in the wider region.

- Only stone artefact sites were recorded. No culturally modified trees, stone arrangements, grinding grooves, art or burial sites were recorded.

From the test excavation, 192 artefacts were recovered with an average of 1.25 artefacts per excavation square. This density of artefacts is extremely low. In addition, 63 auger probes were excavated at nine separate locations.

6.10.5.4 Archaeological Significance Assessment

All newly recorded Aboriginal archaeological sites were assessed for their archaeological (scientific) significance. As a result of the survey and test excavation results, the majority of sites (122 sites) have been assessed as having low scientific significance. The remaining six sites have been assessed to have a low-moderate scientific significance.

While the assessment of scientific significance of the newly recorded sites is straight-forward, this is not the case with many of the previously recorded sites. For example, 13 of the previously recorded sites were recorded in the early 1980s at which time it was not the practice to assign significance values to sites. While the survey attempted to locate all previously recorded sites in order to determine significance this was rarely successful given the length of time that has passed since the site's recording and the fact that the AHIMS coordinates are only approximate and that the original recordings were located by means of topographic maps. As a result, the significance of many previously recorded sites has been determined on the basis of an assessment of the general landforms in which they were located rather than on information from the exact site itself.

The overall scientific significance of sites within the archaeological survey area has been lowered due to:

- wide-spread gully erosion and soil loss that affects nearly all portions of the archaeological survey area

- major disturbances from approved mining activity and other infrastructure

- a relatively dense array of farm and civil related infrastructure

- the archaeological landscape within the archaeological survey area being fragmented between these disturbances

- the varying degrees of archaeological salvage that has been undertaken within the archaeological survey area.

As a result, no sites are assessed to have high or moderate scientific significance.

As all sites within the archaeological survey area are either low density artefact scatters or isolated and/or are located in landforms with depleted A horizon soils and invasive erosion (to varying degrees), they have been assessed as holding low–moderate scientific significance or less.

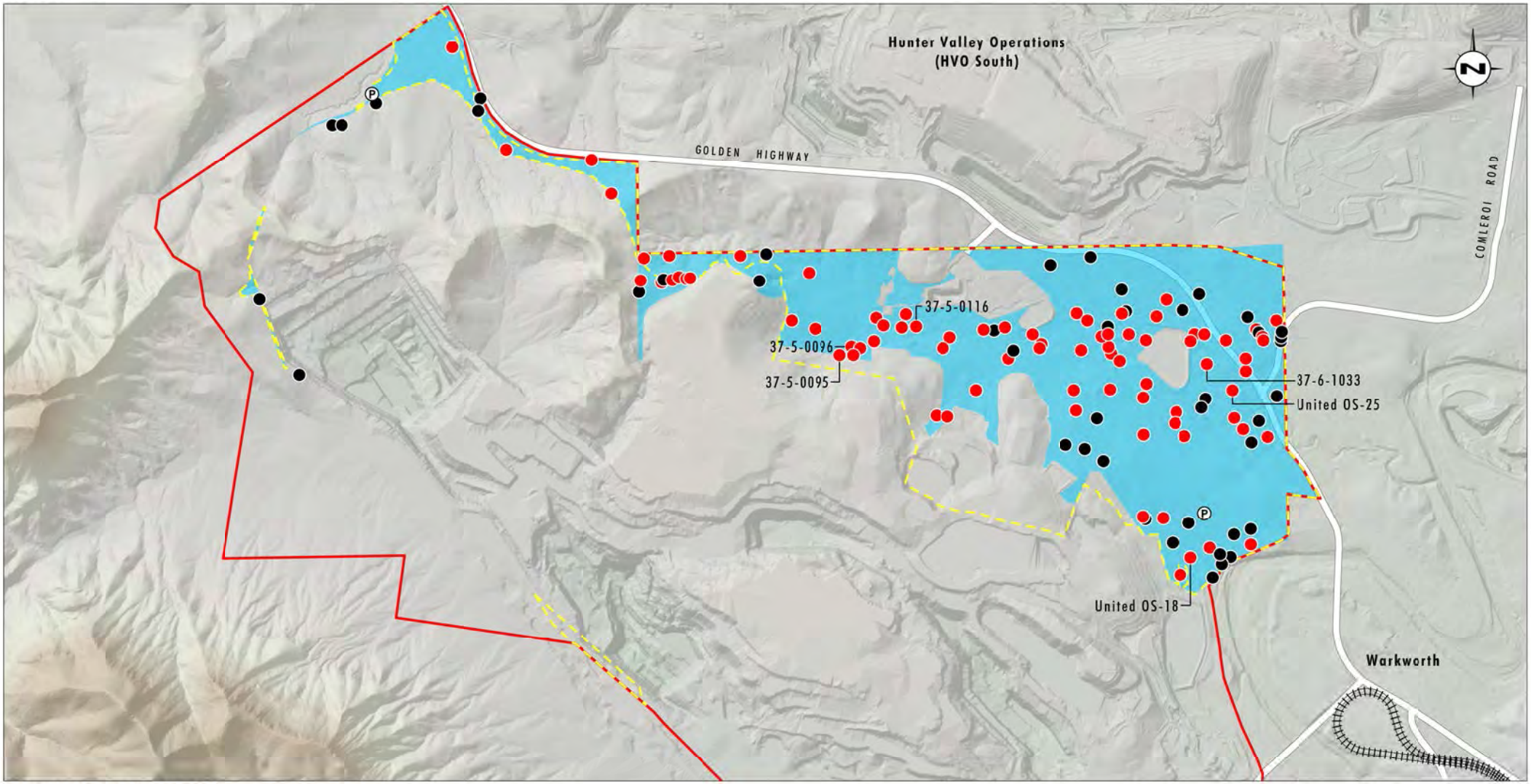


Image Source: United (2015)
Data Source: Glencore (2014), OzArk (2016)

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Legend

- Project Area
- Conceptual Additional Disturbance Area
- Survey Area
- Artefact Scatter
- Isolated Find
- Ⓟ PAD

FIGURE 6.34

Recorded Aboriginal Archaeological Sites

In summary:

- Six sites are assessed as having low–moderate scientific significance: United OS-18; United OS-25; Red Bank Creek 27; Red Bank Creek 28; Red Bank Creek 5 and UC2/1.
- The remaining 122 sites were assessed as having low scientific significance.
- Low significance sites mainly consist of low density artefact scatters or isolated finds on landforms with thin A horizon soils and little potential for further subsurface archaeological deposits.

6.10.6 Aboriginal Cultural Heritage Impact Assessment

The Project would directly impact 127 archaeological sites if approved, consisting of 80 artefact scatters and 45 isolated finds and two PADs. One site (Wambo 202; #37-5-0343) will be partially harmed by the Project.

The Project would also result in indirect impacts on Aboriginal cultural heritage values and add to the cumulative loss of cultural heritage in the Hunter Valley.

The predicted direct and indirect impact on the Aboriginal cultural heritage values of the additional disturbance area add to the cumulative impact of mining development on the cultural heritage resource of the Upper Hunter Valley, and this has been considered in the development of detailed management measures, in collaboration with the RAPs, as outlined below.

6.10.7 Aboriginal Cultural Heritage Management Measures

The management measures proposed for the Project have been aligned to the Aboriginal Community Wellbeing Toolkit and criteria from OEH, in particular the elements that focus on 'Culture'. For the Project, of the eight key principles of the toolkit, the following three are the basis of the management measures proposed:

- sense of community
- education and learning
- cultural identity.

The proposed management measures have been developed for the Project based on the assessment outcomes including recommendations from the disclosed reports (WNAC and PCWP), the workshops held with the WTC and RAPs, and further feedback and consultation following the stakeholder review of the Draft ACHA. Whilst a range of different views and recommendations were provided some common themes were presented which strongly aligned with 'Sense of Community', 'Education' and 'Learning and Cultural Identity' principles. This led the Project to propose funding projects in the areas of:

- **Caring for Land** – this was a common theme raised by the community. The program proposed focuses on Education and Learning from the Wellbeing Toolkit.
- **Bringing People Together** – there were a range of management measures raised that involved bringing people together for community and/or cultural purposes and activities. The program proposed focuses on the Sense of Community and Cultural Identity aspects of the Wellbeing Toolkit.

- **Cultural Awareness/Education** – there were a range of management measures raised that involved Cultural Awareness/Education/Training, especially for younger people (both for Aboriginal and non-Aboriginal youth). The program focuses on Education and Learning with potential flow on effects of Cultural Identity and Sense of Community aspects of the Wellbeing Toolkit.

Opportunities to undertake research in the Wonnarua area, with outcomes for Caring for Land, Bringing People Together and Cultural Awareness/Education, was a theme that came through responses and consultation from the review of the Draft ACHA.

In addition to aligning management recommendations with the Wellbeing tool kit, the proposed programs offer flexibility for the community to propose other projects, so that the implementation will be contemporary with the community's requests at the time.

The proposed management measures will also include:

- alignment to the principles of the Aboriginal Community Wellbeing Toolkit (OEH 2012) that the Project focuses on
- alignment with findings from the ACHA and the Aboriginal Archaeological Values Assessment
- the need to be achievable for practical implementation
- provision of sustainable outcomes to promote intergenerational equity
- ability to show value for money.

Table 6.36 contains the proposed management and mitigation measures which will be implemented should the Project be approved. These measures have been developed by United in consultation with the RAPs including the Knowledge Holder groups. The proposed management and mitigation measures have also been separated into those located onsite (being within the Project Area) and those located offsite (outside the Project Area or not requiring physical works within the Project Area).

Table 6.36 Proposed Management and Mitigation Measures

Action		Proposed Management Measure
Onsite Cultural Heritage Management Measures		
Aboriginal Cultural Heritage Management Plan (ACHMP)	Update ACHMP	The existing United ACHMP will be reviewed for the Project within 12 months of the approval of the Project to outline all Aboriginal heritage management measures for the Project, responsibilities of all parties and the timeframe for required heritage works. The ACHMP will include a staged approach to the required research and salvage works to ensure that areas required for earliest disturbance are completed as a priority.
	ACHMP Dispute Resolution process	The revised ACHMP will include specific provisions regarding ongoing engagement with the RAPs and will include mechanisms for dispute resolution and communication protocols.
Survey, collection and analysis	Survey, collection and analysis	Salvage (excavation, analysis and collection) as per the recommendations of the Aboriginal Archaeological Values Assessment Report (refer to **Appendix 15**) for the salvage of the 128 sites to be harmed within the additional disturbance area.
	Discovery of previously unknown cultural heritage items	The Project agrees to follow all relevant NSW Government guidelines regarding the location of human skeletal remains. The Project will apply the precautionary principle to the development of management measures for the additional disturbance area. This approach will include the development of culturally appropriate management measures for the management of human remains, should this occur during the life of the Project. Protocols and approach will be developed in consultation with RAPs and updated in the revised ACHMP.
	Recording of archaeological sites	The ACHMP will be revised to include the new sites identified in the Aboriginal Archaeological Values Assessment Report completed for the Project.

Action		Proposed Management Measure
Care and Control	Care and control measures regarding Aboriginal objects	Care and control management measures will be developed and included in the ACHMP for Aboriginal objects recovered through the Archaeological research and salvage program implemented for the Project and for long term storage of artefacts recovered from previous research and salvage programs. The care and control management measures will have regard to cultural considerations.
	Repatriation of artefacts from the Project	United acknowledges the desire for a regional Wonnarua Keeping Place, however, this currently does not exist. United proposes to store artefacts from the salvage program at the nearby Wollombi Brook conservation area of the neighbouring Bulga Coal Operations. Should a regional Keeping Place be developed, subject to community support, United would support the relocation of artefacts. United will consider the repatriation of artefacts across rehabilitation areas as part of a closure planning process at the cessation of mining.
	Sites not to be impacted	The Project will implement the Aboriginal archaeological management measures program for sites in the Project Area that will not be impacted by the Project as recommended in the Aboriginal Archaeological Values Assessment report for the Project (refer to **Appendix 15**). These measures will be further outlined in the updated ACHMP.

Action		Proposed Management Measure
Offsite Cultural Heritage Management Measures		
Intergenerational Equity	Caring for land	Knowledge Holders and RAPs have raised the desire to be involved in rehabilitation activities and conservation area management. The RAPs have also commented on the importance of understanding plant and animal resources in the region. United acknowledge the desire for stakeholders to be involved in the caring for and 'healing' of the land. United believes that education forms a significant role in achieving this outcome. United would be pleased to offer 3 x 3 year scholarships of $10,000 each for tertiary education in Environmental Science, Ecology, cultural and other related fields for member(s) of Wonnarua community selected via an agreed application process.
	Bringing people together	Knowledge Holders and RAPs raised a range of issues and potential mitigation strategies with regards to cultural loss. These included: • a desire for community (or groups) to come together outside of development application/disturbance processes • a desire for a range of cultural experiences (such as Cultural Camps, Elders Camps, teaching to younger generations) • assistance to Wonnarua people who may live outside the region to visit Wonnarua Country. United proposes to support a program of activities to assist in bringing people together for cultural purposes. Glencore supports NAIDOC week activities in the Upper Hunter including organising bus tours to significant sites, art programs etc.

Action		Proposed Management Measure
	Cultural awareness and education	The RAPs raised a range of potential mitigation strategies in relation to promoting cultural awareness in young people. These included: • school based awareness/education programs • youth and elder camps • development of teaching materials accessible to young people. United proposes to support a program of activities to assist in promoting cultural awareness and education for young people.
	Wonnarua Research	Knowledge Holders group raised a desire for Wonnarua led research to be undertaken in the region, with a focus on Cultural, archaeological, ecological and social values, with the ultimate goal of providing outcomes and information that Wonnarua people can use and pass to future generations. United propose to support a program of activities to assist Wonnarua led research with outcomes in Caring for Land and/or Cultural Awareness and Education and/or Bringing People Together for the purposes of building cultural knowledge.

The support for the programs outlined in **Table 6.36** would be available for applications from the Wonnarua community for a period of 2 years from the commencement of the Project. As part of the ACHMP development, a process and criteria for the application for this support would be developed. A further budget of $350,000 has been allocated to these programs. Applications could also be made across these areas jointly to allow for research and further outcomes to flow from it.

Ongoing management of cultural heritage values within the approved Wambo surface development area will be undertaken in accordance with the requirements of Wambo's development consents and Aboriginal Heritage Impact Permits.

6.11 Historic Heritage

A comprehensive assessment of the potential impacts of the Project on historic heritage values has been undertaken in accordance with the SEARs for the Project (refer to **Table 4.3**). The assessment was completed by Umwelt with a summary of the key findings provided in this section, and the full report provided in **Appendix 16**. This section discusses impact on historic heritage values. Discussion of impacts on Cultural Heritage values and Aboriginal sites is included in **Section 6.10**.

The assessment identifies the historical heritage sites contained within and in the vicinity of the Project Area and assesses the significance of any impacts on these sites potentially resulting from the Project.

Consultation has been undertaken by United and Wambo with government authorities, including the Heritage Division, OEH and community stakeholders in relation to the Project. Consultation has also occurred with a heritage fence expert, Dr John Pickard, in relation to the dog leg fence located within the Project Area (refer to **Appendix 16**).

The Wambo Homestead Complex, a State significant heritage site, is located in the Wambo area to the south of the Project Area. The Project will not directly impact on this site, however, to assess the potential for indirect impacts a Statement of Heritage Impact on the Wambo Homestead Complex was prepared by EJE Architects (refer to **Appendix 16**).

6.11.1 Historical Context

A detailed review of the historical context of the Project Area and surrounds was undertaken to gain a sound understanding of the potential historical resource that may occur in and surrounding the Project Area. A full description of the historical context of the Project Area is included in **Appendix 16** with a summary included below.

The documented history of the surrounding region indicates that the land has predominantly been utilised by graziers, agriculturalists and in more recent times the mining industry. The historical heritage evidence of the Project Area demonstrates the documented pattern of settlement and use from the early to mid-nineteenth century, including the settlement of the area by Europeans and subsequent use of the land for pastoral and agricultural activities. In general, the historical heritage resource, with the exception of the former Warkworth Royal Australian Air Force (RAAF) Landing Ground – Satellite Airstrip (refer to **Section 6.11.2.1**) is considered to be typical of the surrounding region and includes evidence of former house sites, sheds, yards and other rural structures that demonstrate the pattern of land use and historical development of the area.

As well as grazing, the Hunter Valley was opened up for farming in the 1820s with land granted and areas swiftly developed in the fertile region. The Singleton locality contained several thousand acres clear of timber and covered with rich alluvial soil which produced various heavy crops. Agriculture soon became important to the growing economy of the region and during the period 1821 to 1860 wheat was the most common staple crop, with maize for fodder as the second preference. Crops were primarily grown for use by the individual landholder or to sell locally (Clive Lucas 2013).

Horse breeding also became a thriving industry in the region as early as 1822. While horses were used for transport they were also important in terms of the management of stock and recreation. Thoroughbred horses were imported by the larger (wealthier) landholders throughout the nineteenth century, establishing a strong history of horse breeding in the area.

The development of coal resources comprises an important part of the region's history and coal mining began on a limited scale in the early 1900s, prior to a rapid expansion in the 1950s with the establishment of large open-cut mines (Dean-Jones and Mitchell 1993:2).

Coal mining and electricity generation have become major industries in the Singleton area since the 1950s with the first wave of collieries built to meet export demand at Liddell, Foybrook and Liddell State. Since the mid-twentieth century, coal mining operations expanded from the Cessnock/Maitland area to the triangle bounded by Singleton, Muswellbrook and Denman, using highly mechanised, open cut surface mining techniques in which all overburden was stripped from the surface (Rappoport 2006:24).

6.11.2 Identification of Historic Heritage Items/Sites

In order to identify if any historical heritage items were located within or in the immediate vicinity of the Project Area, desktop searches of relevant heritage databases were conducted including:

- the NSW State Heritage Register (SHR) and State Heritage Inventory
- the Australian Heritage Database (including Commonwealth and National Heritage lists and the Register of the National Estate (RNE))
- Singleton LEP 2013.

No listed sites/items were identified within the Project Area (refer to **Figure 6.35**). However, several listed items were identified within the vicinity (within 3 kilometres) of the Project Area, including the SHR listed Wambo Homestead and Outbuildings.

All listed items identified within the vicinity of the Project Area are listed in **Table 6.37** and identified on **Figure 6.35**.

Table 6.37 Listed heritage items located outside but within the vicinity of the Project Area

Item Name	Location	Co-ordinates (MGA)	Listing and Significance	Distance to Project Area and Disturbance Area
Wambo Homestead	Off The Golden Highway Lot 82 DP 548749	311615.17, 6393166.14	SHR. Singleton Local Environment Plan (LEP) 2013. State significance. Register of the National Estate (RNE1).	Wambo Homestead listed boundary forms part of Project Area boundary. Approximately 2.5 kilometres from the open cut mining proposed as part of the Project at its closest point

1 The Register of the National Estate (RNE) is a non-statutory list of natural, Indigenous and historic heritage places throughout Australia. Many places in the RNE are now included in other statutory lists, such as the state heritage lists, or local government heritage registers. As a result, those places receive protection under the relevant federal, state, territory or local legislation.

Item Name	Location	Co-ordinates (MGA)	Listing and Significance	Distance to Project Area and Disturbance Area
St Philips Church, Warkworth	Off High Road, Warkworth Part Lot 21, DP 755267	314808.49, 6394312.45	Singleton LEP 2013 Local significance	Approximately 1.2 kilometres outside the Project Area boundary. Approximately 1.8 kilometres from the open cut mining proposed as part of the Project at its closest point
Former Queen Victoria Inn – Ruins Archaeological site	Jerrys Plains Road, Warkworth Lot 1, DP 770904	315490.07, 6393872.62	Singleton LEP 2013 Local significance	Approximately 1.8 kilometres outside the Project Area boundary. Approximately 2.5 kilometres from the open cut mining proposed as part of the Project at its closest point

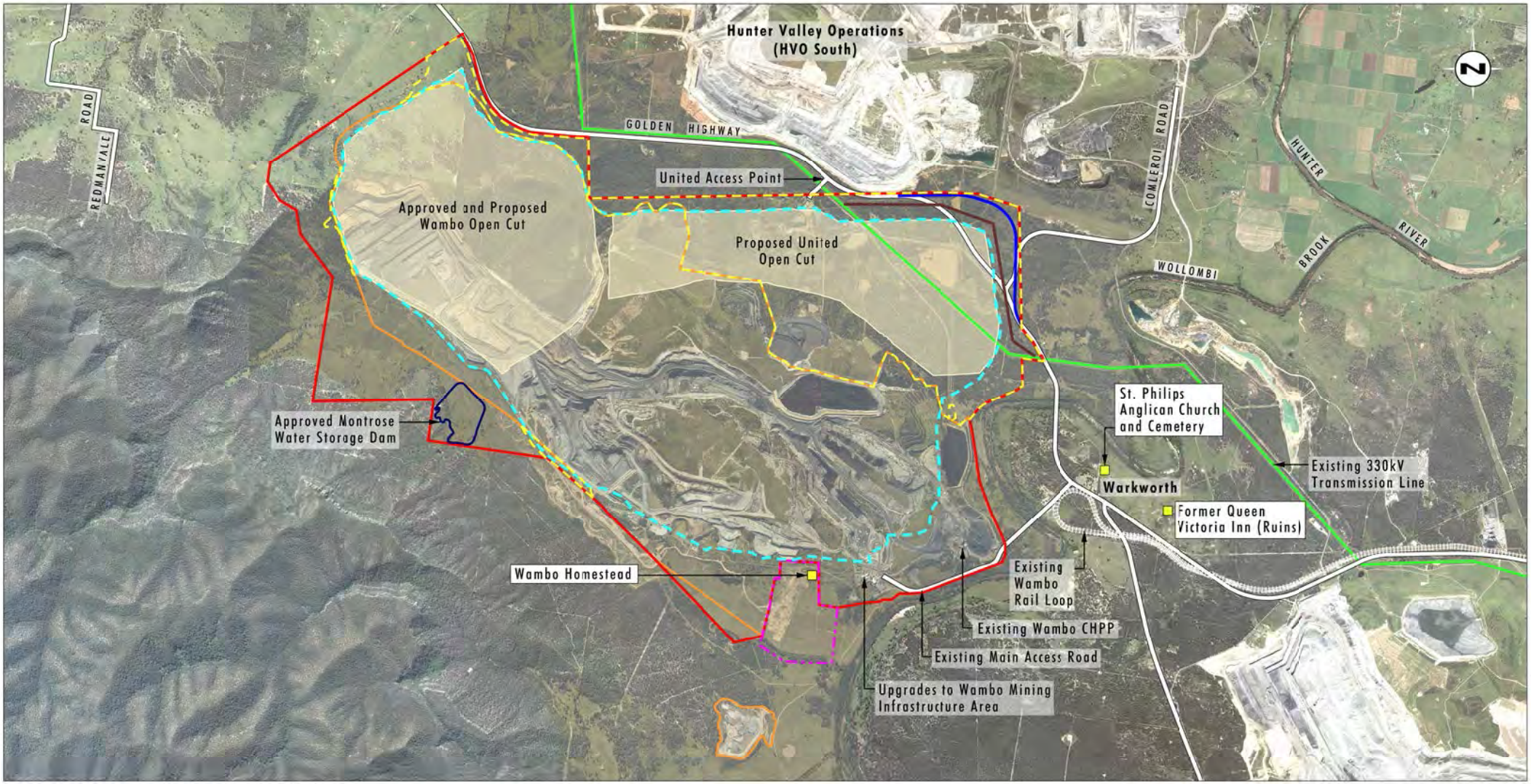


Image Source: AAM (2012), United (2015)
Data Source: Glencore (2014)

0 1.0 2.0 3.0km
1:60 000

Legend

- Project Area
- Conceptual Additional Disturbance Area
- Proposed Conceptual Extraction Area
- Approved Wambo Surface Development Area
- Proposed Golden Highway Realignment
- Existing 330kV Transmission Line
- Proposed Relocated 330kV Transmission Line
- Overburden Emplacement Area
- Approved Montrose Water Storage Dam
- Listed Heritage Items
- Wambo Homestead Listed Boundary

FIGURE 6.35

Listed Heritage Items

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In addition to the three sites above, a targeted approach to site survey was undertaken in order to ground truth:

- the results of the research undertaken
- the review of previously prepared reports which identified several potential sites/items in the wider area
- the review of existing topographic maps and aerial photography
- previously identified areas or sites of potential
- any sites/items identified during the 2015 Aboriginal survey undertaken by OzArk and the Project Registered Aboriginal Parties (RAPs).

An Aboriginal archaeological survey was undertaken from March to June 2015 and subsequent Aboriginal archaeological test excavations were conducted from July to September 2015 by Ozark and the Project RAPs. No previously unknown potential historical heritage sites or items were identified during the 2015 Aboriginal archaeological survey or test excavations.

Several targeted site inspections were undertaken during the assessment of the Project Area. These included:

- an initial inspection of the Dog-leg fence undertaken on 7 March 2013
- a detailed inspection of the Dog-leg fence with Dr John Pickard on 15 August 2015
- a targeted inspection of potential sites within and in the vicinity of Project Area was undertaken on 12 November 2015.

The above investigations identified the following potential historical heritage sites/items within and in the vicinity of the Project Area, in addition to the listed historical items identified in **Table 6.37** above. The location of these sites/items is shown in **Figure 6.36** and presented in **Table 6.38**.

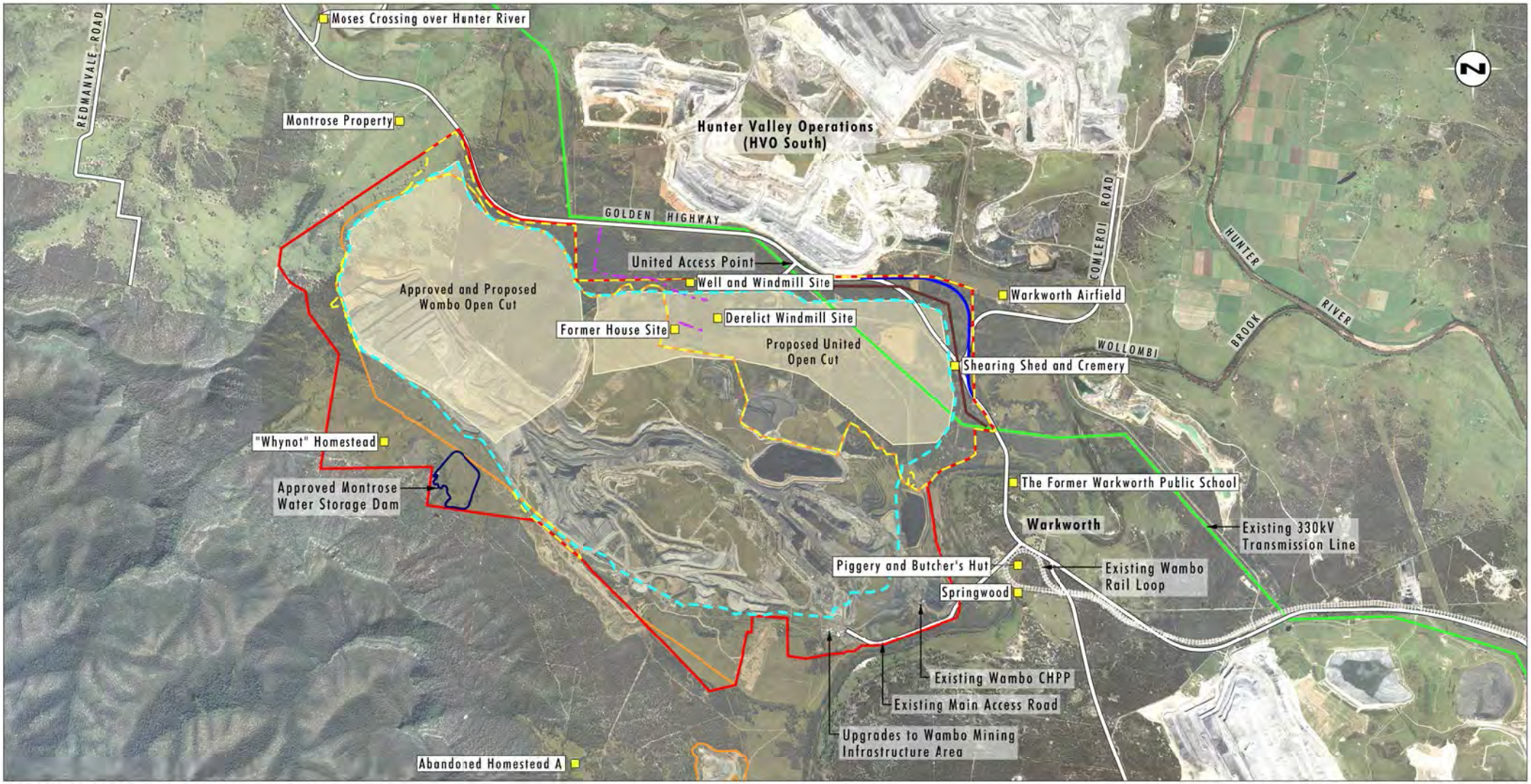


Image Source: AAM (2012), United (2015)
Data Source: Glencore (2014)

0 1.0 2.0 3.0 3.5km
1:65 000

Legend

- Project Area
- Conceptual Additional Disturbance Area
- Approved Wambo Surface Development Area
- Proposed Conceptual Extraction Area
- Proposed Golden Highway Realignment
- Existing 330kV Transmission Line
- Proposed Relocated 330kV Transmission Line
- Overburden Emplacement Area
- Approved Montrose Water Storage Dam
- Potential Historical Heritage Sites
- Dog-leg Fence

FIGURE 6.36

Potential Historical Heritage Sites

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Table 6.38 Potential Heritage items within and in the vicinity of the Project Area

Item Name	Location	Previously Assessed Significance	Distance to Project Area and Additional Disturbance Area
Dog-Leg Fence west of Jerrys Plains Road, Warkworth	South of Golden Highway. North of and partially within Project Area.	N/A	Approximately 450 metres of the Dog-leg fence is located within additional disturbance area (refer to **Figure 6.36**). Approximately 1.3 kilometres of the Dog-leg fence is located immediately outside Project Area (refer to **Figure 6.36**).
Small additional section of Dog-Leg Fence	Near former house site.	N/A	Within proposed United Open Cut (refer to **Figure 6.36**).
Former house site	Lot 55 DP 753792	N/A	Within proposed United Open Cut (refer to **Figure 6.36**).
Well and windmill site	Lot 5 DP 1085145	N/A	Within additional disturbance area (refer to **Figure 6.36**).
Derelict windmill site	Lot 7 DP 753792	N/A	Within proposed United Open Cut (refer to **Figure 6.36**).
Shearing Shed and Creamery	Intersection of the Golden Highway and Comleroi Road, Warkworth	Potentially significant (ERM 2008)	Within additional disturbance area (refer to **Figure 6.36**).
Warkworth Airfield	Comleroi Road	Potentially significant (ERM 2008)	Southwest corner of the current Warkworth Airfield area (not including the runway) is within the Project Area and disturbance area (refer to **Figure 6.36**). Refer to **Section 6.11.2.1** for further description.

Item Name	Location	Previously Assessed Significance	Distance to Project Area and Additional Disturbance Area
"Whynot" Homestead	In southwest corner of the Project Area	Limited Local Significance (EJE 2003: CC-16)	Within the Project Area but not within the additional disturbance area (refer to **Figure 6.36**). Approximately 800 metres from the approved Wambo Open Cut and approximately 3.5 kilometres from the proposed surface extension of the Wambo Open Cut. Over 2.5 kilometres from the proposed United Open Cut area.
Montrose Property	Golden Highway	Slightly Significant (EJE 2003:CC-16)	450 metres outside the Project Area boundary. 750 metres from proposed extension to the northwest corner of the approved Wambo Open Cut. Over 3 kilometres from the proposed United Open Cut area.
The former Warkworth Public School	Warkworth	Potentially significant (ERM 2008)	Approximately 480 metres outside the Project Area boundary. Approximately 1 kilometre from the proposed United Open Cut.
Springwood **(formerly Abandoned Homestead B)**	Warkworth	Local significance (EJE 2003: CC-16)	Approximately 640 metres outside the Project Area boundary. Approximately 2 kilometres from the proposed United Open Cut.
Piggery and Butcher's Hut	Warkworth	Minor local significance (EJE 2003:C-16).	Approximately 730 metres outside the Project Area boundary. Approximately 1.7 kilometres from the proposed United Open Cut.

Item Name	Location	Previously Assessed Significance	Distance to Project Area and Additional Disturbance Area
Abandoned Homestead A	Perimeter Trail Road, South Wambo	Minor local significance (EJE 2003: CC-16)	Approximately 1.8 kilometres outside the Project Area boundary. Over 4.5 kilometres from the proposed United Open Cut.
Moses Crossing over Hunter River	Lemington Road	Potentially significant (ERM 2008)	Approximately 1.9 kilometres outside the Project Area boundary. Over 2.2 kilometres from proposed extension to the northwest corner of the approved Wambo Open Cut.

6.11.2.1 Warkworth RAAF Landing Ground – Satellite Airstrip

The former Warkworth landing ground (located immediately adjacent, and partially inside, the northeast corner of Project Area, refer to **Figure 6.36**) is the remains of a former RAAF landing ground and is one of the three satellite airstrips associated with the parent RAAF Base Bulga, the others being at Broke and Strowan (Jerrys Plains). Satellite airstrips were constructed to alleviate congestion at parent aerodromes (Brew 2001). Land was acquired for the four RAAF landing grounds at Bulga, Warkworth, Strowan and Broke in 1942.

The plans of the RAAF landing ground at Warkworth dated 31 October 1942 show the camouflaged landing strip with taxiways running from the northern side of the runway having eight aircraft hideouts in five groupings among the trees. A camp was also constructed to the north of the airstrip.

It appears that the RAAF Base Bulga and its satellite sites at Broke, Warkworth and Strowan were never used for war related activities. By mid-1943 the need for and use of the bases at Bulga, Broke, Warkworth and Strowan was no longer envisaged, so when the works had been completed to a minimum serviceable standard, consideration turned to future management of the sites (Weir and Phillips 2007).

The site is currently utilised by the Hunter Valley Gliding Club (refer to **Section 6.2**).

6.11.3 Significance Assessment

An assessment of significance is undertaken to explain why a particular place is important and to enable appropriate site management to be determined. In accordance with the SEARs for the Project, a significance assessment of the historic heritage items within the Project Area was undertaken.

The Project Area is typical of a rural landscape within the Upper Hunter region of NSW. The history of the area from the early to mid-nineteenth century, including its settlement by Europeans and subsequent use as cleared pastoral and agricultural land through to its exploitation for mineral resources is reflected in the low potential of the archaeological resource. It is also reflected in the evidence of former house and farm sites and other rural structures and infrastructure which collectively provide a cross section of the cultural record of settlement and pastoral pursuits in the area since settlement.

In general terms, with the exception of the Dog-leg fence and the former house site (refer to **Sections 6.11.3.1** and **6.11.3.2**), the identified and potential historical heritage components within the Project Area have been assessed as having no significance with no research potential.

6.11.3.1 Dog-leg Fence

General evidence of rural fences...may provide information about how the landscape was used and changed during its use as pastoral land. However, in general as individual items they have little research potential beyond the immediate physical presence of their type (Pickard 2015).

Although the condition of the Dog-leg fence has been assessed as being poor, it is a unique example of the former private and government Dog-leg fences once common across NSW and which could be seen as an important icon in Australian history (Pickard 2007). Its physical presence within the Project Area provides an opportunity to study and better understand this form of early fence.

As such, the Dog-leg fence is considered to be of State significance as it is a unique example of a rare type of fence. Only one other example of a Dog-leg fence, at Mt Trooper south of Ingebyra NSW, is known to have been recorded (Pickard 2009). The Dog-leg fence at Mt Trooper does not have the unique stone supporting blocks of the fence located within the Project Area.

6.11.3.2 Former House Site

The former house site (refer to **Figure 6.36**) has been assessed as being of local significance based on the potential to reveal archaeological information regarding what may be a small farmstead enterprise from the mid nineteenth to early twentieth centuries. The visible physical evidence of a concentration of several different structures, potentially with differing functions, suggests there could be intact archaeological evidence of a working pastoral farmstead, with the ability to provide information about the historical development, occupation and use of the site.

6.11.4 Potential Impacts of the Project and Management Commitments

The potential impacts of the Project are considered in terms of direct impacts and indirect impacts. Direct impacts are considered to be physical impacts to a site, including removal and destruction. Indirect impacts are considered to include vibration from blasting, which has the theoretical potential to damage/destroy/ disturb historical heritage items. A detailed Blasting Impact Assessment was undertaken for the Project in accordance with the SEARs (refer to **Section 6.7** and **Appendix 10**).

As a result of the nature of a number of the previously identified potential heritage items/sites and the distance they are located from both the Project Area and the additional disturbance area, a number of the sites identified above have been assessed as not having any risk of impact either physically or to their heritage significance as a result of the Project. These sites include:

- Warkworth Airfield
- Whynot Homestead
- Abandoned Homestead A.

The potential for the Project to impact on the remaining sites is discussed in the following sections.

6.11.4.1 Listed Heritage Items

As discussed in **Section 6.11.2**, there are three listed heritage items within the vicinity of the Project Area (refer to **Figure 6.35**). The listed heritage items located outside, but in proximity to, the Project Area have been considered in terms of potential vibration impacts. Maximum predicted vibration levels are indicated as detailed in the blast assessment (Enviro Strata 2016). The predicted vibration levels for the listed heritage sites are provided in **Table 6.39**.

Table 6.39 Listed Heritage Items located in the vicinity of the Project Area and Predicted Ground Vibration due to blasting

Item Name	Predicted Range of Ground Vibration (mm/s)
Wambo Homestead	0.1 to 1.5
St Philips Church, Warkworth	0.2 to 2.4
Former Queen Victoria Inn – Ruins Archaeological site	1 to 1.5

The predicted vibration levels in **Table 6.40** are below the levels at which no impacts are predicted (i.e. are all less than 3-5 mm/s). Therefore no impacts on these sites are predicted as a result of blasting associated with the Project.

Wambo Homestead

Wambo Homestead and its associated outbuildings is located immediately south of the Project Area. The Wambo Homestead listed boundary forms part of the southern boundary of the Project Area. It is located approximately 2.5 kilometres from the proposed United Open Cut and will not be directly impacted by the Project.

With regard to the potential for indirect impacts, **Table 6.40** indicates the potential heritage impacts to the Wambo Homestead as assessed by EJE Heritage (refer to **Appendix 16**).

Table 6.40 Statement of Heritage Impact for Wambo Homestead

Potential Impact	Heritage Impact Statement
Water, vibration & dust	Is very unlikely to have an additional impact over the existing mining operations due to the distance between the proposed new open cut mine during its life, and the homestead complex.
Existing buildings & Structures	New blasting to be monitored and vibration limited to prevent damage to the existing buildings and structures. Is very unlikely to have an additional impact over the existing mining operations due to distance between the new open cut mine during its life, and the homestead complex.

Potential Impact	Heritage Impact Statement
Moveable Heritage	It is very unlikely to have any impact on moveable heritage.
Protecting the curtilage	It is very unlikely to have any impact within the boundaries of the listing.
Sight lines & View Corridors	It is very unlikely to have any impact on the existing sightlines and view corridors within the complex and to those immediately beyond. The emplacement areas to the north will increase in height, however these should be generally consistent with existing views. This will improve as rehabilitation progresses.
Landscape elements	It is very unlikely to have any impact on landscape elements with respect to the Wambo Homestead Complex, within the listed site. Given the uphill gradient and distance away from the proposed workings, infrastructure and emplacement to the north, it is very unlikely to change the existing landscape conditions in a way that will impact on Wambo Homestead Complex.
Archaeological resources	It is very unlikely to have any impact on archaeological resources within the immediate curtilage of the Wambo Homestead Complex.
Social Impact	It is very unlikely to have any further social impact given the Project will include the continuation of Wambo's operations and that the proposed United Open Cut will be located further to the north of the existing Wambo operations.
Protecting overall significance	There is no obvious reason why the management of the heritage significance and protection of the place would be adversely impacted upon by the Project.
For Character, Sightlines & View Corridors	The Project is very unlikely to have any impact on the character, sightlines and view corridors associated with the Wambo Homestead Complex. The emplacement areas will increase in height, however these should be generally consistent with existing views.
For Landscape Elements	The Project is very unlikely to have any impact on the landscape elements associated with the Wambo Homestead Complex or still contributing to the heritage significance of the Wambo Homestead Complex.

The maximum predicted level of ground vibration for Wambo Homestead and Outbuildings is 1.5 mm/s; below the conservative peak particle velocity criteria of between 3 and 5 mm/s at which no impacts to structures are predicted to occur. The predicted maximum ground vibration levels are also well below the current approved vibration limits for the Homestead in the Wambo mine development consent of 5 mm/s.

In consideration of the EJE Heritage 2016 Statement of Heritage Impact and the low level of predicted ground vibration, it is assessed that the Wambo Homestead will not be affected by the Project.

No additional management measures are required in relation to Wambo Homestead as part of the Project, with the existing management regime in place under the Wambo mine development consent providing for the ongoing effective management of the site. This existing management regime includes:

- adherence to an approved Conservation Management Plan
- blast monitoring undertaken for any blasts located within 2 kilometres of the Wambo Homestead
- review of blast records by a suitably qualified and experienced structural engineer
- annual inspections of the Wambo Homestead by the approved structural engineer.

Wambo will continue to be responsible for the implementation of the Conservation Management Plan and overall management of the Wambo Homestead. Under the Joint Venture agreement between Wambo and United, United will be responsible for managing all aspects of the open cut mining operations. This will include implementing all relevant controls relating to Wambo Homestead that relate to open cut mining activities. United will also implement blast controls and monitoring consistent with the existing management regime in place, including achievement of the relevant blasting criteria.

St Philips Church, Warkworth

St Philips Church is located 1.2 kilometres outside and to the east of the Project Area, approximately 1.7 kilometres from the proposed United Open Cut. The maximum predicted ground vibration level for St Philips Church is 2.4 mm/s, which is below the conservative vibration limit of 3 to 5 mm/s and the current HVO South approved limit of 5 mm/s**.** As such, there are not expected to be any direct or indirect impacts to St Philips Church.

No additional management measures are required in relation to St Philips Church as part of the Project. Blast monitoring will be undertaken utilising existing blast monitors located in Warkworth to confirm that blasting vibration levels meet relevant criteria.

Site of Former Queen Victoria Inn – Ruins Archaeological Site

The Former Queen Victoria Inn site is located 1.8 kilometres outside and to the east of the Project Area, approximately 2.5 kilometres from the proposed United Open Cut. The Former Queen Victoria Inn is considered an archaeological site (subsurface) and is highly unlikely to be affected by vibration. Considering the distance of this site from the Project Area and the nature of the site, there are not expected to be any direct or indirect impacts to the site.

No management measures are required in relation to Former Queen Victoria Inn site as part of the Project.

6.11.4.2 Identified Sites within the Project Area

This section addresses the potential impacts resulting from the Project to each of the sites/items identified within the Project Area and proposes a management strategy to mitigate any impacts. **Figure 6.36** shows the proposed mine plan in relation to the locations of the identified heritage sites/items within the Project Area.

Dog Leg Fence

Two sections of Dog-leg fence are located within the Project Area (refer to **Figure 6.36**). The main section of fence is located at the northern edge of the Project Area. Approximately 335 m of the fence is located within the proposed United Open Cut and will be removed as part of the Project. A further 340 metres is located outside the open cut area but within the proposed Project disturbance boundary and is also likely to be removed as part of the Project (refer to **Figure 6.36**). As such, approximately 675 metres of the Dog-leg fence is likely to be removed as part of the Project. Note that a further 1230 metres is located outside the Project Area. Within the section located outside the Project Area there are many places where the original structure is intact, although partially collapsed.

Sections of the Dog-leg fence have already been destroyed by bush fires leaving only the sandstone support blocks to indicate the former fence alignment. In relation to the Dog-leg fence located within and adjacent to the Project Area, Pickard notes that:

...the pine logs are very weathered with numerous cracks making them susceptible to both wild fires and hazard-reduction burns; even small sparks lodging in cracks cause smouldering and destruction of the logs. In recent years, the fence has been protected from hazard-reduction burning, but it is almost inevitable that a wild fire will consume the fence (Pickard 2015).

Due to the nature and degradation of the structure, the impact of blasting on the fence cannot be accurately predicted (refer to **Appendix 10**). As a result, the 1230 metres length of Dog-leg fence located outside the Project Area may be susceptible to damage from ground vibration; particularly the section closest to the open cut boundary and blasting impacts are likely to occur.

The Dog-leg fence has been assessed as being of State significance.

As discussed in Pickard 2015, protecting the fence against fire would be impossible and hazard reduction is not a preferred option on land associated with open-cut coal mines. Mechanical fire breaks would not be wide enough to be effective in the type of vegetation surrounding the fence line. As such, detailed recording of both sections of the Dog-leg fence is the only practicable option.

A detailed survey and photographic/archival recording is planned to be undertaken in accordance with Heritage Division, OEH guidelines *Photographic Recording of Heritage Items Using Film or Digital Capture* (2006). Recording the surviving alignment of the Dog-leg, including the section located outside the Project Area, will ensure all surviving physical aspects of the fence are identified and documented prior to any disturbance as a result of the Project or natural threats such as bushfires, termite attack and decay. The proposed detailed archival recording will ensure that a full understanding and record of the Dog-leg fence will be available for future generations. As part of the archival recording additional research will be undertaken to attempt to identify (if the information is available) an exact date of construction and who may have built the fence.

In addition to the detailed recording an interpretation strategy will be developed for the Dog-leg fence. Creating a permanent interpretation feature at the site is not possible because of the nature of the mine site. However, the stone blocks could be salvaged and combined with logs from the fence or cut from within the Project Area, when it is cleared as part of site preparation works for the open cut, to reconstruct a section of Dog-leg fence (Pickard 2015).

The interpretive potential could be enhanced through the use of signage; providing opportunity to highlight the heritage significance in a way that the general community can identify with. The location of the proposed reconstruction could, if practicable, be at the entrance to the mine site or within a community space/park in Jerrys Plain or Warkworth. Consultation will be undertaken with interested members of the community, local historical society and Singleton Council when preparing the interpretation strategy for the Dog-leg fence.

Former House Site

The Former House Site is located within the proposed United Open Cut and will be removed as part of the Project. The Former House Site has the potential to be a locally significant archaeological resource.

Prior to the commencement of works that impact on this site, including ground preparation/clearing works, archaeological investigation of the Former House Site will be undertaken to relevant professional standards. The investigations will comprise (subject to consultation with the Heritage Division, OEH) a program of archaeologically monitored machine stripping of the grass cover focusing around the known former building locations.

Following the stripping of all grass cover across the area of archaeological interest, any archaeological remains (including concentrations/deposits of artefacts, structural remains or deeper cut features) exposed in this area during the monitored machine stripping would be recorded and hand excavated as part of the archaeological works. If no potential archaeological remains are identified following initial monitored machine stripping, further monitored machine stripping would be undertaken until either archaeological remains are exposed or sterile deposits with no evidence of historical archaeological remains or deposits have been encountered. Excavation would not be required once natural sub-soils are exposed, unless an archaeological feature is identified cut into the sub-soil.

The use of an archaeologically monitored excavator is considered an efficient and effective method of identifying the presence (or absence) of any archaeological evidence or remains. Prior to archaeological works commencing an archaeological work method statement detailing the proposed works is proposed to be provided to the Heritage Division, OEH for comment.

Well and Windmill Site

The well and windmill site is located within the additional disturbance area and will be removed as part of the Project (refer to **Figure 6.36**). This site has been assessed as having no significance and no research potential.

This site has been recorded as part of the preparation of the Historic Heritage Assessment (refer to **Appendix16**). The photographic catalogue (photographic record sheets) and photographs are included in **Appendix 16**.

No further management of the well and windmill site is required for the Project.

Derelict Windmill Site

The derelict windmill site is located within the proposed United Open Cut and will be removed as part of the Project (refer to **Figure 6.36**). This site has been assessed as having no significance and no research potential.

This site has been recorded as part of the preparation of the Historic Heritage Assessment (refer to **Appendix 16**). The photographic catalogue (photographic record sheets) and photographs are included in **Appendix 16**.

No further management of the derelict windmill site is required for the Project.

Shearing Shed and Creamery

The Shearing Shed and Creamery is located within the additional disturbance area, immediately adjacent to the proposed United Open Cut and will be removed as part of the Project. The former creamery building was identified by ERM in 2008 as a potentially significant heritage item.

The Shearing Shed and Creamery may have some local significance with the community and the community's sense of place as a frequently seen landmark and ruin standing in the rural landscape that has been present at the junction of Comleroi Road and the Golden Highway for possibly close to 100 years.

This site has been recorded as part of the preparation of the Historic Heritage Assessment (refer to **Appendix 16**). The photographic catalogue (photographic record sheets) and photographs are included in **Appendix 16**.

The photographic record included as **Appendix 16** is considered to be a sufficient record of the site.

Any potential additional associated features or archaeological 'relics' that are identified during any works in the area will be managed following the principles of Section 146 of the Heritage Act.

6.11.4.3 Identified Sites within the vicinity of the Project Area

As part of the Blasting Impact Assessment (refer to **Appendix 10**) prepared for the Project by Enviro Strata (Enviro Strata 2016) predicted vibration levels were identified for the non-listed potential heritage items located outside, but in the vicinity of, the Project Area. **Table 6.41** details the potential heritage items located outside, but in proximity to, the Project Area that should be considered in terms of potential vibration impacts (refer to **Figure 6.36**).

Table 6.41 Identified Potential Heritage Items Located in the Vicinity of the Project Area, Impacts and Management

Item Name	Predicted Range of Ground Vibration (mm/s)	Impacts and Management Commitments
Montrose Property	1.7 to 14	The maximum predicted level of ground vibration for the site is 14 mm/s. The Montrose Property may be susceptible to damage from ground vibration. A photographic/archival recording of the shearing shed associated with the Montrose Property will be undertaken in accordance with Heritage Division, OEH guidelines prior to any blasting being undertaken as part of the Project that may exceed 5 mm/s. The main house on the Montrose Property has been recorded as part of the preparation of the Historic Heritage Assessment and this is considered to be a sufficient record.
The former Warkworth Public School	0.5 to 6.7	Blast sizes will be managed to 5 mm/s for this building via the application of lower charge masses to negate the risk of vibration impacts, except where agreed otherwise with the owner and/or based on a structural assessment that identifies an alternate acceptable vibration level. Ongoing blast vibration monitoring will be undertaken as part of the Project to monitor compliance with the relevant criteria. No additional management measures are required in relation to the former Warkworth Public School as part of the Project.
Springwood **(formerly Abandoned Homestead B)**	0.2 to 2.2	The maximum predicted ground vibration level for Springwood is 2.2 mm/s; below the conservative vibration limit of between 3 to 5 mm/s. As such, there are not expected to be any direct or indirect impacts to Springwood. No additional management measures are required in relation to Springwood as part of the Project.
Piggery and Butcher's Hut	0.2 to 2.8	The maximum predicted ground vibration level for the site is 2.8 mm/s; below the conservative vibration limit of between 3 to 5 mm/s. As such, there are not expected to be any direct or indirect impacts to the Piggery and Butcher's Hut site. No management measures are required in relation to Piggery and Butcher's Hut site as part of the Project.

6.11.5 Mitigation Measures

Further to **Section 6.1**1.4, a number of additional preventative management measures will be implemented as part of the Project. These measures include:

- In the unlikely event that unexpected archaeological remains or potential heritage items not identified as part of this report are discovered during the Project, all works in the immediate area should cease, the remains and potential impacts should be assessed by a qualified archaeologist or heritage consultant and, if necessary, the Heritage Division, OEH notified in accordance with Section 146 of the *Heritage Act 1977* (NSW).

- If an archaeological relic is located as part of the Project a S146 Discovery of a Relic notification form must be completed and submitted to the Heritage Division, OEH.

- In the unlikely event that a potential burial site or potential human skeletal material is exposed within the Project Area, the following procedure should be followed in accordance with the *Policy Directive – Exhumation of Human Remains* (NSW Department of Health 2008), *Skeletal Remains – Guidelines for the Management of Human Skeletal Remains under the Heritage Act 1977* (NSW Heritage Office 1998) and the *Aboriginal Cultural Heritage Standards and Guidelines Kit* (NPWS 1997):

    - as soon as remains are exposed, work is to halt immediately to allow assessment and management
    - contact local police, OEH and the Heritage Division
    - a physical or forensic anthropologist should inspect the remains in situ, and make a determination of ancestry (Aboriginal or non-Aboriginal) and antiquity (pre-contact, historic or forensic)
    - if the remains are identified as forensic the area is deemed as crime scene
    - if the remains are identified as Aboriginal, the site is to be secured and OEH and all registered Aboriginal parties are to be notified in writing, or
    - if the remains are non-Aboriginal (historical) remains, the site is to be secured and the Heritage Branch is to be contacted.

    The above process functions only to appropriately identify the remains and secure the site. From this time, the management of the remains is to be determined through liaison with the appropriate stakeholders (NSW Police Force, forensic anthropologist, OEH, Heritage Division, registered Aboriginal parties etc) and in accordance with the *Public Health Act 1991*.

6.12 Visual Amenity

The SEARs for the Project require a detailed assessment of the likely visual impacts of the development (including dust, blasting and night lighting) on surrounding private landowners and key vantage points in the public domain, paying particular attention to impacts on private residences, tourists and road users (refer to **Table 4.3**). Minimising visual impacts was one of the key design considerations for the Project, in particular for the United Open Cut area which will remain behind a ridge in the north of the Project Area to reduce visibility of mining operations to the north. The approved Wambo Open Cut will mine through part of this ridge and will have increased visibility to the north, however, the provision of an improved final landform as part of the Project will mitigate this impact in the medium to long-term.

Visual amenity was raised as key issue of concern to local community stakeholders, with key issues relating to decreased amenity and impact on rural outlook. Impacts of lighting from night operations and beautification of the final landform were also raised by a small number of stakeholders. United held a workshop with community members to discuss the conceptual final landform and revegetation strategy for the Project, and has committed to creating a more natural looking and functioning final landform which will reduce long term visual impacts. The revegetation strategy will also be a combination of woodland, grassland with pockets of woodland and pastoral grassland to provide visual contrast and to blend into the surrounding landscape.

6.12.1 Existing Visual Environment

The Hunter Valley has a diversity of landforms, vegetation patterns and land uses resulting in considerable variation in scenic quality. In general terms, scenic quality is considered to improve with increasing diversity of topographic ruggedness, vegetation patterns, natural and agricultural landscapes and water bodies (Andrews Neil 1999).

Extensive clearing for agricultural purposes since non-indigenous settlement has created a strong landscape contrast in the Hunter Valley between forested slopes bordering the valley and farmland on the valley floor, including cleared areas for grazing and areas of intensive agriculture along the alluvial river flats. The development of the power and coal industries particularly over the past 55 years has added to this contrast, resulting in areas of strong visual contrast to the surrounding vegetated and agricultural areas (Andrews Neil 1999).

The industrial nature of parts of the Upper Hunter Valley, which has significant areas occupied by mining and power generation land uses, is highly visible from the major transport routes of the Golden Highway and New England Highway. As identified in **Section 1.6.1**, the Project Area exists within a mining landscape and is surrounded predominantly by the existing mining activities of Wambo, HVO, MTW and their associated surrounding mine owned lands, with several other mines located further to the north, east and south including Ravensworth Operations, Rixs Creek Mine and Bulga Mine, (refer to **Figure 1.2**). In the vicinity of the Project, mined land, coal related infrastructure (conveyors, mining surface facilities, rail facilities and lines) and other built infrastructure such as high voltage power lines contribute to the immediate visual environment.

Outside of the mining land, the local area is dominated by agricultural land uses, predominantly grazing, with more intensive cropping land located on the alluvial flats associated with the Hunter River and Wollombi Brook. Approximately 0.5 kilometre to the west of the Project Area lie the foothills of the Wollemi National Park. The hills and escarpments within the National Park form the dominant natural features to the west of the Project Area, with steeper heavily vegetated slopes and escarpment areas fringing the Hunter Valley floor and framing the visual catchment of the area (refer to **Figure 1.2**).

To the north west of the Project Area is a ridgeline which extends to a height of approximately 200 mAHD (refer to **Figure 1.7**). This ridgeline provides a topographic barrier between the area proposed for the United Open Cut and the private land to the northwest, including Jerrys Plains. Part of this ridge will be mined through by the approved Wambo Open Cut. The remaining surrounding topography is characterised by gently sloping alluvial plains and undulating hills (refer to **Figure 1.7**).

These various landscape elements provide significant contrast in visual amenity. Areas with a largely natural or agricultural character are generally considered of high visual amenity, while areas characterised by significant mining or industrial landscape features are typically considered to have a low visual amenity.

The night time scenic quality of the local area is not typically rural. As a result of mining operations and associated infrastructure, night light and glow emanating from these activities is common. There is also glow from the nearby villages. Whilst it is not natural, the night glow is now part of the character of the background night environment in this area of the Upper Hunter. Also contributing to the existing night time scenic quality is light from moving vehicles, both on the Golden Highway and vehicles operating in the mines.

6.12.2 Impact of Existing Mining Operations on Visual Character

Views of existing Wambo operations and associated infrastructure are currently available from surrounding areas, including residential areas, and from public viewing locations including the Golden Highway. The majority of views of Wambo are of the overburden emplacement areas. Views of active mining areas are largely currently shielded from public view by topography and vegetation surrounding the mine. As mining in the approved Wambo Open Cut progresses north and removes a ridge, there will be increased visibility of the Wambo operations to the north, including views of active mining areas and overburden emplacement areas from both residences to the north (e.g. Moses Crossing area) and users of the Golden Highway. Some distant views of Wambo emplacement areas and mine infrastructure are possible from locations within Maison Dieu and a small number of residences to the north west of Bulga. The existing approved 24 hour mining operations at Wambo currently contribute to a night time glow, which, along with other mining operations, affects the local night time visual amenity.

Restricted views of the existing United are available from the Golden Highway, including views of mining infrastructure and some established rehabilitation areas.

The HVO South operations, located north of the Project Area, are highly visible from the Golden Highway, from some residences including residences in Maison Dieu and some residences along the Golden Highway northwest of the Project Area. Active mining areas associated with the HVO South operations are located adjacent to the Golden Highway and are currently visible from sections of the Highway. There is bunding in place and vegetation screening located along parts of the Golden Highway, however, views of active mining areas remain available. Prominent views of overburden emplacement areas are also available from the Golden Highway.

The rural residential area of Maison Dieu also has views of overburden emplacement areas associated with the MTW Mine.

In summary, many of the residences surrounding the Project Area and other surrounding public viewing locations currently have extensive views of open cut mining and associated activities.

6.12.3 Assessment Methodology

To assess the visual impacts of the Project a series of radial analyses (viewshed analysis), panoramic photographs and visual montages have been completed for potentially impacted locations surrounding the Project Area. The process of identifying potentially impacted viewing locations involved an initial desktop review and preparation of a series of radial analyses from private residences and public viewing locations surrounding the Project Area, to determine the theoretical extent of potential views based on topography. Site inspections and photographs were then used to further refine the selection of representative assessment locations within each public viewing location surrounding the Project.

Radial analyses are developed using 3D topographic information and electronic data files relating to the Project to identify what can theoretically be seen from particular vantage points. The radial analysis illustrates what is visible from a height of 1.7 metres at that location (i.e. from approximate eye height). It should be noted that the radial analyses are topography based only and do not include vegetation which may in fact screen a portion of a viewshed. Radial analyses were completed based on the potential worst impact year for each relevant viewing location. Typically this was Year 16, where maximum height of the constructed landform is reached and the full progression of the proposed mine footprint is achieved. However, for views from the south, Year 2 was also considered due to topography and the extent of active overburden emplacement visible at this time.

Ten representative visual assessment locations were selected from seven geographical areas surrounding the Project. These locations are considered to be representative of the public viewing localities that have the highest potential for visual impact. The visual assessment locations chosen are illustrated on **Figure 6.37** and described below:

- from the east

    1. **Warkworth** – represents views from the closest private residence in Warkworth.

- from the northeast

    2. **Maison Dieu** – provides a representative location for residents in more elevated locations within Maison Dieu.

- from the northwest

    3. **Moses Crossing** (residences near the Golden Highway north of the Project Area) – provides a representative view from elevated private residence to the north west of the Project Area where there is greatest potential for visual impact from operations within the Wambo Open Cut.

    4. **Moses Crossing** – provides a representative view from an elevated private residence to the north west of the Project Area where there is greatest potential for visual impact from operations within the Wambo Open Cut.

    5. **Jerrys Plains** – provides a representative view from an elevated private residence in Jerrys Plains.

    6. **Redmanvale Road -** provides a representative view from private residences to the northwest of the Project Area along Redmanvale Road.

- from the south:

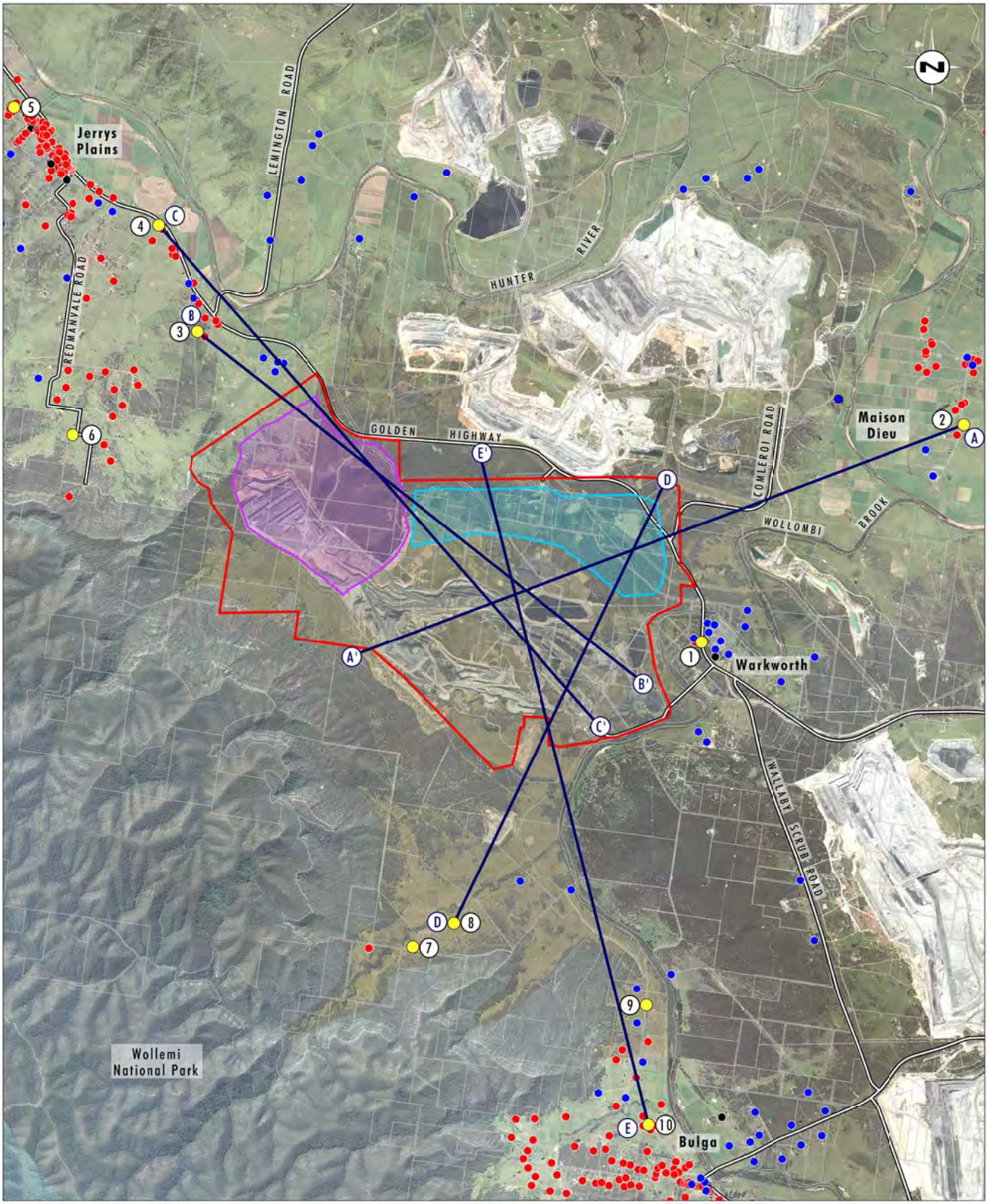
    7. **South Wambo** – representative views from a private residence located to the northwest of Bulga village.

    8. **South Wambo** - representative views from a private residence located to the northwest of Bulga village.

    9. **Bulga** – representative of the views from the closest private residence on the outskirts of Bulga village.

    10. **Bulga** – representative of the views from private residence located within Bulga village.

An assessment of visual impact was also completed for the Golden Highway and involved preparation of a series of radial analyses and site inspections to determine potential impacts for people travelling on the Golden Highway.



Data Source: LPMA (2009), Department of Natural Resources (2005)

0 1.0 2.0 4.0km
1:90 000

Legend

- Project Area
- Proposed Conceptual United Open Cut Pit
- Proposed Conceptual Wambo Open Cut Realignment
- Private Residence
- Mine Owned Residence
- Other Residence
- View Point Location
- Visual Transect Line

FIGURE 6.37

Radial Analysis View Points and Visual Transect Locations

File Name (A4): R06/3509_352.dgn
20160513 9.48

Visual montages were completed for each of the major public viewing locations surrounding the Project Area where potential visual amenity impacts were identified from the assessment process. Visual montages are developed using a panoramic photograph (made using a series of individual photos), 3D topographic information, and electronic data files pertaining to the proposed Project. Constructing visual montages of 'before and after' scenarios illustrates the existing landscape and provides a comparison landscape including the Project and its visual amenity management measures.

Visual montages for this assessment included a comparison between existing views and the operations of the Project in Year 2 or Year 16, depending on the worst case year for the relevant public viewing locations.

6.12.4 Visual Impact Assessment

The key aspects of the Project that have the potential to result in visual impacts include:

- clearing and overburden removal, which may be associated with views of mobile plant and equipment, exposed surfaces, dust, blasting operations and night lighting
- active mining operations, which may be associated with views of mobile plant and equipment, exposed surfaces, dust, blasting operations and night lighting
- emplacement of overburden, which may be associated with views of mobile plant and equipment, exposed surfaces, dust and night lighting
- rehabilitation, which may be associated with views of mobile plant and equipment and regenerating vegetation.

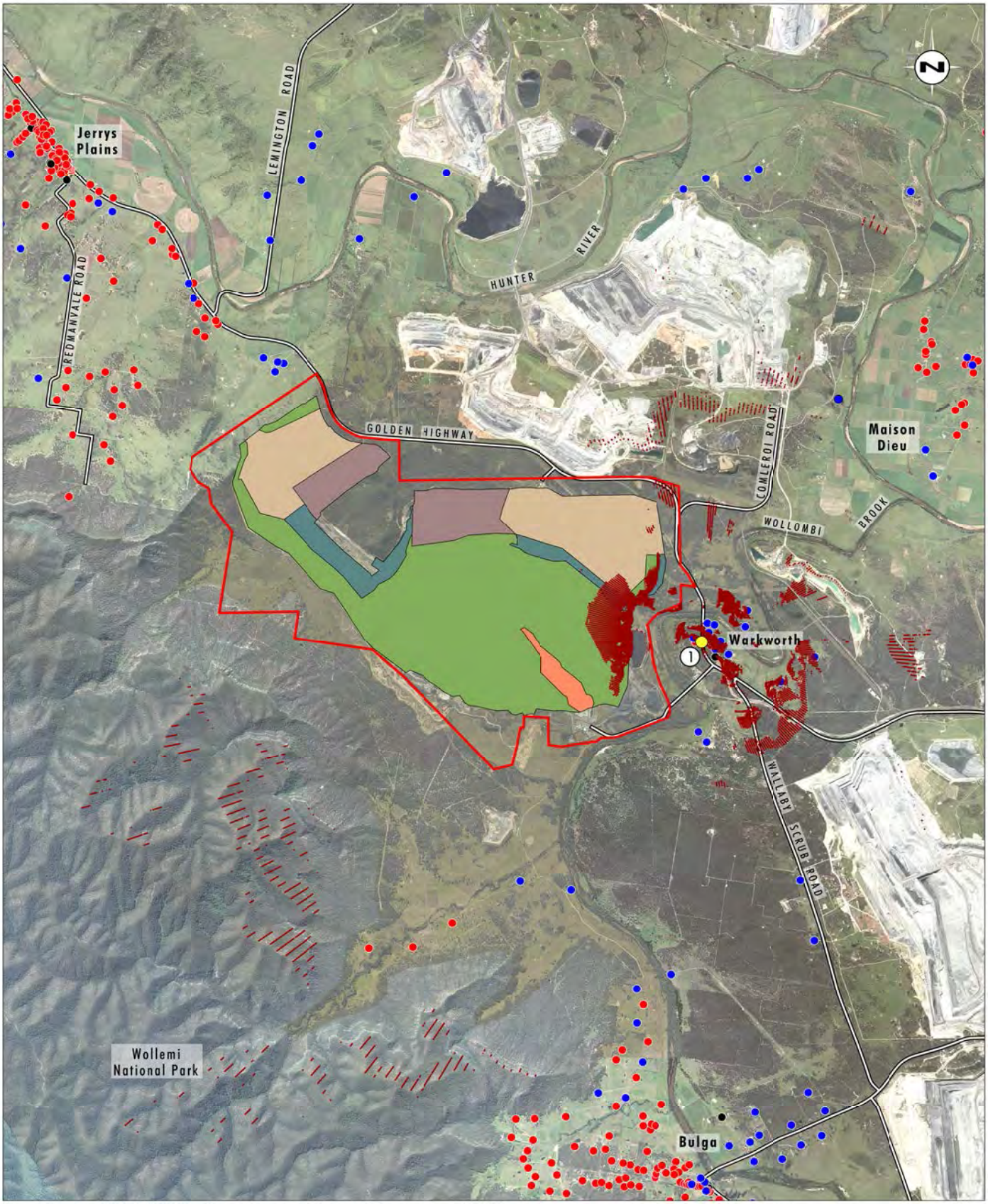
A combination of these activities will be occurring throughout the life of the Project as each of the active mining areas progress and the overburden emplacement areas progressively achieve their final landform and are rehabilitated (refer to **Figures 3.11** to **3.16**). There is also the potential for visual impacts associated with the relocation of the Golden Highway and the 330 kV transmission line.

The visual impact of the Project has been assessed at each of the representative viewpoints surrounding the Project Area and is discussed below.

6.12.4.1 Views from the East

Visual Assessment Location 1 (Warkworth)

Figure 6.38 illustrates the radial analysis from the one remaining private residence in Warkworth, receiver 19. The radial analysis, which is based on topography alone, suggests that the southeastern corner of the United Open Cut overburden emplacement area may be visible from this location, however given the extent of existing vegetation surrounding this property and the proximity of thick screening vegetation to the residence, these potential views of the Project are expected to be largely screened from view.



Data Source: LPMA (2009), Department of Natural Resources (2005)

0 1.0 2.0 4.0km
1:90 000

Legend

- Project Area
- Active Dumping Area
- Active Mining Area
- Rehabilitation
- Temporary Rehabilitation
- Tailings Emplacement
- Private Residence
- Mine Owned Residence
- Other Residence
- View Point Location
- Visible Terrain

FIGURE 6.38

View Extent from Location 1 - Year 16

File Name (A4): R06/3509_345.dgn
20160413 16.55

6.12.4.2 Views from the North East

Visual Assessment Location 2 (Maison Dieu)

Figure 6.39 illustrates the radial analysis from a representative private residence in Maison Dieu. The radial analysis indicates that this area of Maison Dieu will have distant (greater than 5 kilometres) views of mining activities in the Wambo Open Cut and United Open Cut. Overburden emplacement activities will also be visible. Depending on the location of the residence, views toward the Project Area are filtered somewhat by existing scattered vegetation within Maison Dieu. As discussed above, residences in Maison Dieu currently have views of the HVO South mine which is closer than the Project and some also of MTW mine.

The likely views of the Project from Location 2 are further illustrated by the transect included as **Figure 6.40** and the photomontage included as **Figure 6.41**. **Figure 6.41** shows the predicted views for Year 16 when the United Open Cut has reached its full extent, overburden emplacement is active in the United and Wambo Open Cut and following establishment and rehabilitation of the out of pit overburden emplacement area. As can be seen, the rehabilitated out of pit overburden emplacement area is the key Project element visible at this location. Once rehabilitated, the visual impacts of this emplacement area will be significantly reduced and the rehabilitated areas will largely blend into the surrounding landscape. It is also noted that the potential views of the Project are consistent with existing views of other mining operations currently possible from this location, as shown on **Figure 6.41**.

6.12.4.3 Views from the North West

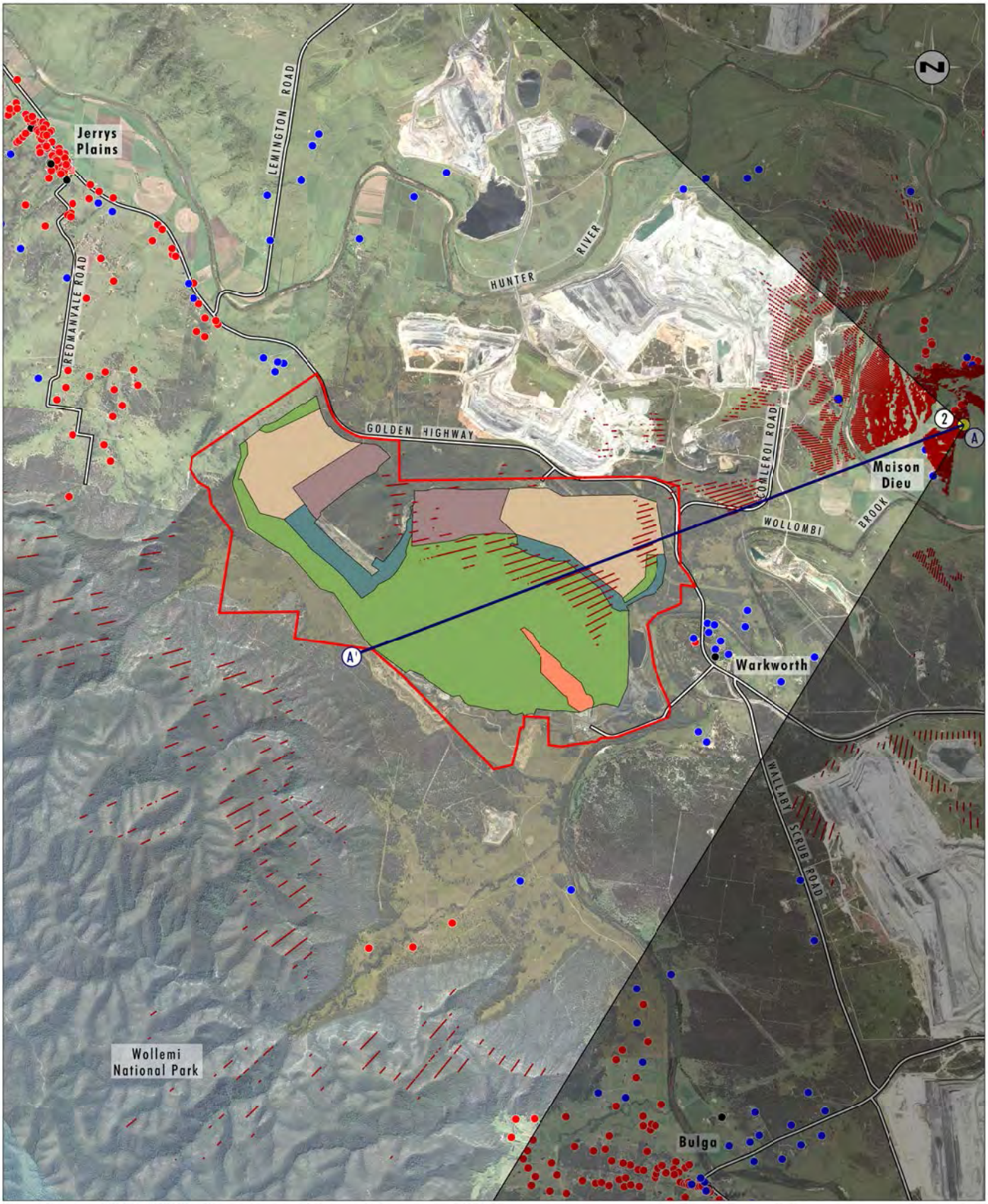
Visual Assessment Location 3 (Moses Crossing)

Figure 6.42 illustrates the radial analysis from the closest private residence to the northwest of the Project Area at Moses Crossing. Views of the Project Area from Location 3 are partially shielded by an intervening low ridgeline to the northwest of the Project Area. However, views of a range of mining activities will be available from this residence, including emplacement, rehabilitation and active mining faces within the approved Wambo Open Cut. It is noted that the residence at Location 3 and the adjacent residences in Moses Crossing are located within the predicted noise affectation zone for the Project and are likely to have voluntary acquisition rights should the Project be approved.

The likely views from Location 3 are further illustrated by the transect included as **Figure 6.43** and the photomontage included as **Figure 6.44**. As shown on **Figure 6.44**, this residence will have views of the active mining face within the Wambo Open Cut as mining progresses through the main ridgeline. As noted previously, mining through this ridgeline is approved, with the Project not significantly altering the visibility of the mining operations in the Wambo Open Cut area. These views are currently filtered by trees located next to the residence, however more direct views are available from other elevated locations within this private property. Once mining has progressed through this ridgeline in the latter stages of the Project, visual impacts will be significantly reduced as emplacement and rehabilitation of the Wambo Open Cut progresses. Overburden will be visible along the northwestern edge of the pit once emplacement commences between Year 11 and Year 16. This area has been prioritised for early rehabilitation thereby reducing the visual impact of this emplacement area over time.

No views of the United Open Cut are predicted from this location due to the intervening ridgeline.

It is noted that the residence at visual assessment Location 3, along with five other nearby residences in Moses Crossing, are predicted to exceed the noise acquisition criteria set by the DPE and therefore may be provided with voluntary acquisition rights as a result of the Project.



Data Source: LPMA (2009), Department of Natural Resources (2005)

0 1.0 2.0 4.0km
1:90 000

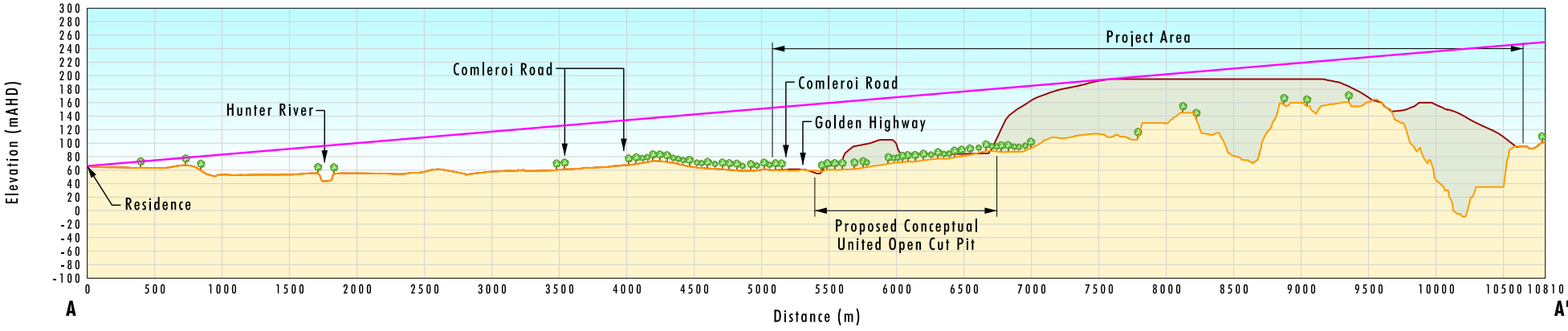
Legend

- Project Area
- Active Dumping Area
- Active Mining Area
- Rehabilitation
- Temporary Rehabilitation
- Tailings Emplacement
- Private Residence
- Mine Owned Residence
- Other Residence
- View Point Location
- Visible Terrain
- Visual Transect Line

FIGURE 6.39

View Extent from Location 2 - Year 16

File Name (A4): R06/3509_348.dgn
20160513 9.55



Transect Location 2

Legend

- Existing Surface
- Proposed Surface
- Line of Sight
- Tree Location

0 0.5 1.0 2.0km
Horizontal Scale 1:45 000

0 100 200 400m
Vertical Scale 1:9 000

Note: Vertical Exaggeration 1:5

FIGURE 6.40

Transect A-A'
Location 2

File Name (A4): R06/3509_358.dgn
20160309 10.50



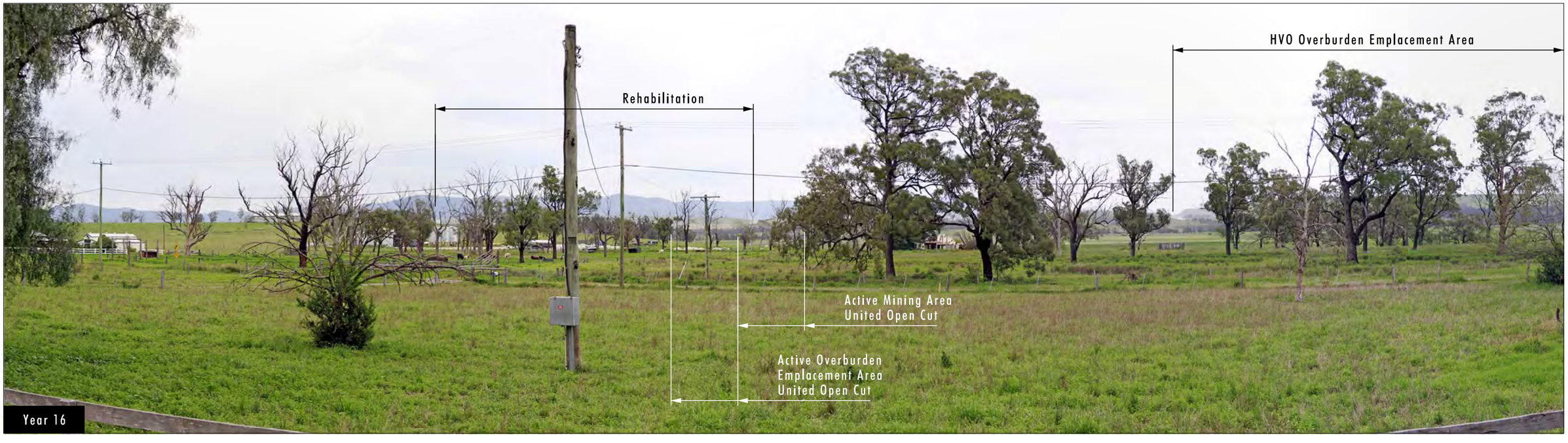
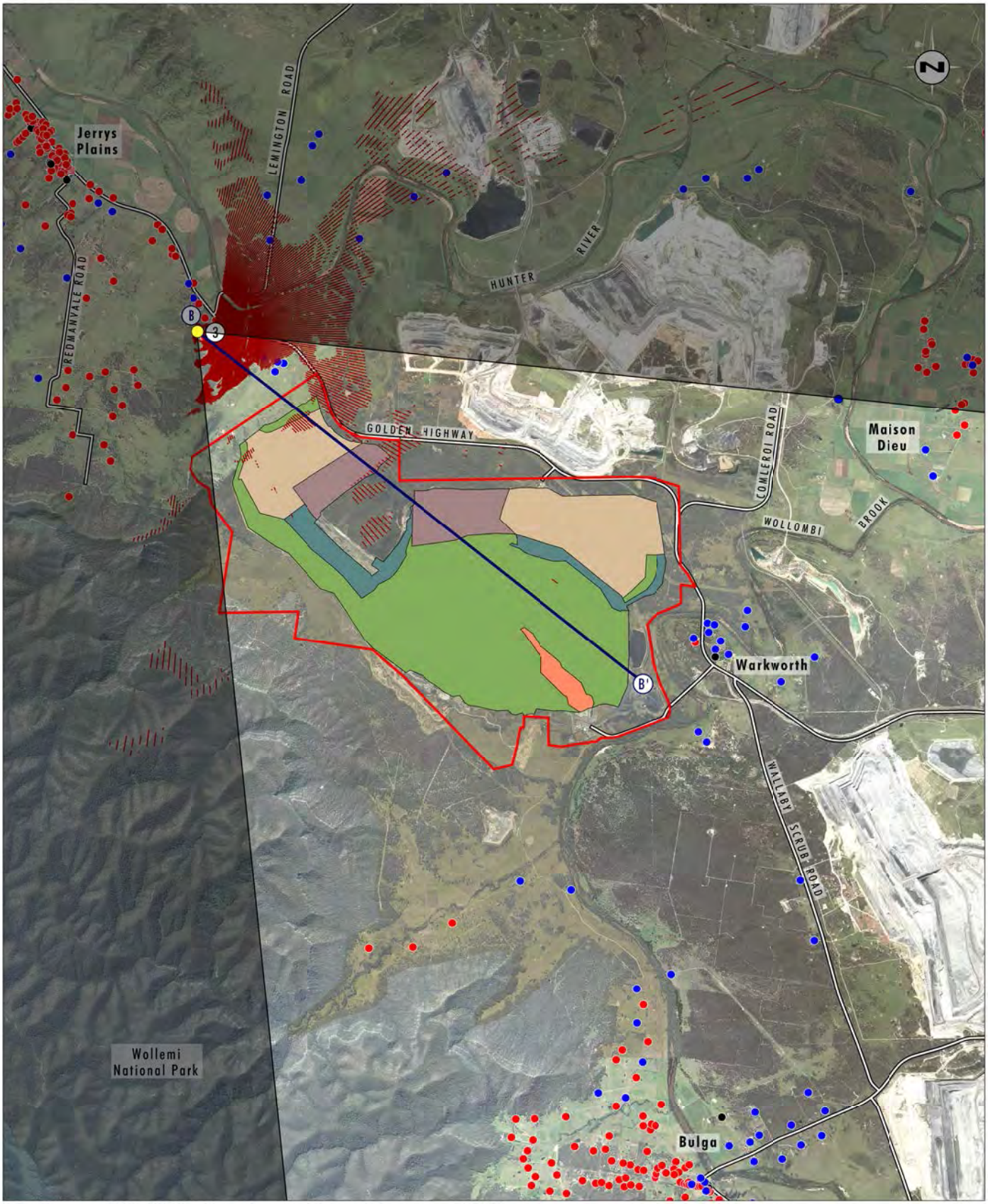


FIGURE 6.41

Visual Montage from View Point 2 - Year 16



Data Source: LPMA (2009), Department of Natural Resources (2005)

0 1.0 2.0 4.0km
1:90 000

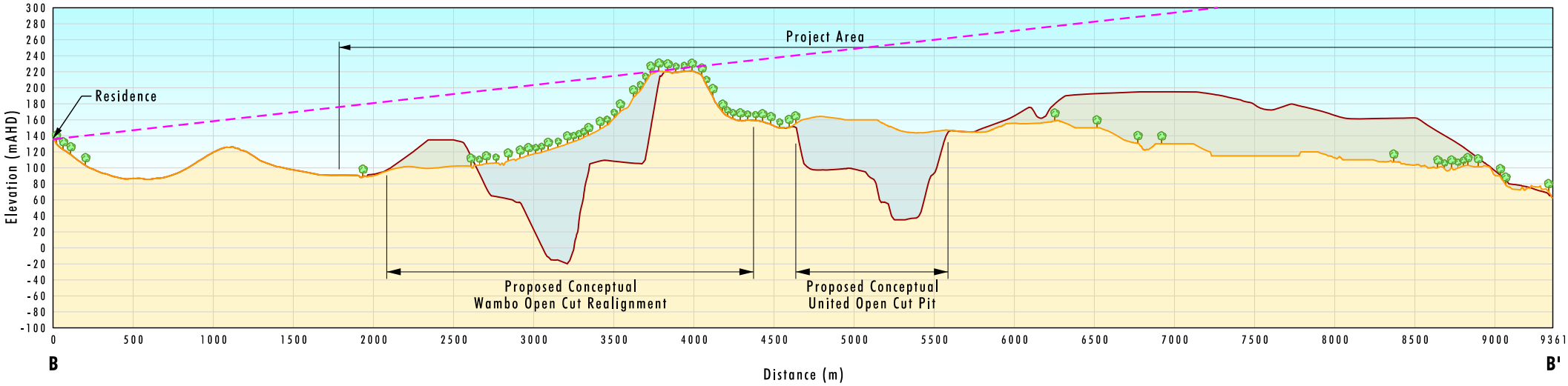
Legend

- Project Area
- Active Dumping Area
- Active Mining Area
- Rehabilitation
- Temporary Rehabilitation
- Tailings Emplacement
- Private Residence
- Mine Owned Residence
- Other Residence
- View Point Location
- Visible Terrain
- Visual Transect Line

FIGURE 6.42

View Extent from Location 3 - Year 16

File Name (A4): R06/3509_337.dgn
20160413 17.35



Transect Location 3

Legend

- Existing Surface
- Proposed Surface
- Filtered Line of Sight
- Tree Location

0 0.5 1.0 2.0km
Horizontal Scale 1:35 000

0 100 200 400m
Vertical Scale 1:7 000

Note: Vertical Exaggeration 1:5

FIGURE 6.43

Transect B-B'
Location 3



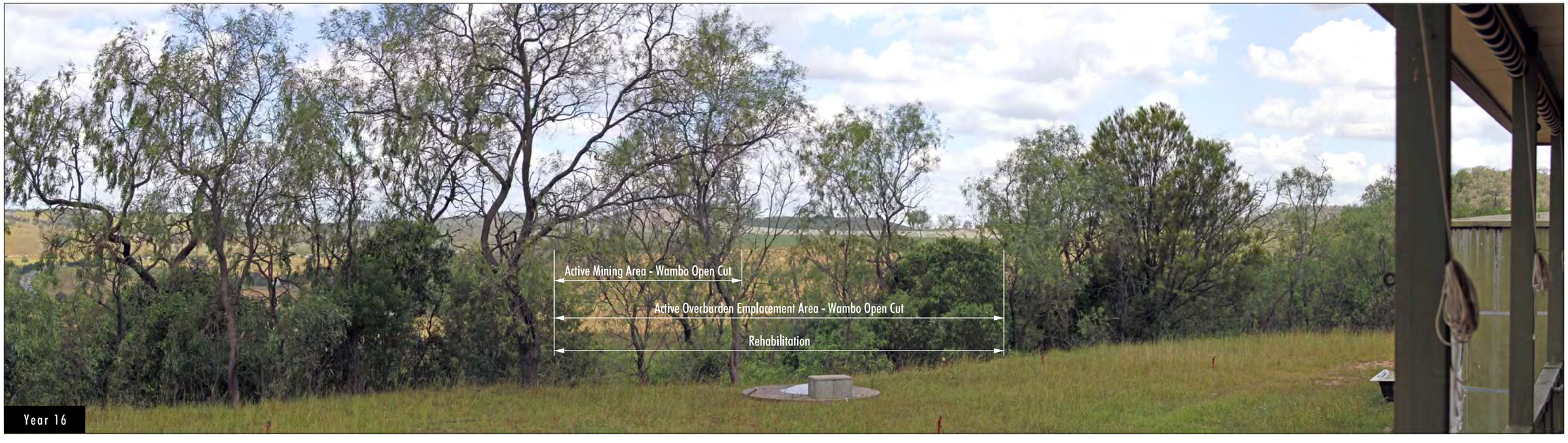


FIGURE 6.44

Visual Montage from View Point 3 - Year 16

Should the property not be subject to voluntary acquisition, United will consult with the landholder regarding the potential for additional tree screening/landscaping to minimise visibility of the Project.

Visual Assessment Location 4 (Moses Crossing)

Figure 6.45 illustrates the radial analysis from a private residence located further northwest towards Jerrys Plains. As for visual Location 3, views of emplacement activities and the active mining face within the Wambo Open Cut will be possible from this residence as mining progresses through the main ridgeline. As noted previously, mining through this ridgeline is approved, with the Project not significantly altering the visibility of the mining operations in the Wambo Open Cut area. The likely views from Location 4 are further illustrated by the transect included as **Figure 6.46** and the photomontage included as **Figure 6.47**. Views of the active mining face will occur over distances of greater than 5 kilometres. Once through this ridgeline in the latter stages of the Project, visual impacts will be significantly reduced as emplacement and rehabilitation of the Wambo Open Cut progresses.

No views of the United Open Cut are predicted from this location due to the intervening ridgeline.

United will consult with the landholder regarding the potential for additional tree screening/landscaping to minimise visibility of the Project.

Figure 6.47 also illustrates the potential visual impacts for users of Golden Highway as discussed in **Section 6.12.4.5**, with the location of this photomontage being adjacent to the highway.

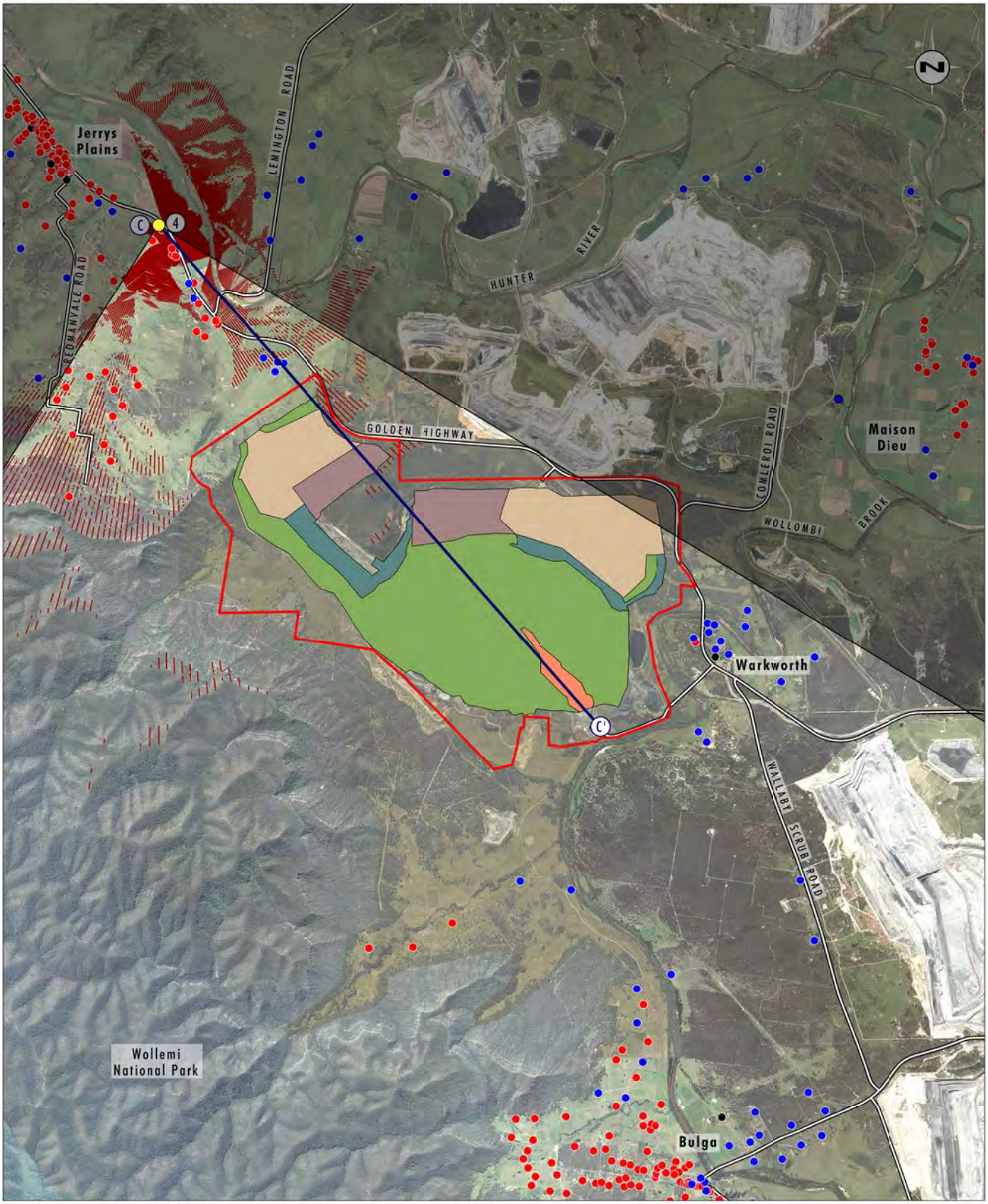
Visual Assessment Location 5 (Jerrys Plains)

Figure 6.48 illustrates the radial analysis from a representative residence in Jerrys Plains. As indicated by **Figure 6.48**, residents within Jerrys Plains are unlikely to have views of the Project Area due to intervening topography. Based on topography alone, the only views possible are of the very highest points of the overburden emplacement areas, however, the site inspection indicated that views are likely to be prevented by intervening vegetation and structures. These unlikely potential views occur over a distance of approximately 6 kilometres and, if the mine is visible at all, it is unlikely to significantly impact visual amenity for residents within Jerrys Plains.

In regard to the areas to the west of Jerrys Plains that are occupied by horse studs, including the Coolmore Horse Stud which is approximately 14 kilometres from the Project Area, the Project is not predicted to be visible due to the distance and intervening topography.

Visual Assessment Location 6 (Redmanvale Road Residences)

An initial desktop screening exercise identified that residences along Redmanvale Road will not have views of the Project Area due to topographical shielding. This was confirmed during site inspections and by a series of radial analyses completed for residence locations in this area. **Figure 6.49** illustrates the radial analysis from a representative residence along Redmanvale Road. As can be seen, the local topography prevents views of the Project from this location.



Data Source: LPMA (2009), Department of Natural Resources (2005)

0 1.0 2.0 4.0km
1:90 000

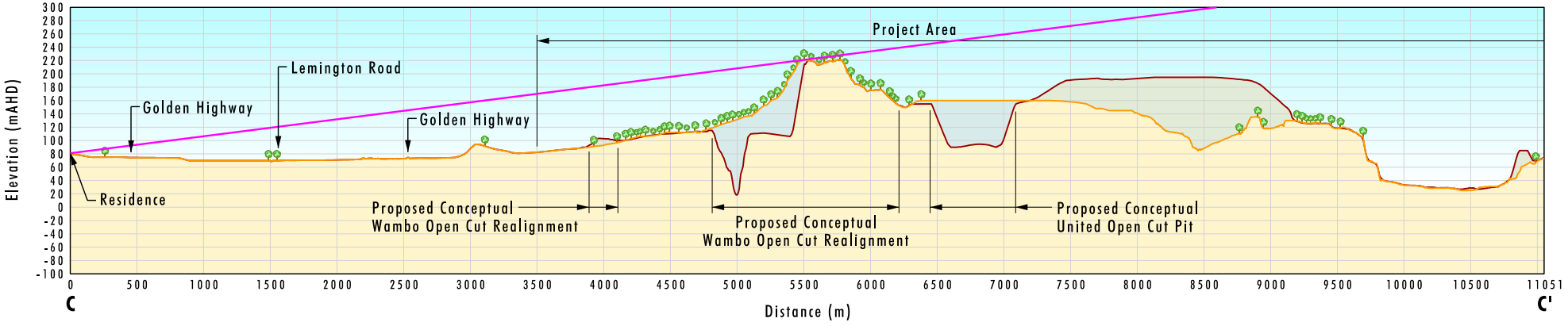
Legend

- Project Area
- Active Dumping Area
- Active Mining Area
- Rehabilitation
- Temporary Rehabilitation
- Tailings Emplacement
- Private Residence
- Mine Owned Residence
- Other Residence
- View Point Location
- Visible Terrain
- Visual Transect Line

FIGURE 6.45

View Extent from Location 4 - Year 16

File Name (A4): R06/3509_340.dgn
20160413 17.38



Transect Location 4

Legend

- Existing Surface
- Proposed Surface
- Line of Sight
- Tree Location

0 0.5 1.0 2.0km
Horizontal Scale 1:45 000

0 100 200 400m
Vertical Scale 1:9 000

Note: Vertical Exaggeration 1:5

FIGURE 6.46

Transect C-C'
Location 4

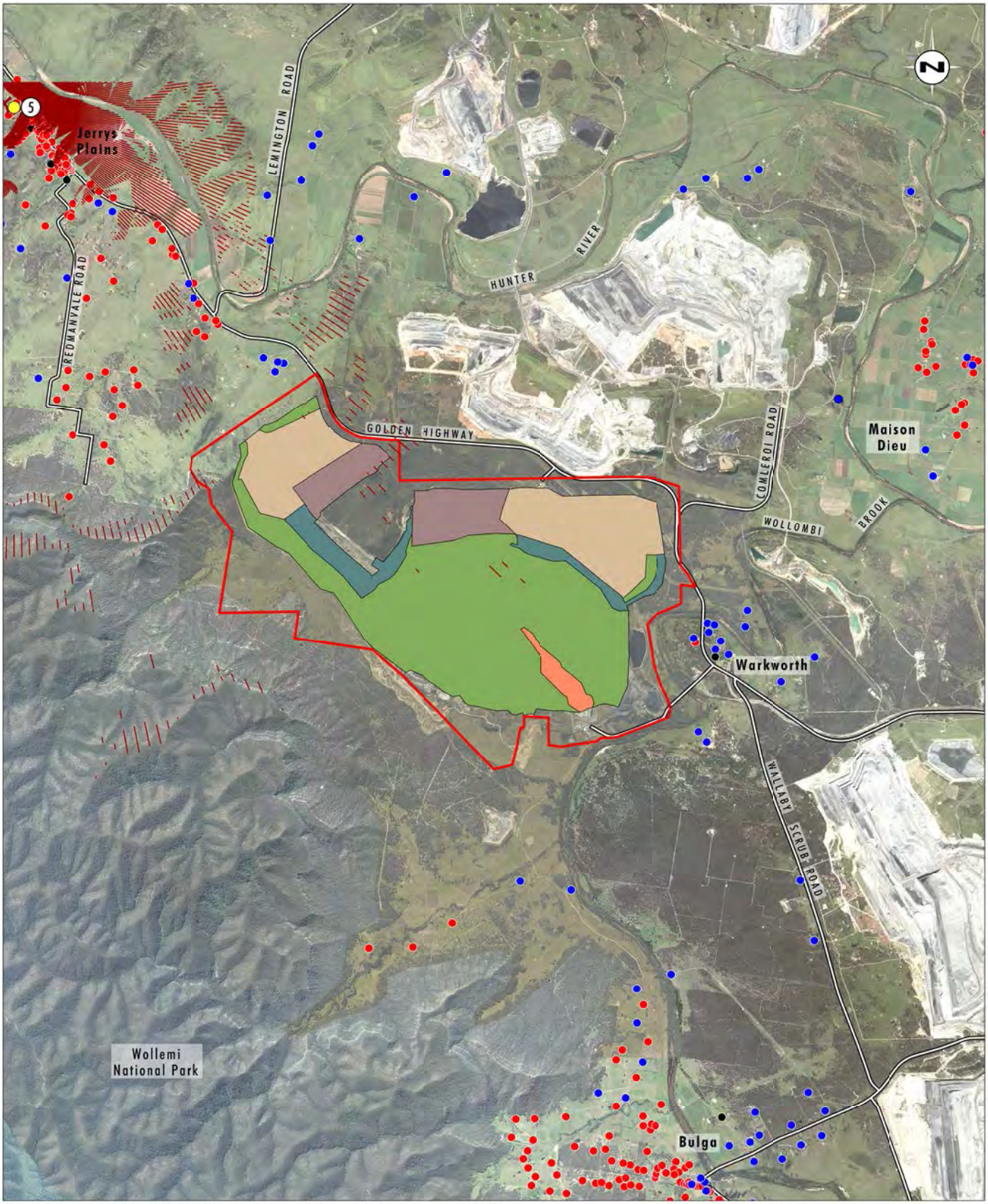
File Name (A4): R06/3509_356.dgn
20160309 10.51





FIGURE 6.47

Visual Montage from View Point 4 - Year 16



Data Source: LPMA (2009), Department of Natural Resources (2005)

0 1.0 2.0 4.0km
1:90 000

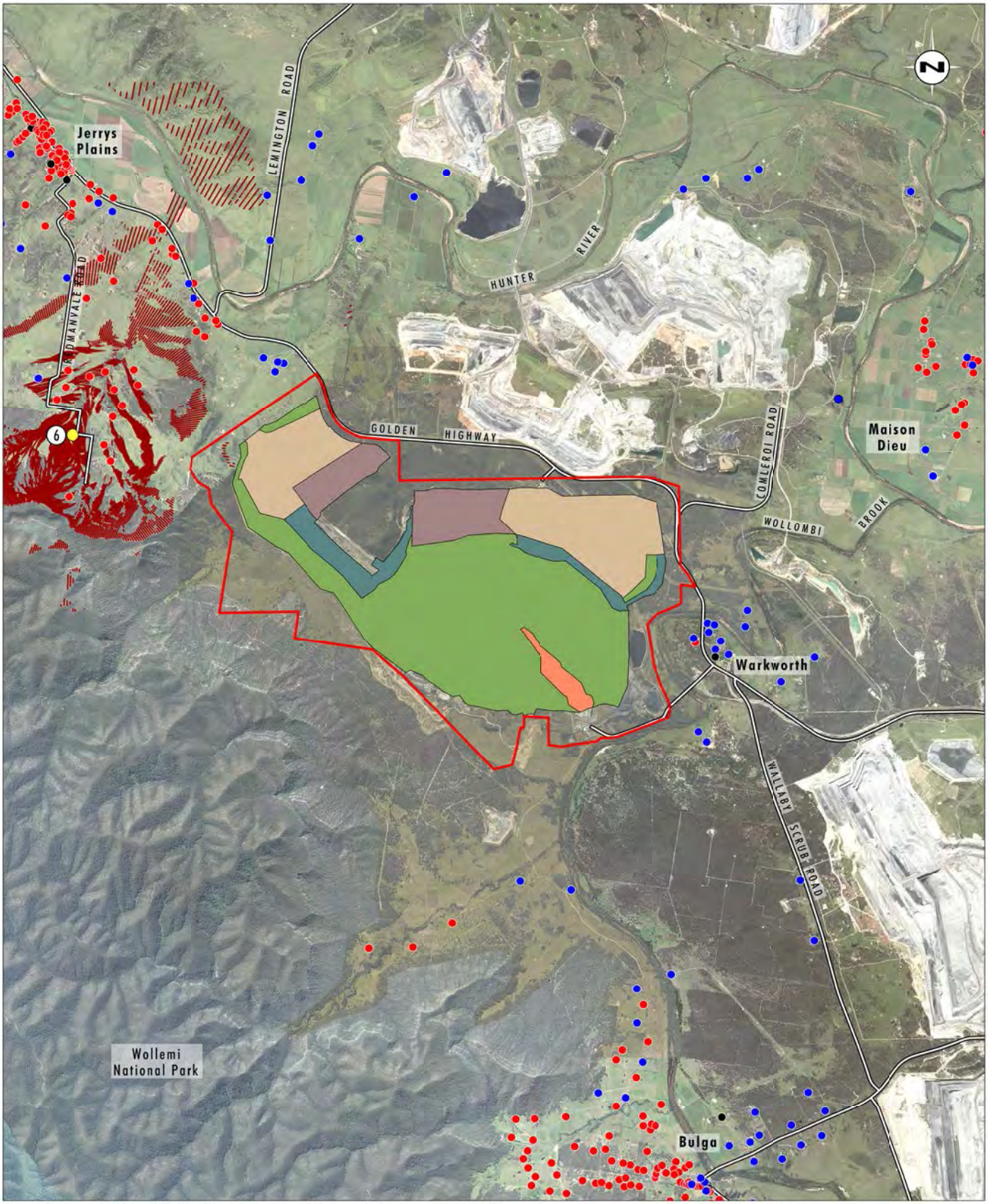
Legend

- Project Area
- Active Dumping Area
- Active Mining Area
- Rehabilitation
- Temporary Rehabilitation
- Tailings Emplacement
- Private Residence
- Mine Owned Residence
- Other Residence
- View Point Location
- Visible Terrain

FIGURE 6.48

View Extent from Location 5 - Year 16

File Name (A4): R06/3509_341.dgn
20160413 17.39



Data Source: LPMA (2009), Department of Natural Resources (2005)

0 1.0 2.0 4.0km
1:90 000

Legend

- Project Area
- Active Dumping Area
- Active Mining Area
- Rehabilitation
- Temporary Rehabilitation
- Tailings Emplacement
- Private Residence
- Mine Owned Residence
- Other Residence
- View Point Location
- Visible Terrain

FIGURE 6.49

View Extent from Location 6 - Year 16

File Name (A4): R06/3509_427.dgn
20160413 17.40

6.12.4.4 Views from the South

Visual Assessment Locations 7 and 8 (South Wambo)

Figures 6.50 and **6.51** illustrate the radial analyses from two private residences in an isolated rural area to the south of Wambo. The existing Wambo Open Cut operations are currently highly visible from this location. As indicated by **Figures 6.50** and **6.51**, as part of the Project, a broad expanse of the out of pit overburden emplacement area will be visible from the early years of the Project. **Figure 6.51** shows the extent of active overburden emplacement visible in Year 2, while **Figure 6.50** shows the extent of the emplacement area visible once rehabilitated in Year 16. The out-of-pit emplacement area will be largely formed and progressively rehabilitated by Year 11, with rehabilitation complete by Year 16 except for the final reshaping work required at the end of the Project life associated with capping the Homestead tailings storage facility. Once rehabilitated, the visual impact of the emplacement area will be significantly reduced.

The likely views from Location 8 are further illustrated by the transect included as **Figure 6.52** and the photomontage included as **Figure 6.53**. These views are representative of the impacts in Year 2 of the Project when active emplacement is occurring in this area and progressive rehabilitation is in its earliest stages. The emplacement area will increase in height in later years, however this increase in height will be aligned with progressive rehabilitation of the lower slopes.

United will consult with the two landholders at these locations regarding the potential for additional tree screening/landscaping to minimise visibility of the Project.

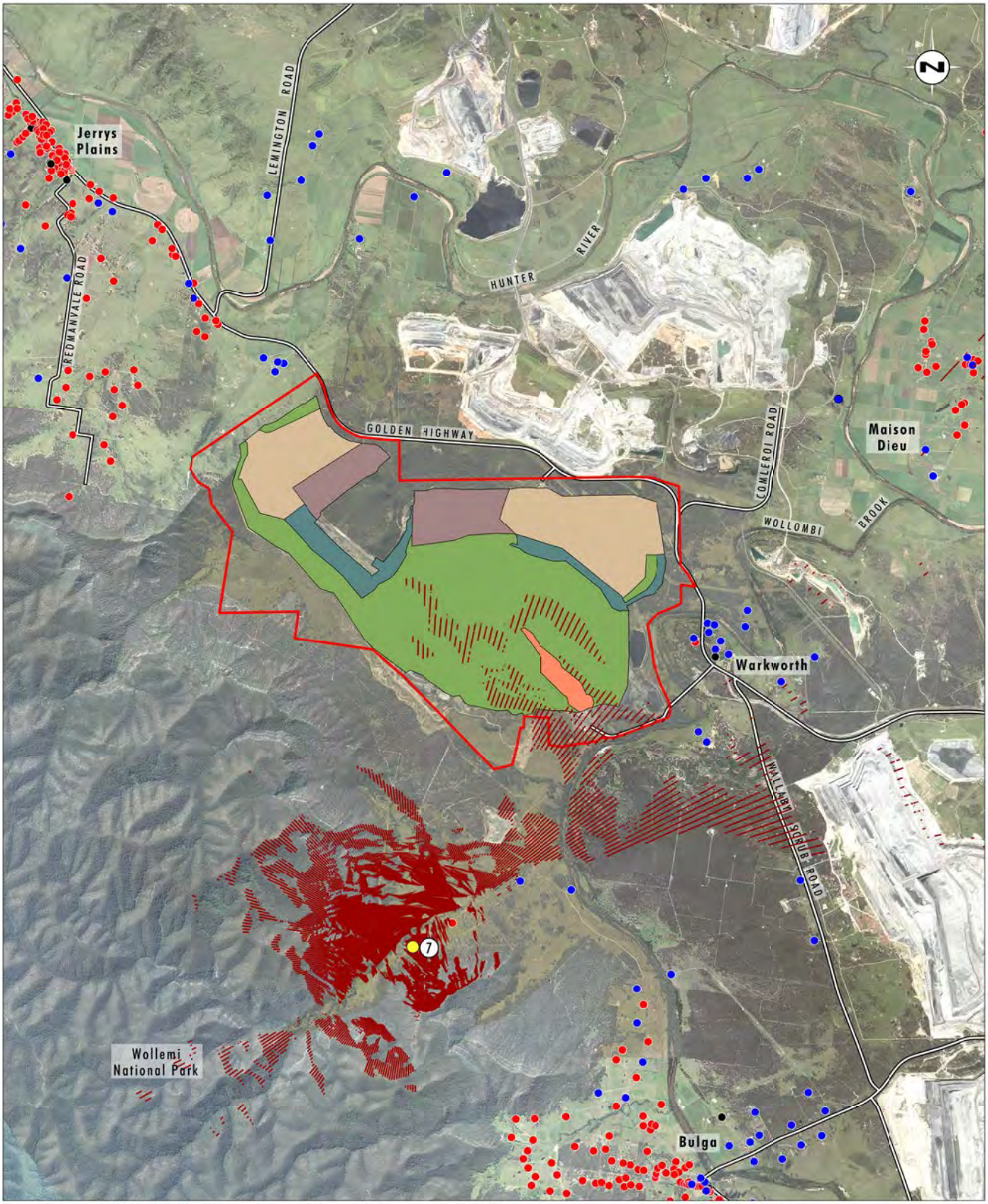
Visual Assessment Locations 9 and 10 (Bulga)

Figures 6.54 and **6.55** illustrate the radial analyses from two private residences in the Bulga area. Based on an assessment of topography alone, **Figures 6.54** and **6.55** indicate that potential views from Bulga will be largely consistent with those from Locations 7 and 8, in South Wambo, however, they are from a greater distance (approximately 5-7 kilometres). Views of the upper slopes of the out-of-pit overburden emplacement area will be possible, as are more limited views of the in pit emplacements within the United Open Cut and Wambo Open Cut.

The likely views from Location 10 are further illustrated by the transect included as **Figure 6.56**. Progressive rehabilitation of the out of pit overburden emplacement area will commence from the earliest stages of the Project and will continue through to Year 16, with substantial completion of the most visible slopes by Year 11. Once rehabilitated, the visual impact of the emplacement area will be significantly reduced.

Summary of Visual Impacts from Residences

Views of existing Wambo overburden emplacement areas and infrastructure are currently available from surrounding residential areas to the northeast and south. Views of active mining areas are largely currently shielded from public view by topography and vegetation surrounding the mine. The visual assessment has indicated that emplacement areas will generally continue to be the most visible element of the Project for viewing locations to the south, east and northeast. However, the active mining face within the approved Wambo Open Cut will be the most visible element for viewing locations to the northwest as mining progresses through the main ridgeline. The Project will not substantially alter these views. The progressive rehabilitation of overburden emplacement areas from the early stages of the Project and shaping of the final landform to conform to the surrounding natural environment is expected to reduce the visual impact of emplacement areas.



Data Source: LPMA (2009), Department of Natural Resources (2005)

0 1.0 2.0 4.0km
1:90 000

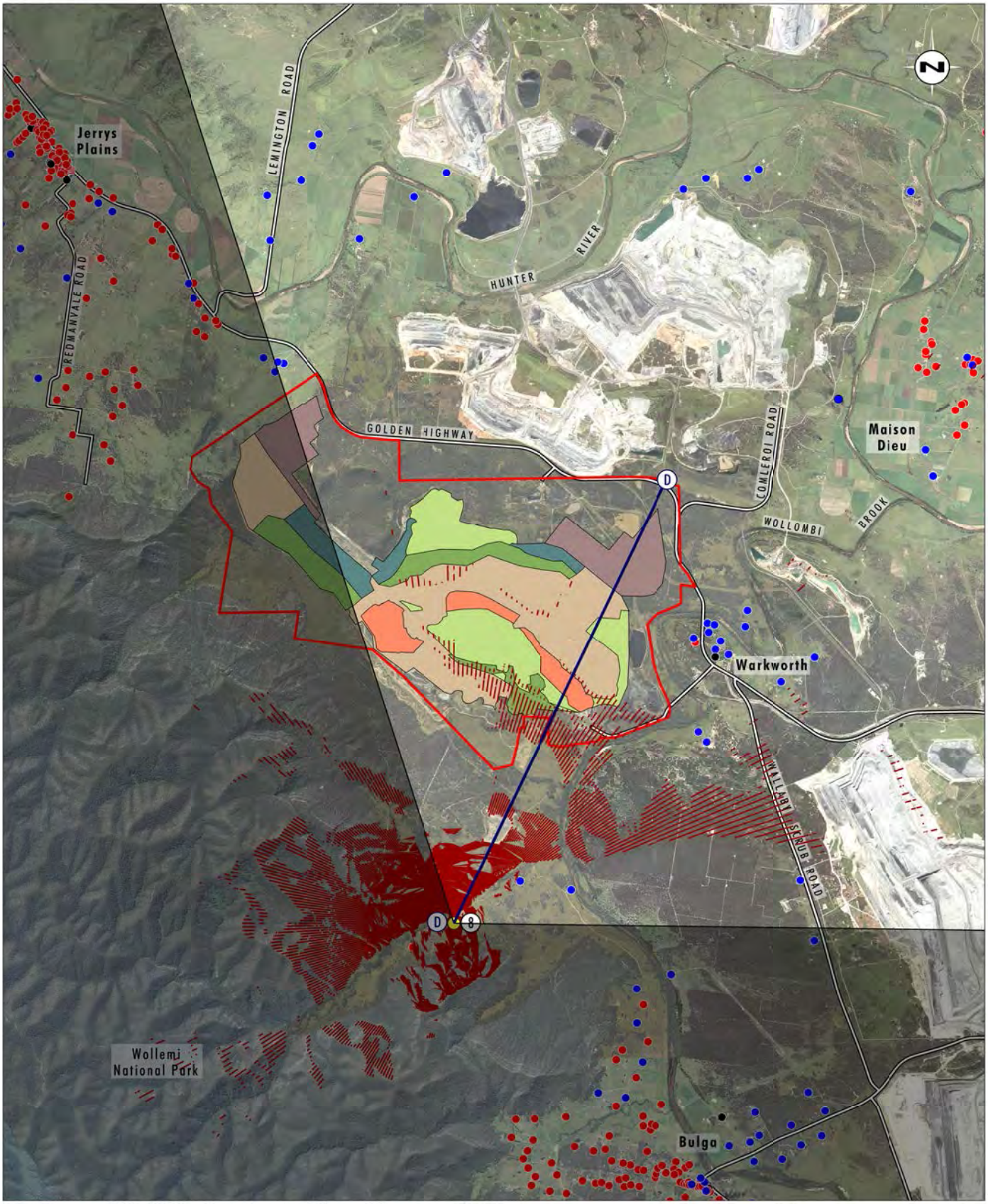
Legend

- Project Area
- Active Dumping Area
- Active Mining Area
- Rehabilitation
- Temporary Rehabilitation
- Tailings Emplacement
- Private Residence
- Mine Owned Residence
- Other Residence
- View Point Location
- Visible Terrain

FIGURE 6.50

View Extent from Location 7 - Year 16

File Name (A4): R06/3509_338.dgn
20160413 17.41



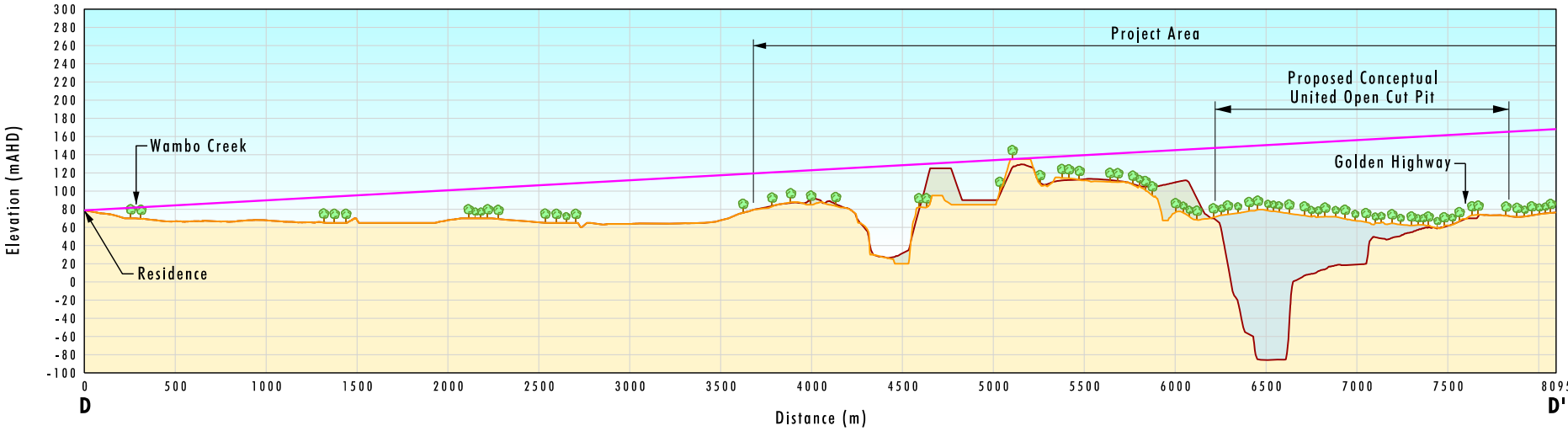
Legend

- Project Area
- Active Dumping Area
- Active Mining Area
- Rehabilitation
- Temporary Rehabilitation
- Tailings Emplacement
- Private Residence
- Mine Owned Residence
- Other Residence
- View Point Location
- Visible Terrain
- Visual Transect Line

FIGURE 6.51

View Extent from Location 8 - Year 2

File Name (A4): R06/3509_347.dgn
20160413 17.42



Transect Location 8

Legend

- Existing Surface
- Proposed Surface
- Line of Sight
- Tree Location

0 0.5 1.0 2.0km
Horizontal Scale 1:35 000

0 100 200 400m
Vertical Scale 1:7 000

Note: Vertical Exaggeration 1:5

FIGURE 6.52

Transect D-D'
Location 8

File Name (A4): R06/3509_357.dgn
20160309 11.09



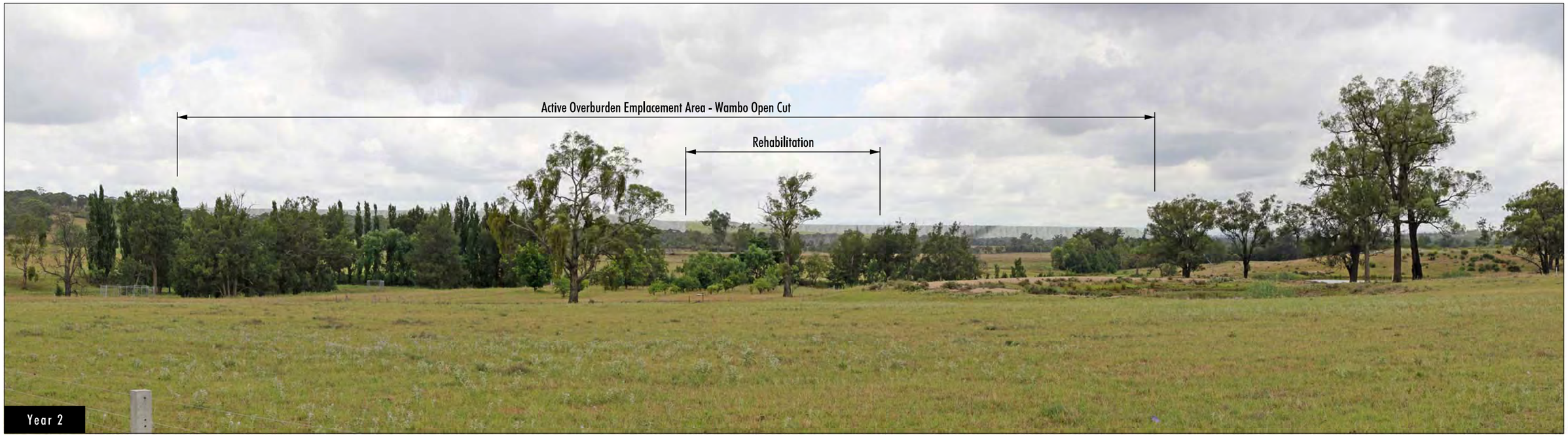
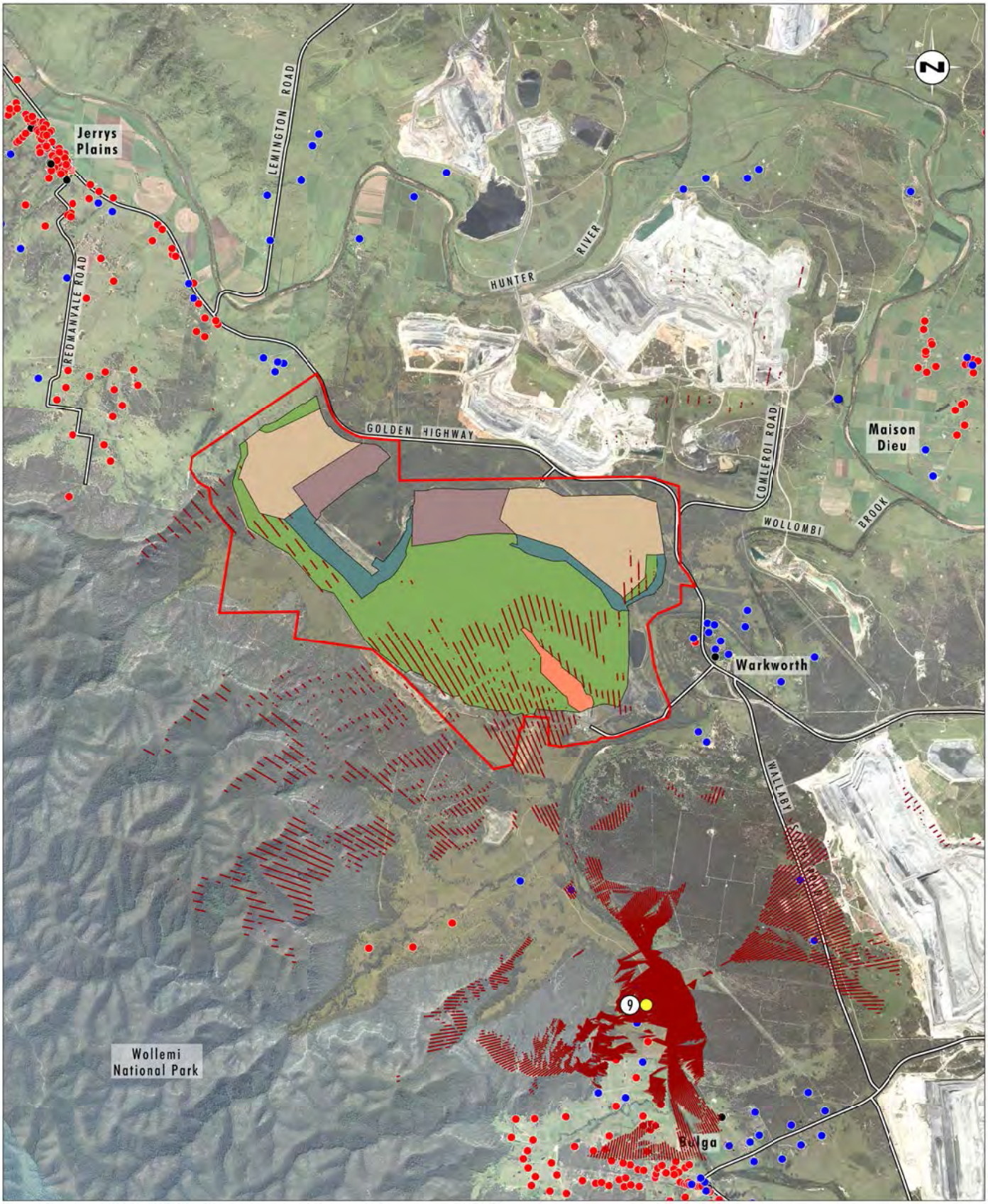


FIGURE 6.53

Visual Montage from View Point 8 - Year 2



Data Source: LPMA (2009), Department of Natural Resources (2005)

0 1.0 2.0 4.0km
1:90 000

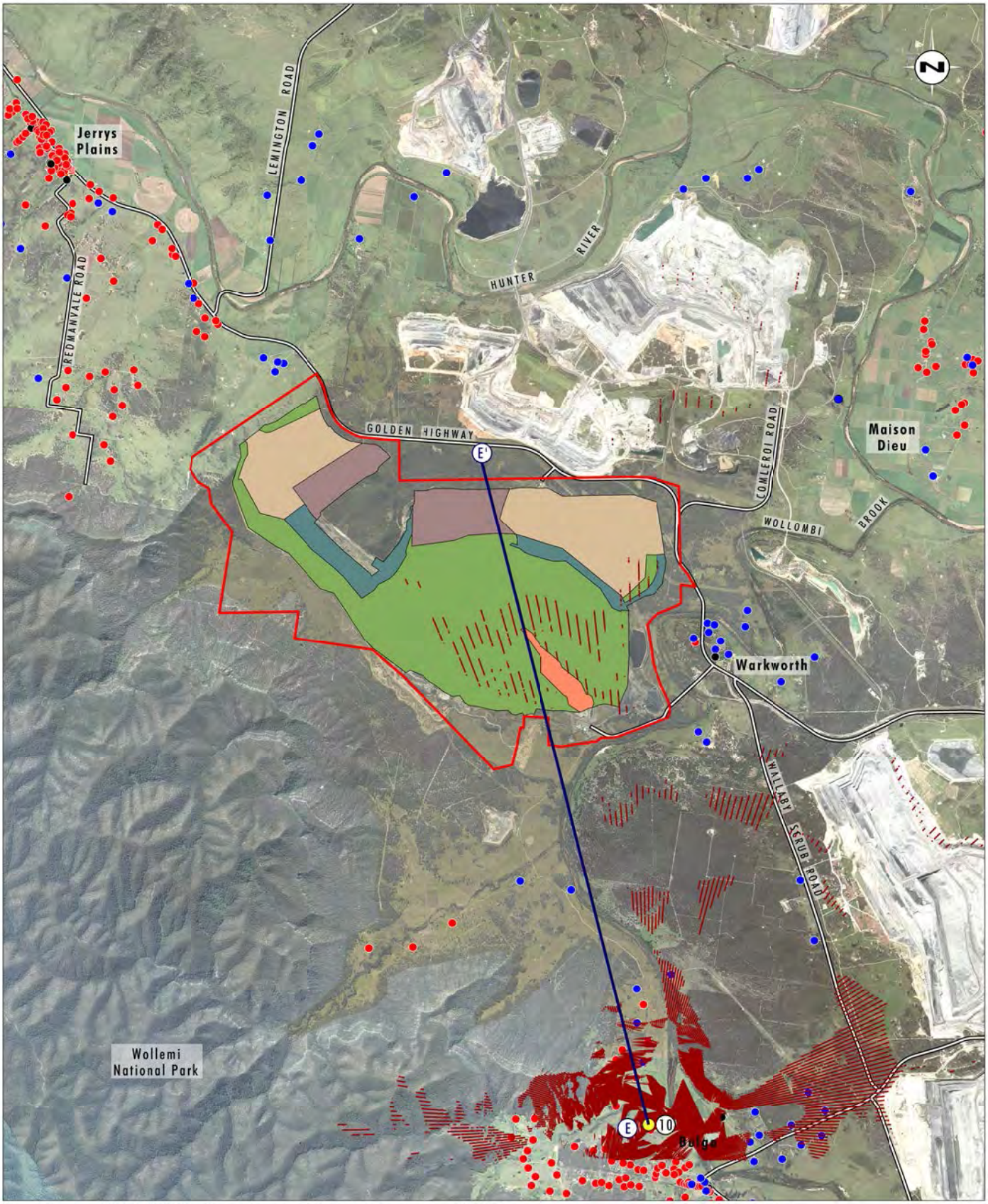
Legend

- Project Area
- Active Dumping Area
- Active Mining Area
- Rehabilitation
- Temporary Rehabilitation
- Tailings Emplacement
- Private Residence
- Mine Owned Residence
- Other Residence
- View Point Location
- Visible Terrain

FIGURE 6.54

View Extent from Location 9 - Year 16

File Name (A4): R06/3509_346.dgn
20160729 15.31



Data Source: LPMA (2009), Department of Natural Resources (2005)

0 1.0 2.0 4.0km
1:90 000

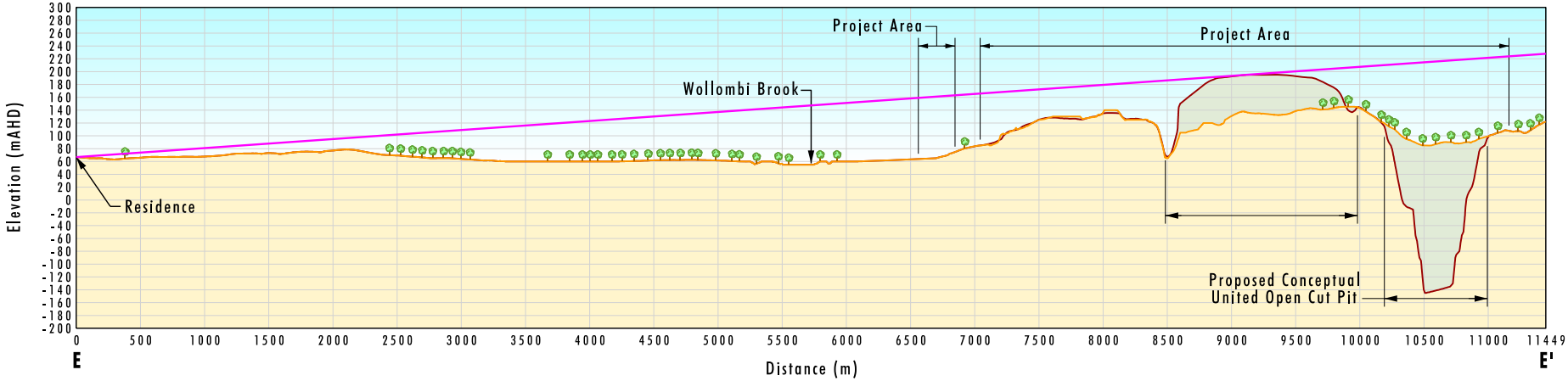
Legend

- Project Area
- Active Dumping Area
- Active Mining Area
- Rehabilitation
- Temporary Rehabilitation
- Tailings Emplacement
- Private Residence
- Mine Owned Residence
- Other Residence
- View Point Location
- Visible Terrain
- Visual Transect Line

FIGURE 6.55

View Extent from Location 10 - Year 16

File Name (A4): R06/3509_339.dgn
20160413 17.43



Transect Location 10

Legend

- Existing Surface
- Proposed Surface
- Line of Sight
- Tree Location

0 1.0 2.0 2.5km
Horizontal Scale: 1:50 000

0 200 400 500m
Vertical Scale: 1:10 000

Note: Vertical Exaggeration 1:5

FIGURE 6.56

Transect E-E'
Location 10

File Name (A4): R06/3509_426.dgn
20160309 11.21

6.12.4.5 Views from the Golden Highway

An assessment of the potential visual impact of the Project for road users on the Golden Highway has been completed.

The Golden Highway at Warkworth crosses the alluvial flats of Wollombi Brook before turning west and rising up from the valley floor. The highway follows a low ridgeline westward between HVO South and the Project Area before turning north towards Jerrys Plains. Views of the Project Area and surrounds are limited for much of this length of road due to the presence of roadside vegetation and a small ridge running along the southern side of the road. The Project Area is visible from some elevated sections of the highway where roadside vegetation is absent.

Extensive views of mining activities within HVO South are currently available along this section of the Golden Highway in locations where roadside vegetation is absent and where emplacement areas extend above roadside vegetation.

It is anticipated that emplacement and mining activities associated with the Project will be visible to road users along some sections of the highway. The areas of greatest potential visual impacts for users of the Golden Highway are expected to be:

- Views of mining activities within the United Open Cut when approaching and using the proposed Golden Highway realignment. The United Open Cut overburden emplacement area will be located within 120 metres of the realigned section of the Golden Highway and is likely to be highly visible to road users. Additional roadside tree plantings will be incorporated into the detailed design for the realigned section of road to assist in screening views of the United Open Cut from the road.

- Views of mining activities within the Wambo Open Cut from the elevated section of the Golden Highway adjacent to the Project Area where it turns north towards Jerrys Plains. The Highway in this location is elevated above the Project Area and in sections there is little roadside vegetation to screen views of the Project Area. The Wambo Open Cut advances to within approximately 120 metres of the highway in this location and elevated views across the pit will be possible. Subject to agreement with RMS and relevant landholders, additional roadside tree planting will be undertaken to filter potential views in this location. It is noted that extensive views of mining activities within Hunter Valley Operations are also possible along this stretch of the Golden Highway, in the vicinity of the Project Area.

- Views of the active mining face within the Wambo Open Cut when travelling south from Jerrys Plains towards the Project Area. These views will be possible as mining in the Wambo Open Cut progresses through the main ridgeline, a key topographical feature within the Project Area, from around Year 11. As noted above, mining through the ridgeline is currently approved and the Project will not substantially change the approved mining in this area. Given the height of the ridgeline in relation to surrounding topography and the elevated open environment from which it is viewed, visual mitigation measures such as bunds or tree screening are not practical. Once the ridgeline has been mined through and the subsequent overburden emplacement area is rehabilitated, visual impacts to road users will be significantly reduced.

- The relocated 330 kV transmission line will also run alongside and cross the realigned section of the Golden Highway and will be clearly visible. The existing 330kV transmission line currently crosses the Golden Highway and sections of the line are visible. With the proposed realignments there will be increased visibility of the transmission line, however, these views are not considered to be inconsistent with existing views from the local sections of the Golden Highway with transmission lines highly visible from a number of sections of the highway.

Summary of Visual Impacts from Golden Highway

Road users on the Golden Highway will have intermittent views of mining activities within both the United Open Cut and Wambo Open Cut. Views from the north will be dominated by the approved Wambo Open Cut, particularly as it mines through the main ridgeline. The Project will not substantially alter these views. Overburden emplacement will also be visible in some locations along the road. With additional roadside tree planting and progressive rehabilitation of emplacement areas, the visual impact of these activities will reduce over time. The Project will also result in increased views of the 330 kV transmission line.

6.12.5 Night Time Scenic Quality

As discussed in **Section 6.12.1**, the existing approved 24 hour mining operations at Wambo currently contribute to a night time glow, which along with other mining operations affects the local night time visual amenity. Lighting is required on site to meet operational and safety requirements but will be kept to a minimum where practicable and will be installed and maintained in accordance with the relevant Australian Standard (*Australian Standard AS4282 (INT) 1995 – Control of Obtrusive Effects of Outdoor Lighting*).

As part of the Project, mobile lighting will be required in active mining and emplacement areas during night time operations. This will be provided by mobile lighting plants and equipment headlights. Where possible, mobile lighting plant will be screened from residences and public viewing locations by overburden emplacement areas, vegetation or natural topography. Ongoing management will, however, be required on all emplacement areas that are visible from public roads or private residences so that mobile lighting does not impact on road users or local amenity. This is typically managed by pointing lights away from public roads and residences and through directing lights down at operational areas. This will be particularly important for the Golden Highway which will have views of each of the emplacement areas at various stages of the Project.

6.12.6 Visual Impact Mitigation and Management

To assist in minimising the visual impacts of the Project, United will also implement the following controls:

- progressive rehabilitation will be undertaken to reduce the duration of visible soil exposure, including the use of temporary rehabilitation as appropriate
- subject to the agreement of RMS and relevant landholders, additional roadside tree planting along the Golden Highway to screen views of the Project
- incorporation of roadside tree planting into the detailed design for the realigned section of the Golden Highway to assist in screening views of the Project from the road
- United will consult with potentially affected landholders in the Moses Crossing and South Wambo areas regarding the potential for additional tree screening/landscaping to minimise visibility of the Project
- ongoing management of mobile lighting to reduce the impacts of lighting at night, positioning lights so they are not pointing off site, and are shielded by walls, overburden emplacement areas and vegetation where practicable. Procedures will be implemented regarding the appropriate placement of mobile lighting plant to reduce the potential for lighting impacts on local residents and public roads
- all new fixed lighting associated with the Project will be installed and maintained in accordance with *Australian Standard AS4282 (INT) 1995 – Control of Obtrusive Effects of Outdoor Lighting*.

6.13 Rehabilitation and Final Landform

Mine closure planning has been a key consideration in the design of the Project, with the objective of maximising opportunities to achieve a sustainable rehabilitated landform post closure. As discussed in **Section 1.0**, a key benefit of the Project is that it will provide for an improved final landform across the Wambo and United complex, with the proposed mining operation placing overburden to result in an integrated and more natural final landform. The final landform achieved for the Project will be a substantial improvement on the final landform that would have resulted from two adjoining, but not integrated mines, such as would likely have occurred without the Joint Venture. The approach to developing the final landform for the Project was subject to community consultation including a workshop, and the local community's views have been incorporated into the design.

The proposed base case mine closure strategy for the Project, as discussed in this section, has been developed in consideration of the opportunities and constraints associated with the existing local and regional environment, input from the community and government stakeholders, and operational considerations. The proposed rehabilitation strategy also aligns with key commitments previously agreed through the approval of Wambo and United.

As discussed in **Section 5.0**, United implemented a comprehensive stakeholder engagement program including a large number of community and government stakeholders as part of the planning process for the Project. Both community and government stakeholders consulted identified the need to create landforms that are commensurate with the surrounding natural landform.

As part of the engagement process, a draft final landform design and rehabilitation strategy was presented to government and community stakeholders for further feedback. This included a workshop with members of the local community which specifically addressed final landform and rehabilitation. As a result of this process the following key issues regarding final landform and land use were identified by stakeholders as matters that should be considered as part of the detailed mine closure planning:

- Post-mining land uses should be consistent with relevant strategic plans and the values of the areas at the cessation of mining. Potential options that were tabled for future consideration included
    - Utilisation of the water body in the final voids for aquaculture
    - Sustainable agricultural activities. There was a community desire for the inclusion of grazing land within the final landform plan, not just the inclusion of woodland.
- Public safety in relation to final voids and highwalls.
- Responsibility for ongoing management of rehabilitated land (i.e. management in perpetuity) following the relinquishment of mining leases.
- Socio-economic impacts of mine closure and the implications on land value in the area (including sale of mine owned land following mine closure).

The approach to the completion of the final landform/revegetation strategy involves the revegetation of the site into three broad categories:

- ecological rehabilitation (woodland conforming to the Central Hunter Valley Eucalypt Forest and Woodland CEEC as part of the biodiversity offset strategy for the Project and to provide ecosystem functions in the rehabilitated landscape)

- grassland with pockets of woodland vegetation
- agricultural pasture land.

As outlined in **Section 3.0**, once mining operations are complete, United proposes to return a large portion of the Project Area to woodland habitat generally consistent with the ecological communities that would have historically occurred in the area. As part of the proposed offset strategy for the Project, (refer to **Section 6.9**), a minimum of approximately 878 hectares of ecological rehabilitation conforming to Central Hunter Valley Eucalyptus Woodland and Forest CEEC, is proposed to be established as part of the rehabilitation strategy. Further information regarding the proposed biodiversity offset strategy for the Project is provided in **Appendix 13**.

The indicative final landform and rehabilitation plan for the Project is provided in **Figure 6.57**. Opportunities for part of the Project Area to be used for other land uses will also be considered as part of the detailed mine closure planning process that will commence five years prior to closure of the mine.

The rehabilitated area will provide native vegetation corridors linking surrounding remnant vegetation areas, including future vegetation areas planned on rehabilitated mining land to the north and east (refer to **Figure 6.57**). Key linkages will include:

- from the Wollemi National Park through the Project Area to the proposed native rehabilitation areas of HVO South mine to the north
- to the northeast of the Project Area, through to the proposed native rehabilitation area of the Warkworth mine
- to the southeast of the Project Area.

Woodland areas have also been identified for riparian zones within the lower reaches of creeks in the Project Area most likely to have permanent or semi-permanent water. Hill crest regions of the final rehabilitated landform have been identified as the conceptual location for grassland areas, with pockets of woodland vegetation. Agricultural land is proposed for the northwestern portion of the site in the area where better quality soils, including a small area of BSAL has been recorded. Agricultural land is also proposed for the southwestern portion of the site near North Wambo Creek and adjacent to existing agricultural land to the west of the site boundary.

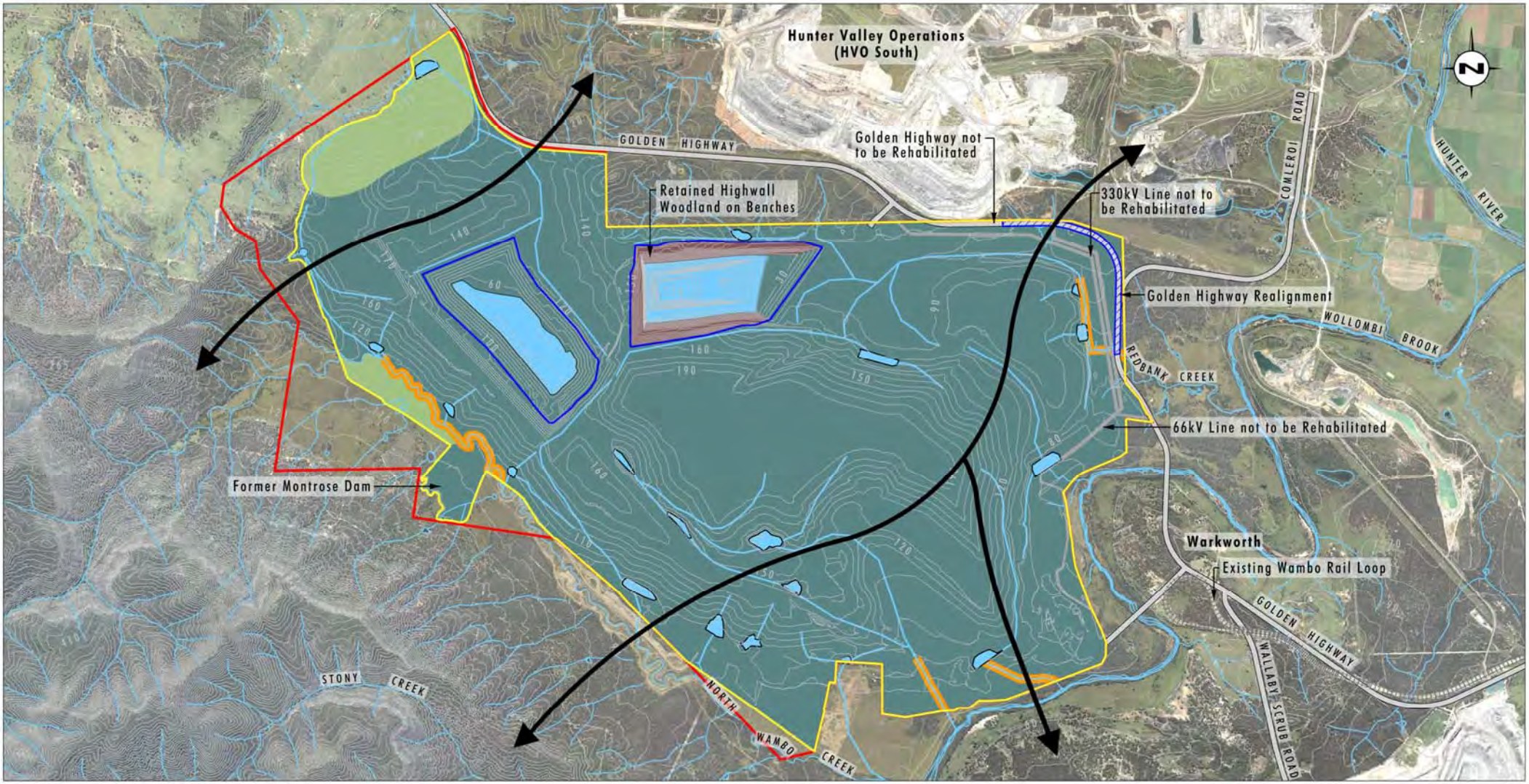


Image Source: AAM (2012), United (2015)
Base Data Source: Glencore (2015), LPI (2009)
Note: Contour Interval 10m

0 1.0 2.0 2.5km
1:50 000

Legend

- Project Area
- Conceptual Rehabilitation Boundary
- Final Void
- Dam
- Woodland or Open Woodland
- Grassland (Agricultural)
- Riparian Vegetation
- Highwall
- Habitat Corridors (existing and proposed vegetation)
- Drainage Line

FIGURE 6.57

Conceptual Final Rehabilitation

File Name (A4): R02/3509_140.dgn
20160413 17:23

Some of the key mine closure planning considerations in the Project design include:

- no change in number of final voids. Two final voids are currently approved for the Wambo Open Cut and the Project will result in two voids remaining in the final landform
- potential habitat linkages between surrounding remnant vegetation and proposed rehabilitation at neighbouring mine sites have been considered in the design of both the post-mining native revegetation and biodiversity offset strategies
- achieving a more natural final landform
- the final landform drainage design and void configuration have been designed in consideration of post mining potential surface and groundwater characteristics
- the visual amenity of the area has been a major focus for the Project design and the indicative final landform design. The visibility of highwalls will be limited, and the post-mining landform and revegetation strategy is commensurate with those found in the local area
- overburden handling, reject emplacement and rehabilitation procedures have been designed in consideration of geotechnical and geochemical characteristics.

The remainder of this section:

- outlines the proposed closure and rehabilitation strategy for the Project including the objectives and preliminary completion criteria (refer to **Section 6.13.1**)
- describes the proposed indicative final landform (refer to **Section 6.13.2**)
- discusses how the proposed closure and rehabilitation strategy aligns with strategic land use objectives for the local area and region (refer to **Section 6.13.3**)
- outlines the rehabilitation strategy that will be implemented for the Project (refer to **Section 6.13.4**)
- discusses the scope of mine closure works to be implemented on the completion of mining (refer to **Section 6.13.5**).

A discussion of the measures that would be implemented for the long term protection and management of offsite biodiversity offset areas is provided within the ecological assessment (refer to **Section 6.9**).

The detailed mine closure planning process will commence five years prior to the planned mine closure. The detailed mine closure plan will be developed in consultation with community, government and other stakeholders with the majority of demolition/decommissioning works expected to be completed within two years of the cessation of mining. Closure works will, however, continue until all works are completed and the closure criteria are met (refer to **Section 6.13.1**).

It is noted that United will be responsible for rehabilitation and closure of the Project components that are under United's management (that is, the open cut operations). Wambo will remain responsible for the rehabilitation and closure of those components under Wambo control, that is, the CHPP, Wambo MIA, Wambo train loading facility and Wambo underground. Wambo will undertake rehabilitation of the Wambo operations in accordance with its existing development consent conditions. The remainder of this section of the EIS should be read in this context.

6.13.1 Rehabilitation Planning and Management

6.13.1.1 Mine Closure Planning Process

Glencore, the manager of United, has implemented a proactive approach to rehabilitation and mine closure by developing a protocol that is implemented across its business units, and is proposed for the Project. This includes planning for closure as an integrated part of the life of mine planning process. Specific guidance is provided for developing, implementing and reviewing mine closure plans taking into consideration economic, social and environmental factors so that each of Glencore's operations meet statutory requirements and achieves sustainable post-closure land uses.

Glencore has a number of policies and protocols in place to manage the mine closure and rehabilitation process, which will inform mine closure planning for the Project. The Glencore (GCAA) HSEC Protocol for Mine Closure Planning (2015) has been developed to guide Glencore operations to meet the requirements and expectations of the *Glencore Environmental Policy (Policy)* related to closure planning and rehabilitation. The objective of the Glencore mine closure planning process is to establish a process to guide all decisions and actions across the life of the mine such that:

- A post-closure vision is clearly defined up front in the Project life.
- The Project is designed, planned and operated in a manner that considers closure obligations throughout the mine life.
- Closure risks and gaps are identified for the Project and a treatment plan is established.
- Closure costings and financial provisioning is based on a thorough, transparent and justifiable process to provide for sufficient funds to implement required actions until complete relinquishment is achieved.
- At the cessation of mining, the closure liability includes those closure items that could not be undertaken during the operational phase of the mine, as far as practicable.
- The post mining land uses for the Project are beneficial and sustainable in the long-term as measured against established rehabilitation objectives and criteria.
- Adverse socio-economic impacts are minimised and socio-economic benefits are maximised.

The mine closure plan required for each mine includes the scope of mine closure activities required at each phase of mining, with closure planning commencing at the exploration phase, continuing through the operational phase and eventually to sign-off of rehabilitation and successful mining lease relinquishment. The level of detail required in a closure plan increases as the operation proceeds towards the planned closure date. Specifically, the protocol requires that when a mine is within five years of the planned closure date a detailed closure planning process is to be initiated.

The process includes the completion of a Pre-Feasibility Constraints and Opportunities Analysis, the development of the Project Closure Plan and the execution of the Project Closure Plan. This requires detailed investigations so that final land use options are confirmed, the full scope of closure issues are identified, appropriate solutions (e.g. engineering solutions) are developed and adequate provisions are accrued so that post mining land use objectives are met following the execution of the Final Closure Plan.

A new Conceptual Closure Plan will be developed as part of the implementation of the Project, including the incorporation of the Wambo Open Cut. The Conceptual Closure Plan will be incorporated into the MOP/Rehabilitation Management Plan and will be developed in consideration of the approach outlined in this EIS, and will include details regarding final land use objectives and closure criteria, rehabilitation and final void management strategies as well as the process for engaging relevant stakeholders in the closure planning process to be adopted throughout the mine life.

6.13.1.2 Indicative Post Mining Land Use Options

The indicative post mining land use for the Project Area following completion of the Project, will involve the establishment of native vegetation communities including ecological rehabilitation forming part of the biodiversity offset strategy for the Project (refer to **Section 6.9.6**) as well as other areas of open woodland, and grassland areas suitable for grazing.

Irrespective of any other potential uses of the land identified during the final Mine Closure Planning process, a minimum of approximately 878 hectares of Central Hunter Valley Eucalypt Forest and Woodland CEEC and a further approximately 1500 hectares of native open woodland vegetation will be established in the rehabilitated landform. The commitment to reinstate at least 878 hectares of Central Hunter Valley Eucalypt Forest and Woodland CEEC is directly related to the additional ecological impacts associated with the Project. The establishment of approximately 1500 hectares of additional native open woodland vegetation maintains the existing rehabilitation commitments under the approved Wambo Controlled Activity approval (granted under the EPBC Act). In all, approximately 2450 hectares of native woodland (approximately 80 per cent of the total Project Area) will be established in the rehabilitated landform.

The indicative revegetation strategy is shown in **Figure 6.57**. The proposed land use has been developed in consideration of existing approval commitments, strategic land use planning objectives, stakeholder feedback and site opportunities and constraints as discussed below. However, in recognition of the 23 year operational life of the Project, the potential for other sustainable and economically productive post-closure uses of the land to arise is recognised. Any such alternate land uses will be investigated in light of the local and regional land use strategies that exist at the time of closure. This process will be undertaken as part of the Glencore detailed mine closure process (refer to this section) and in consultation with relevant stakeholders.

Other potentially viable land use options may include industrial uses, particularly in consideration of the availability of the rail loop, as well as the suitability of infrastructure associated with the workshop, office complex and other surface facilities including water management structures.

The return of native ecosystems to the majority of the area disturbed by mining and the creation of habitat corridors is captured in the closure objectives and criteria (refer to **Sections 6.13.1.3** and **6.13.1.4** respectively), which have been developed to guide rehabilitation and decommissioning activities discussed in **Sections 6.13.4** and **6.13.5**.

The approach for ongoing management of the post mining land use will be determined as part of the detailed mine closure planning process. This will involve investigations into a range of mechanisms that will allow for the land to be managed sustainably into the future as well as to allow disposal of the land asset when the appropriate closure and rehabilitation criteria have been met. The area of ecological rehabilitation that forms part of the biodiversity offset for the Project will be subject to long-term conservation under BioBanking Agreement.

6.13.1.3 Rehabilitation and Closure Objectives

In consideration of the proposed final land use, United's rehabilitation objectives for the Project Area include the following:

- Provide for the safety of employees and the public during and following the closure of the mining operations.
- Provide a sustainable final landform and uses that can co-exist with surrounding land uses. This includes a commitment to the establishment of 'micro-relief' within the final landform for the Project to assist with long-term landform stability and to provide a more natural looking and functioning landform.
- Establish similar native vegetation communities to those that will be impacted by the Project.
- Establishment of ecological rehabilitation as part of the biodiversity offset for the Project.
- Develop native vegetation corridors linking surrounding remnant vegetation areas to the southwest of the Project Area to existing remnants in the north east and south east, and the proposed future native rehabilitation areas of HVO mine and MTW (refer to **Figure 6.57**).
- Inclusion of grassland areas for agricultural land use where appropriate.

In achieving these objectives, United will also aim to:

- Minimise the potential environmental impacts from closure activities.
- Comply with relevant regulatory requirements and attain regulatory consensus on the successful closure and rehabilitation of the site.
- Reduce the need for long term monitoring and maintenance by achieving effective rehabilitation.
- Regularly consult with the relevant stakeholders during the closure and rehabilitation planning and implementation process.

6.13.1.4 Closure and Rehabilitation Completion Criteria

Completion criteria are objective target levels or values assigned to a variety of indicators (i.e. slope, species diversity, groundcover etc.), which can be measured against to demonstrate progress and the ultimate success of rehabilitation. As such, they provide a defined end point at which time rehabilitation can be deemed successful and the mining lease relinquishment process can proceed.

The preliminary closure and rehabilitation completion criteria for the Project are outlined in **Table 6.42**. The criteria have been developed considering site specific issues and final land use objectives, Glencore's standards and the outcomes of the 2005 ACARP study titled *Development of Rehabilitation Completion Criteria for Native Ecosystem Establishment on the Coal Mines in the Hunter Valley*.

These completion criteria, which will be subject to refinement as the Project progresses, including through detailed consultation with the relevant stakeholders, will be utilised to demonstrate achievement of rehabilitation and final land use objectives. Completion criteria will also be refined and detailed as mining progresses through the MOP process regulated by DRE. The achievement of the completion criteria will be monitored and reported within the regular reports to be submitted to relevant government agencies.

In addition to the preliminary completion criteria listed in **Table 6.42**, further criteria specific to the creation of at least 878 hectares of Central Hunter Valley Eucalypt Forest and Woodland CEEC on the site as part of the biodiversity offset strategy for the Project is detailed in the UHSA Statement of Consistency Report (refer to **Appendix 13**). The completion criteria proposed for the area of ecological rehabilitation have been developed having regard to the Ecological Rehabilitation Guidelines (OEH 2015c).

Table 6.42 Preliminary Closure and Rehabilitation

Aspect	Objective	Preliminary Closure Criteria
Decommissioning	• All infrastructure that is not to be utilised as part of the future intended land use are removed to make the site safe and free of hazardous materials.	• All surface infrastructure, including offices and workshops, and services which do not have a potential future use associated with any post mining land use will be removed, unless such removal has a greater environmental impact than rehabilitating the area with the infrastructure remaining in place. • Where services are buried (i.e. pipelines, cables etc.) and their retrieval may lead to further disturbance, the infrastructure may be left *in situ* provided that they don't pose constraints to the post mining land use. In this situation, the location of the services will be surveyed and marked on the record tracings and a suitable caveat developed to provide that they are readily identifiable for future land holders.
	• All infrastructure that is to remain as part of the future land use is safe and does not pose any hazard to the community.	• Potential hazards (i.e. electrical, mechanical etc.) have been effectively isolated. • The structural integrity of the infrastructure has been inspected by a suitably qualified engineer and determined to be suitable and safe as part of the intended final land use. • Appropriate security measures have been implemented to minimise the potential for unauthorised access during the period that the site is transitioned to the intended final land use.
	• There is no residual soil contamination on site that is incompatible with intended land use or that poses a threat of environmental harm.	• Contamination will be appropriately remediated so that appropriate guidelines for land use are met, e.g. Health Investigation Level of the National Environment Protection (Assessment of Site Contamination) Measure (1999). • Where practical, exposed carbonaceous material will be removed and co-disposed within the mining voids or suitably capped *in situ*.

Aspect	Objective	Preliminary Closure Criteria
Landform Establishment	• Landform suitable for final land use and compatible with surrounding landscape as sustainable native ecosystem.	• Slopes will be safe, stable and non-polluting. The final landform will be free-draining and will be in keeping with surrounding landscapes. Rehabilitated slopes (with the exception of final void retained highwalls and slopes) will be, on average, <10 degrees. To allow for the creation of micro-relief in topography, slope angles will be >10 degrees in some areas. • No significant erosion is present that would constitute a safety hazard or compromise the capability of supporting the end land use. • Drainage structures (including drainage lines established in the final landform) are stable and there is no evidence of overtopping or significant scouring as a result of runoff. • Surface layer is free of any hazardous materials. • Any final void and associated highwall has been assessed by a qualified geotechnical engineer to validate that it is stable and does not pose a safety risk. • Tailings and reject emplacement areas will be capped and shaped to be free draining. • Runoff water quality from rehabilitation areas is within the range of water quality data recorded from analogue sites and/or baseline data and does not pose a threat to downstream water quality.
Growing Media Development	• Growing media is capable of supporting sustainable vegetation growth.	• The rehabilitation surface is a suitable growing medium for the proposed end land use. • Monitoring demonstrates soil profile development in rehabilitated areas (e.g. development of organic layer, litter layer).

Aspect	Objective	Preliminary Closure Criteria
Ecosystem Establishment – Native Open Woodland	• Revegetation is sustainable for the long term and only requires maintenance that is consistent with the intended final land use.	• Revegetation areas contain flora species assemblages characteristic of the succession pathways expected of local native vegetation communities (note: conformity with EEC or CEEC listing is not required). • There is no significant weed infestation such that weeds do not compromise a significant proportion of species in any stratum. • Appropriate bushfire hazard controls have been implemented on the advice from the NSW Rural Fire Service.
Ecosystem Establishment and Sustainability – Ecological Rehabilitation	• To create 878 hectares of Central Hunter Valley Eucalypt Forest and Woodland CEEC	• Criteria specific to the creation of woodland conforming to Central Hunter Valley Eucalypt Forest and Woodland CEEC is detailed in **Appendix 13**. • Criteria for Ecological Rehabilitation areas are to conform to the Ecological Rehabilitation Guidelines (OEH 2015d).
Ecosystem Sustainability – Agricultural lands	• Pasture areas capable of supporting sustainable grazing • Land capability of proposed agricultural land areas will be comparable to pre-mining land capability	• Grazing areas are assessed to have a Rural Land Capability Class IV or V. • No significant erosion is present that constitutes a safety hazard or compromises the capability of supporting the end land use. • Species composition consists of grasses, legumes and trees appropriate to the district and recognisable as suitable for beef cattle grazing, consistent with analogue sites. • Grazing areas are assessed to have comparable productivity to district averages (i.e. carrying capacity) for similar rural land capability classes. • Rehabilitation monitoring indicates there is a second generation of pasture plants • There is no significant weed infestation such that weeds do not comprise a significant proportion of species.

Aspect	Objective	Preliminary Closure Criteria
Ecosystem Sustainability – Native Open Woodland	• Revegetation areas will provide habitat value in the future.	• Rehabilitated areas provide a range of vegetation structural habitats (e.g. eucalypts, shrubs, ground cover, developing litter layer, etc.) to encourage use by native fauna species. • Second generation trees are present or likely to be, based on monitoring in comparable older rehabilitation sites (i.e. evidence of fruiting of native species observed). • More than 75 per cent of trees are healthy and growing as indicated by long term monitoring.

The preliminary closure completion criteria will be reviewed and revised throughout the Project life through consideration of the results of rehabilitation and analogue site monitoring programs; any relevant research trials; and consideration of stakeholder feedback. It is envisaged that this process will occur as part of the development of the MOP and regular statutory reporting. The completion criteria will be finalised as part of the detailed mine closure planning process and presented in the Final Closure Plan for approval by the relevant government agencies.

The gradual achievement (or otherwise) of these completion criteria will be assessed and discussed as part of regular statutory reporting processes along with any measures that need to be implemented to meet the criteria. Proposed rehabilitation monitoring is discussed in **Section 6.13.4.2**.

6.13.2 Proposed Post-Mining Landform

The conceptual final landform, as shown in **Figure 6.57**, has been designed to maintain consistency with the terrain in the local area and will predominantly consist of an undulating landform. The key features of the final landform are discussed below.

6.13.2.1 Final Voids and Highwalls

As part of the preparation of the EIS, stakeholder engagement was undertaken with DRE, Singleton Council and community representatives in regards to mine closure, specifically final landform. In response to issues raised by the community and government agencies during the consultation process, this section provides an outline of the key considerations for the design of final voids and associated highwalls.

Based on the depth of coal seams, the optimal mine design for the Project results in two final voids remaining at the completion of mining. This is consistent with the currently approved final landform for the Project Area with the Wambo Open Cut having two final voids in its approved final landform. The Project adds the United Open Cut as an additional mining area without increasing the number of voids, however, the location and size of the voids have changed. The key design features and processes associated with the final voids are outlined below:

- the highwalls may incorporate a series of approximately 15 to 50 metre wide benches. The stability of the highwalls will be assessed by a suitably qualified geotechnical engineer and appropriate stabilisation measures will be installed (where required) progressively

- a safety berm will be established along the top of each highwall, designed to restrict inadvertent access to the highwalls. This berm and associated drainage will also prevent runoff from flowing over the face of the highwalls

- the highwall benches will be revegetated with a suitable native vegetative mix using local species, where appropriate, above the predicted final void water level. Highwall treatment will be undertaken to facilitate a safe and stable final landform. Potential safety issues associated with the retained highwalls are also considered to be manageable through the development of a bund or berm at the top of the highwalls to prevent inadvertent access

- the lowwalls will be reshaped and revegetated to a safe and stable slope.

A surface drainage network will be established to divert the majority of surface water away from the final voids so as to reduce runoff capture in the voids and maximise drainage flows into the local catchment areas (refer to **Figure 6.19**).

As outlined in **Section 6.8.2**, a groundwater assessment of the final landform (at closure) indicates that the voids will be a long-term hydraulic sink. This system will comprise an open water pit lake within the confines of the final pit shell.

The above design features have been developed to manage public safety risks and minimise the sterilisation of land and water resources.

Modelling associated with the final void and final landform has been undertaken to predict the final water level within the voids (refer to **Section 6.8.2**), with this modelling to be refined throughout the life of mine. The refinements to the modelling will update modelling predictions and evaluate the long term pit lake hydrochemistry and water level that will prevail post-closure.

As a means to confirm the ongoing management and land use strategy associated with the voids, a Final Void Management Plan incorporating the outcomes of specific final void groundwater assessments will be developed and included in the Final Closure Plan. The final closure planning process will be commenced five years prior to cessation of mining.

6.13.2.2 Overburden Emplacement Areas

Key design considerations associated with the overburden emplacement areas are outlined below:

- All final overburden landform slopes will be battered to minimise erosion risk. Concave profiles may be implemented to further enhance stability and provide consistency with surrounding natural landforms.
- Overburden emplacement areas will include variation in vertical relief in order to prevent ponding of surface water as well as to create a variable profile that is commensurate with the natural local topography.
- The footprint of the overburden emplacement areas has been designed to be irregular in shape in order to provide a more natural landscape.

6.13.2.3 Surface Water Drainage

As indicated in **Figure 6.19,** the final landform will generally be designed to direct runoff away from the final voids and into the Wollombi Brook and Waterfall Creek catchments. Some lowwall slopes within the final voids will report to the void water storage.

Drainage structures will be designed to minimise scouring associated with anticipated runoff. Where practicable, drainage lines will be designed to be commensurate with natural landforms.

6.13.3 Alignment with Strategic Land Use Objectives

The strategic land use objectives for the area, which have been considered as part of the concept closure planning process for the Project, include those within the Singleton LEP (2013), DRE's Synoptic Plan and the Strategic Regional Land Use Plan for the Upper Hunter (Department of Planning and Infrastructure 2012). Discussion of the alignment of the conceptual closure plan with these strategies is outlined below.

Singleton LEP 2013

The Project Area is zoned RU1 Primary Production and SP2 Infrastructure under the Singleton LEP (2013) (refer to **Section 4.2**). The primary objectives of RU1 zone relevant to the post mining land use of the Project Area include:

- To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.
- To encourage diversity in primary industry enterprises and systems appropriate for the area.
- To minimise the fragmentation and alienation of resource lands.
- To minimise conflict between land uses within this zone and land uses within adjoining zones.

The primary objectives of SP2 zone relevant to the post mining land use of the Project Area include:

- To provide for infrastructure and related uses.
- To prevent development that is not compatible with or that may detract from the provision of infrastructure.

As discussed in **Section 6.3**, the low soil fertility across much of the Project Area limits the potential for sustainable agricultural use of the land in a manner that is both financially and environmentally responsible. Considering the inherent fertility of the soils, landform and the effects of mining activity, the use of the Project Area for agricultural purposes post-closure will primarily be targeted at a small portion of the northwestern corner and along the southwestern portion of the Project Area near North Wambo Creek (refer to **Figure 6.57**). Realistically, in the absence of significant inputs, the most sustainable post mining land use is regeneration back to native vegetation, such as woodlands, grasslands and riparian vegetation. The proposed post mining land use for much of the disturbed land is targeted towards the protection and preservation of natural ecological systems and processes, particularly as it aims to promote local and regional native ecosystem corridors through effective rehabilitation for use by a range of native flora and fauna species.

DRE Synoptic Landscape Plan

The DRE Synoptic Landscape Plan (Andrews Neil, 1999) aims to provide a basis for the development of a long term integrated strategy for rehabilitation of mines in the Upper Hunter Valley. The rehabilitation strategy for the Project has been developed to meet the intent of the Synoptic Plan and considers the potential regional outcomes for visual amenity, biodiversity and sustainable post closure use. The final landform aims to provide habitat corridors; this is consistent with the intent of the broader regional corridor system for the Warkworth/Jerrys Plains region outlined within the Synoptic Plan. The woodland revegetation corridors proposed (refer to **Figure 6.57**) are in alignment with the corridors identified in the Synoptic Landscape Plan.

Upper Hunter Strategic Regional Land Use Plan (DP&I 2012)

The Upper Hunter Strategic Regional Land Use Plan has been developed to provide a strategic framework for delivering the necessary context for government investment priorities, servicing strategies and local environmental plan development for the Upper Hunter. Amongst the various land use types, the Strategy outlines the importance of the protection of biodiversity through strategic land use planning. It recognises that post mining rehabilitation has the potential to contribute to biodiversity conservation in the longer term, but will require effective design and planning to maximise its landscape in the future.

The Strategic Regional Land Use Plan has provided a regional conservation assessment and has identified and mapped areas of terrestrial and aquatic biodiversity values. It is considered that the proposed final land use of much of the Project Area as native woodland vegetation (CEEC and open woodland) that forms vegetation corridors is consistent with these values and in the long term, as once the rehabilitation matures, it will contribute to a broader regional conservation outcome by providing an effective corridor link from the nearby Wollemi National Park to remnant and rehabilitated native vegetation on the Hunter Valley floor.

Draft Hunter Regional Plan

The NSW DP&E has developed a Draft Hunter Regional Plan that outlines a vision, goals and actions for the sustainable growth of the region between 2015 and 2036.

The Project Area site falls within the Upper Hunter Valley link portion of the Hunter Region as identified in the Draft Hunter Regional Plan. Through the implementation of the Draft Hunter Regional Plan, the Upper Hunter Valley link is intended to progressively increase habitat connectivity through co-ordinated planning and rehabilitation of mining sites. The proposed rehabilitation of much of the site as native woodland therefore aligns with the strategic objectives of the Draft Hunter Regional Plan.

6.13.4 Rehabilitation Strategy

Rehabilitation will be undertaken in accordance with a Mining Operations Plan (MOP) that will be prepared for the Project and submitted to DRE for approval. The MOP will detail performance measures and criteria for specific rehabilitation areas, to be used as benchmarks against which performance of the rehabilitation strategy can be measured. The monitoring of rehabilitation performance will be regularly reported to DRE and DPE. As discussed above, Wambo will undertake rehabilitation of the Wambo operations in accordance with its existing development consent conditions.

Disturbed areas will be progressively rehabilitated over the life of the Project. The indicative sequence for progressive rehabilitation is shown in **Figures 3.11** to **3.16**. Whilst it is intended to maximise opportunities for progressive rehabilitation, potential deviations from the indicative schedule may occur due to:

- changes or delays in the mining schedule
- postponement of rehabilitation activities to avoid seeding and planting in conditions which may lead to poor quality rehabilitation or failure.

Where rehabilitation is delayed due to the above scenarios, overburden areas will be shaped to final landform as close as reasonably practicable behind the active mining operation, however, final revegetation may be delayed until suitable conditions occur and a cover crop applied on exposed areas to minimise dust and erosion.

The proposed process for the implementation of the conceptual final landform will utilise a natural landform design incorporating micro-relief principles. The process will be undertaken as part of the detailed mine planning process completed through MOPs for the operation. The key objectives of such an approach will include:

- the drainage density of the final landform is to reflect the nature of the drainage patterns in surrounding landforms
- steeper slopes are to be located higher in the catchment (that is, where water flows are smallest), with slope gradients flattening out downstream

- drainage lines will have both channel and floodplain components to provide stability during frequent flood events

- gentle flow transitions which emulate natural transitions and maintain a balance between scour risk and sediment load.

The micro-relief design process also results in a more natural looking landform, which reduces the visual impact of the final landform. Similar management commitments were made and are now successfully being implemented at Glencore's Mangoola Mine. The detailed design of the natural landform implemented at Mangoola has been developed progressively as part of the detailed mine planning process and is included in the staged rehabilitation plans in the MOP. The progressive development of micro-relief in the landform as part of the progressive detailed mine planning process is necessary to ensure that overburden material is efficiently handled and the drainage system of the rehabilitated final landform works effectively as part of the mine water management system.

United's approach to the development of detailed final landform design will be similar to that currently applied at Mangoola and will have the benefit of assimilating learnings from Mangoola and Glencore's other operations where similar approaches are also being applied.

Figure 6.58 shows an example of what the landform in the Project Area rehabilitated area may look like with detailed natural landform features incorporated into the final landform design. **Figure 6.58** illustrates what can be achieved with the final landform. As discussed above, the final landform design incorporating micro-relief will be developed progressively during the life of the Project.

The ecological rehabilitation and the grassland with woodland pockets will focus on the establishment of the Central Hunter Valley Eucalyptus Woodland and Forest CEEC. Suitable riparian species will also be established in drainage lines in the post mining landform. Areas proposed for agriculture will utilise agriculture specific grassland species as appropriate.

Temporary revegetation (predominantly fast growing grass species) will also be undertaken on unshaped overburden dumps and other disturbed areas that are planned to be inactive for one to two years. Temporary revegetation of these areas will improve both visual amenity and the control of dust emissions.

6.13.4.1 Proposed Rehabilitation Techniques

Management of Acid Rock Drainage Potential

Analysis was undertaken by Geoterra Pty Ltd (Geoterra) to assess the acid rock drainage (ARD) potential of the materials to be mined. The study indicated that the vast bulk of overburden, interburden and floor materials represented by the samples tested are unlikely to be acid producing or release significant salinity and will be acid consuming. This is consistent with the current experience within the Project Area, however, the Geoterra laboratory results did identify some small areas of potential acid forming (PAF) material present within the Project Area (1 out of 87 samples collected) and the development of a management approach for this PAF material is therefore appropriate.

The general buffering nature of most of the overburden and interburden material and the likely small proportion (if any) of PAF material potentially present in the mining area provides considerable flexibility in mine materials management. Operational mixing of any PAF and high acid neutralising capacity (ANC) materials is expected to be sufficient to control any potential for acid generation. Nonetheless, further investigation of any identified PAF material will be undertaken during operations to confirm any potential for acid forming material, confirm the appropriate approach to management of this material and to demonstrate the effectiveness of the management techniques proposed.

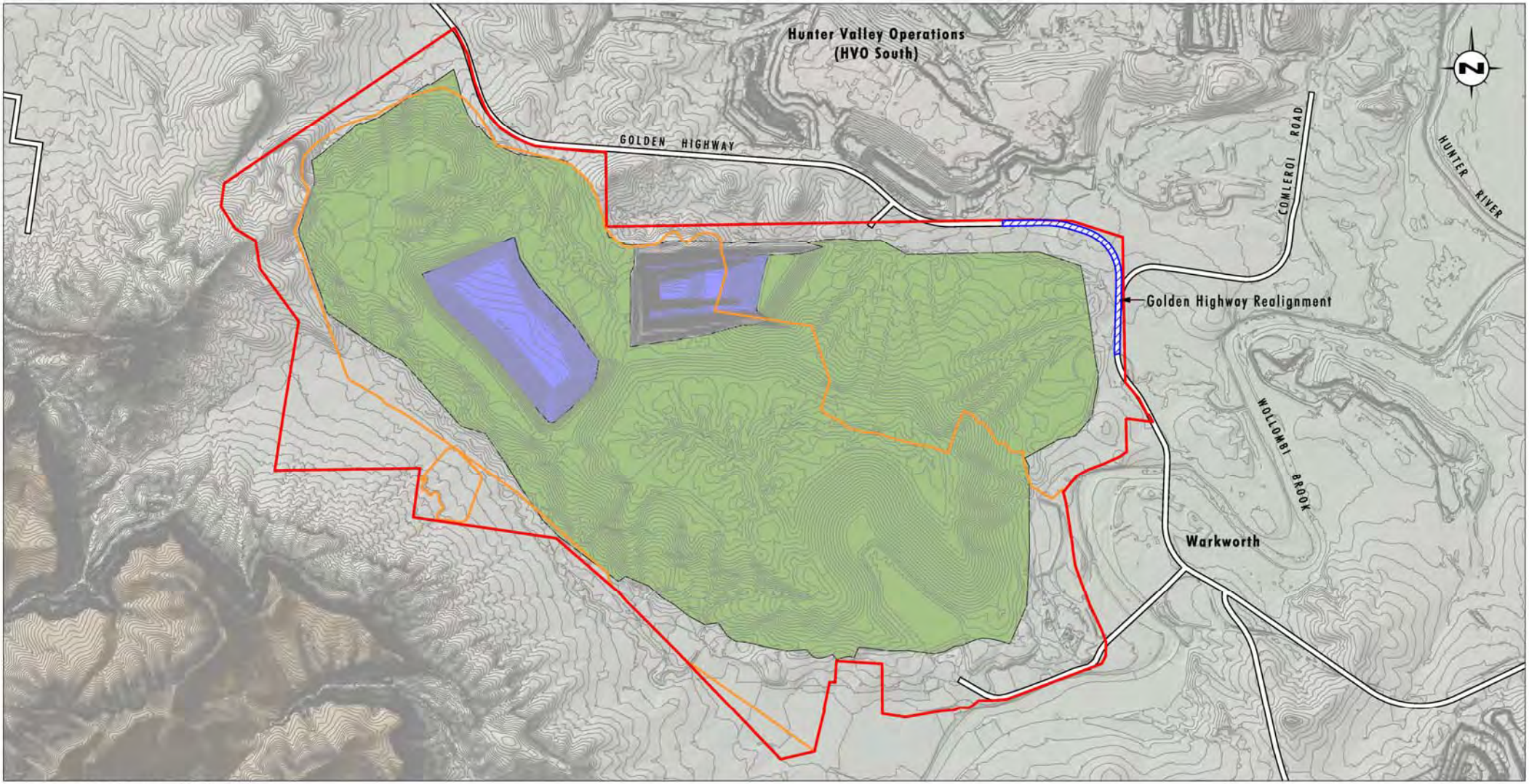


Image Source: United LiDAR (2015)
Data Source: Glencore (2015)
Note: Contour Interval 5m

0 1.0 2.0 2.5km
1:50 000

Legend

- Project Area
- Approved Wambo Surface Development Area
- Rehabilitation
- Final Void

FIGURE 6.58

Example of Conceptual Micro-relief Landform

Should PAF material be identified, the following management strategies will be considered for PAF material where operational blending is not sufficiently effective:

- placement of PAF material in thin layers of no more than 5 metres with traffic compaction and immediate over-dumping with non-acid forming (NAF) spoil
- avoid placing PAF material within 5 metres of the natural ground level in out-of-pit emplacement areas to isolate it from any water flow along the interface between the overburden and natural ground
- mixing of acid neutralising materials (limestone and/or high ANC NAF overburden and interburden) with PAF material to increase lag times before onset of acid conditions
- selective placement of PAF material at least 100 metres back from the outer perimeter of the emplacement area with a thick (not less than 20 metre) outer zone of NAF materials (preferably high ANC material) and incorporate strategies to limit oxygen transfer to and fluctuating moisture conditions in PAF materials
- selective placement of PAF materials in-pit below the long term recovery water table to allow inundation at closure and prevent long term exposure to atmospheric oxidation.

A program of routine sampling and testing of the overburden/interburden material identified in the Geoterra study as being PAF will be carried out during operations to better define the ARD potential and variability of rejects. A program of routine sampling and testing of seepage and runoff from pit walls and floors, overburden emplacements, ROM stockpiles and washery waste disposal areas where the testing has identified a risk of ARD will also be carried out to check for ARD generation, assess the performance of management strategies, and determine and/or refine non-acid forming/potentially acid forming blending ratios and limestone treatment requirements (if required). The need for ongoing monitoring will be reviewed periodically should the testing and monitoring indicate negligible risk of ARD with the management practices above being implemented.

Tailings Storage Facility Decommissioning

The tailings storage facilities on site will be filled, capped and shaped to the conceptual final landform plan. The primary objective of the capping design will be to minimise the potential for exposure of potentially environmentally sensitive tailings material in the rehabilitated landform and prevent the occurrence of spontaneous combustion. Following capping, these areas will be revegetated in accordance with the rehabilitation strategy as outlined in **Section 6.13.4**.

To promote the geotechnical stability of capped tailings emplacement areas and avoid the potential sterilisation of land in the post-mining landform, dewatering strategies will be incorporated into the design of the proposed tailings facilities. The aim of the strategy will be to progressively dewater the tailings facilities and promote the consolidation of material throughout the tailings profile. Water extracted from the process will be re-utilised for on-site purposes such as the processing of coal or for dust suppression.

Capping of Wambo's existing tailings storage facilities (North East and Hunter) will be completed by Wambo prior to the Project placing overburden in these areas.

Coarse Reject

Coarse reject material will be co-disposed with overburden material and incorporated into the final landform. The coarse reject material will be placed at a suitable depth within the final landform to minimise any potential interference to rehabilitation establishment as well as minimise the potential for

spontaneous combustion or ignition of carbonaceous material in the event of bushfire occurring within the revegetated landscape.

A program of sampling and testing of rejects from seams identified as potentially containing PAF material will be implemented as part of the Project. PAF coarse reject material will be managed in the same manner as PAF overburden and interburden material (refer above).

Topsoil Management

United will undertake topsoil handling in accordance with the topsoil stockpile handling strategy detailed below to maintain the quality of topsoil for subsequent use in rehabilitation. This strategy will be implemented for the Project. Materials management and monitoring techniques to be adopted for this strategy include:

- Material characterisation of topsoil and subsoil will be undertaken at an appropriate scale across the site. Representative samples will be taken to characterise the nature of the soil material (e.g. sodicity, acid-generating potential, etc.) to determine the potential limitations to rehabilitation and sustainable plant growth. The results will be used to determine specific ameliorant techniques that may be applied to the soil material in order to overcome potential limitations and enhance vegetation establishment.

- Topsoil and subsoil stripping activities are to be restricted during adverse weather conditions to minimise the potential for dust generation.

- Topsoil and stripping depths will be identified for each stripping area and will be undertaken using appropriate equipment (e.g. dozer or scraper).

- Topsoil and subsoil layers will be assessed and managed so that they can be appropriately re-applied in areas to be rehabilitated.

- Wherever practicable, topsoil will be transferred directly from stripping location to areas that have been reshaped for rehabilitation, eliminating the need for storage and re-handling.

- Topsoil stockpiles will be located away from traffic areas and at an appropriate distance from watercourses.

- Appropriate sediment controls will be installed around topsoil stockpiles.

- Stockpiles will be generally less than 3 metres high to retain biological activity within the topsoil.

- Stockpiles to be kept longer than six months will be sown with a suitable cover crop to minimise soil erosion and invasion of weed species.

- Where required, machinery used to handle and transport topsoil will be washed down prior to and at the completion of works to minimise the transfer of weeds.

- Weed growth on topsoil stockpiles will be monitored and subsequently controlled if necessary.

- Prior to re-spreading, any weed growth will be scalped from the top of the stockpiles to minimise the transport of weeds into rehabilitated areas.

- Stockpiles will be appropriately identified to minimise the potential for inadvertent use or disturbance.

Substrate Preparation

Surface preparation activities for rehabilitated areas will commence as soon as practicable following the completion of mining activities. The general surface preparation activities to be undertaken within the Project Area include:

- Prior to the commencement of rehabilitation of the shaped overburden surface, representative samples will be taken to characterise the nature of the spoil material (e.g. sodicity, acid-generating potential, etc.) to determine the potential limitations to rehabilitation and sustainable plant growth. Where woodland revegetation is proposed, the chemical and physical properties from natural analogue sites will be used to assess whether specific amelioration techniques (e.g. addition of gypsum, lime, organic matter, deep ripping etc.) are required to overcome potential limitations for landform stability, plant establishment and growth.

- Soil ameliorants will be applied where appropriate.

- Where appropriate and practical, structures such as tree hollows, logs and other woody debris will be incorporated into the final landform to augment the habitat value of the proposed vegetated corridors generally consistent with the approach outlined in the Ecological Rehabilitation Guidelines (OEH 2015d).

- The installation of appropriate habitat structures (e.g. ponds) will be undertaken where practical.

Decisions regarding appropriate substrate preparation techniques will be driven by the proposed final land use for each particular portion of the Project Area. For example, areas proposed for agricultural land use may require additional substrate management when compared to other grassland areas, prior to revegetation taking place.

Revegetation

After appropriate surface soil amelioration and tillage is completed for any given area, revegetation will commence as soon as practicable.

As discussed earlier, the rehabilitation strategy for the Project primarily involves the establishment of:

- ecological rehabilitation (woodland conforming to the Central Hunter Valley Eucalypt Forest and Woodland CEEC)

- open woodland vegetation

- agricultural pasture land.

The ecological rehabilitation will be undertaken through the creation of corridors of rehabilitated woodland which will link to remnant stands of native vegetation within the existing Project Area, from remnants adjoining the Project Area and to proposed future woodland areas of rehabilitated HVO and MTW Mine. Rehabilitated woodland areas will contain flora species assemblages characteristic of the dominant vegetation communities impacted by the Project. The target woodland community that will comprise the woodland components of rehabilitation areas is the Central Hunter Valley Eucalyptus Woodland and Forest CEEC.

During the rehabilitation process, the ecological structure of the rehabilitated land will be consistent with what would be expected in a typical disturbed landscape transitioning back to woodland. Succession patterns are likely to be similar to those that are observable in forest areas heavily impacted by bushfire and cleared land (such as agricultural land) regenerating to bushland. Most or all of the vegetation to be disturbed has been previously cleared, and is comprised now of regenerated vegetation that has developed through various successional stages.

The succession pathway expected in rehabilitated areas is represented in **Figure 6.59**. During the early stages of rehabilitation, grasses and fast growing pioneer species will initially dominate with pioneer species such as acacias dominating the mid strata and canopy. As shown in **Figure 6.59**, it is not uncommon for there to be low densities of shrubs and ground layer species as these fast growing pioneer species and young canopy species dominate the upper strata and shade the ground. Pioneer species such as acacias typically die back and thin out within 5 to 15 years, depending on the species. The existence of the pioneer species in the earlier years of vegetation establishment encourages the eucalypt and other canopy species to grow in height. As the pioneer species thin out, other canopy species such as the eucalypt species grow, increase in dominance and occupy a greater percentage of canopy. In rehabilitated areas (and heavily disturbed environments), until pioneer species have started to die back, there is little light available in the lower storeys and typically a consequential low species richness in ground and shrub layers. As the pioneer species die out and canopy height increases, increased species richness can be expected to develop in the understorey.

Monitoring results from the rehabilitated areas of other Glencore operations (for example, at Glencore's Mount Owen operations) demonstrates that there is a strong trend towards the re-establishment of self-sustaining woodland communities within mine site rehabilitation. It is also noted that areas of mine rehabilitation at United and Wambo and within the additional disturbance area for the Project, although not yet mature, have been assessed as conforming to the Central Hunter Valley Eucalypt Forest and Woodland CEEC. This finding confirms that the CEEC can be re-established through mine rehabilitation on the substrates within the Project Area.

A seed collection and handling program aimed at maximising the viability and diversity of local seed in the revegetation mix will be implemented as part of the rehabilitation program, however, endemic species may also be sourced from other sources, where required. As rehabilitation progresses, additional species can be planted to mimic succession processes where necessary to achieve the target woodland community.

It is noted that the groundstorey and understorey density in the Central Hunter Valley Eucalypt Forest and Woodland CEEC ranges from non-existent and sparse through to moderately dense. Various factors such as fire history and soil fertility and depth play a role in this. Accordingly, the final completion criteria will need to have regard to the natural variability found in these communities. Completion criteria in the MOP for the Project will be developed based on the expected stages of growth/succession as outlined above.

Open woodland will be seeded with a native species mix from the list of species typically found to occur within the Central Hunter Valley Eucalypt Forest and Woodland CEEC and other native woodland communities currently occurring within the Project Area.

6.13.4.2 Proposed Rehabilitation Monitoring

United will undertake a rehabilitation monitoring program in accordance with Glencore standards. The objectives of the program will be to:

- assess the long term stability and functioning of re-established ecosystems on mine affected land
- assess rehabilitation performance against the closure criteria
- Facilitate continuous improvement in rehabilitation practices.

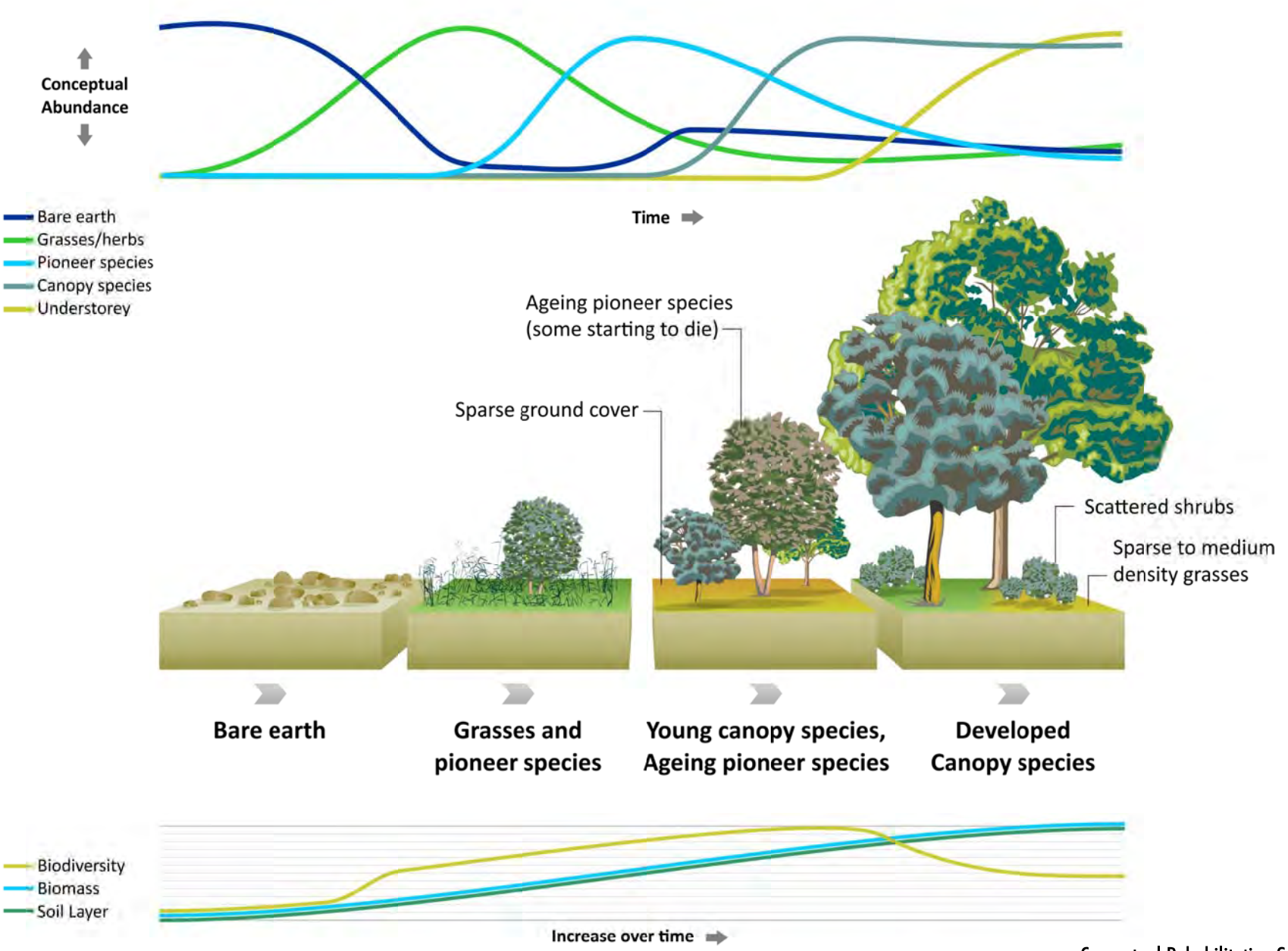


FIGURE 6.59

Conceptual Rehabilitation Succession Pathway

The monitoring program will be continued within rehabilitated as well as non-mined areas until it can be demonstrated that rehabilitation has satisfied the closure criteria. Information from this monitoring program will also be used to refine closure criteria as required.

6.13.4.3 Revegetation Care and Maintenance

Based on the outcomes of the rehabilitation monitoring program, a care and maintenance program will be implemented so that rehabilitation is sustainable for the long term. The scope of the care and maintenance program may include weed and feral animal control, fertilising, re-seeding or planting (where required) and erosion and sediment control works. It is envisaged that this program will be continued as required until it can be demonstrated that the rehabilitation of the Project Area has satisfied the closure criteria.

6.13.4.4 Proposed Rehabilitation Sign-Off Process

Based on the outcomes of the rehabilitation monitoring programs and in consultation with the relevant government agencies, it is United's intention to seek progressive sign-off of rehabilitation areas once the agreed closure and rehabilitation criteria have been satisfied.

6.13.5 Scope of Mine Closure Decommissioning Works

At the end of the operational life of the mine, United proposes to decommission all on-site infrastructure and associated facilities as part of the mine closure process with the exception of any required as part of the final land use. Closure monitoring and maintenance works will continue until it can be demonstrated that the criteria have been met (refer to **Section 6.6.1**).

In accordance with the Glencore standards for mine closure, a detailed mine closure plan will commence at least five years prior to the anticipated mine closure date (e.g. cessation of mining) with the closure plan being finalised at least two years prior to this date. During the development of the mine closure plan, consultation will be undertaken with relevant government agencies and the local community. This plan will specifically address the major aspects of decommissioning and rehabilitation and define future rehabilitation care and maintenance requirements for the site, and ongoing monitoring and management.

A summary of the general decommissioning activities that will be undertaken as part of the closure and decommissioning of the Project is outlined in **Table 6.43**.

Table 6.43 General Approach to Decommissioning Activities

Mine Closure Aspect	General Approach
Site Services	• Services will be removed unless they are of use in the post mining land use. • Electricity services to any remaining infrastructure will be removed prior to the commencement of any associated building demolition works. • Telecommunications, water supply and other services will also be disconnected and removed where practical. • Where services are buried (i.e. pipelines, cables etc.) and their retrieval may lead to further disturbance, the infrastructure may be left *in situ* provided that they don't pose constraints to the post mining land use. In this situation, the location of the services will be surveyed and marked on the record tracings and a suitable caveat developed to provide that they are readily identifiable for future land holders.

Mine Closure Aspect	General Approach
Buildings and Fixed Plant	• All buildings, fixed plant and other infrastructure that are not required as part of the post-closure land use will be demolished and removed from the site. Where appropriate the materials recovered during demolition will be sold for re-use or recycled. • Concrete footings and pads along with other inert building waste will be broken up and buried with overburden in the pit area or used in rehabilitation where appropriate. • Where they do not pose a constraint to the proposed final land use, structures such as footings, underground water pipelines and disconnected power cables may be left *in situ*. This may include where it is not practical to retrieve the structures or where their removal may lead to environmental damage. These remaining structures will be surveyed and recorded on a plan.
Removal of Carbonaceous/ Contaminated Material	• Excess coal material remaining at closure will be scraped up and either reprocessed or disposed of within the tailings/coarse reject emplacement areas on site. • Any remaining carbonaceous material (e.g. coal reject) on the base of the coal stockpile area will be either capped with inert material in accordance with relevant guidelines or scraped up and removed and disposed of with tailings or as coarse reject within the emplacement area. • Where there is potential that contamination may have occurred as a result of site activities (e.g. refuelling areas, workshops, etc.), investigations will be undertaken to determine the presence and extent of any contamination. Where identified, contaminated material will be bioremediated on site or disposed of offsite at an authorised waste facility.
Equipment Storage Areas	• Any redundant plant or equipment will either be sold or disposed of at an appropriate landfill facility. • Storage areas will be assessed for potential contamination (e.g. hydrocarbons) and remediation undertaken as required.
Hardstand Areas, Roadways and Car Parks	• Hardstand areas, roadways and car parks will be removed (unless required for a post mining land use) with inert waste material (e.g. bitumen, concrete) being placed and capped in the tailings/overburden emplacement areas or incorporated into the final voids.
Hazardous Materials Management	• All remaining hydrocarbons such as diesel and lubricants and other hazardous materials will be either utilised or disposed of at an authorised facility. • The storage tanks will be removed and depending on their condition either sold or disposed of at an authorised facility.

Mine Closure Aspect	General Approach
Dangerous Goods	• It is envisaged that the majority of dangerous goods remaining onsite at the end of the mining operations will include gas bottles and cleaning agents, which will be utilised during decommissioning activities or disposed of offsite in accordance with the regulatory arrangements in force at the time.
Water Management Infrastructure	• The final design of the water management system will be dependent upon the outcomes of the final land use study and will be provided in the detailed closure plan. • Depending on the chosen final land use, issues that will be addressed as part of post-mining water management system will likely include: o removal of excess sediment from the surface dams for future use by the subsequent land owner or alternatively filling or removing the dams if they are no longer required o reshaping dams (where required) in accordance with their intended use. This may involve resizing, facilitating stock access or reshaping to enhance habitat functionality for specific fauna species o where dams are to be retained, drainage structures will be designed to capture runoff from sufficient catchment area so that the dam can be utilised for its intended use o the installation of appropriate sediment and erosion control measures. • Sediment material extracted from dams will be subject to a risk assessment to determine the potential for contamination and, if present, will be appropriately managed.

6.14 Social Impact and Opportunities

A detailed Social Impact and Opportunities Assessment (SIOA) has been prepared for the Project in accordance with the SEARs for the Project (refer to **Table 4.3**). The SIOA assesses the potential impact of the Project on local and regional communities and provides a description of the measures to be implemented to minimise the adverse social and economic impacts of the Project and enhance the positive aspects.

The detailed SIOA has been prepared by Umwelt and can be found in **Appendix 4** with key findings of the assessment outlined below.

Engagement with the community has been a key component of the Project and the various assessment studies (refer to **Section 5.0**). In terms of the SIOA, stakeholders were engaged through a wide range of mechanisms including the use of one-on-one interviews, community information evenings, newsletters, focus groups, surveys and community group meetings (refer to **Section 5.0**).

6.14.1 Methodology

SIOA is an approach to assessing and predicting the likely consequences of a project in social terms, that is how the project may affect people's way of life (how they live, work and interact with each other), their culture (norms and traditions) and their community (institutions and structures). A further objective of a SIOA is to identify how such impacts may be more effectively managed or opportunities enhanced to improve social outcomes.

The SIOA program for the Project was designed to identify, assess and address the potential social impacts of the Project on neighbouring and local communities, and more specifically to:

- identify potential social impacts and opportunities, including consideration of cumulative impacts
- ensure effective integration of study outputs with other environmental assessment studies to inform broader Project design and planning
- identify relevant management and enhancement strategies to address any predicted social impacts.

A wide range of assessment methods have been used to develop a detailed understanding of current interactions between existing operations and local communities and to identify potential social impacts that may be associated with the Project. A summary of the methods and approaches adopted in the assessment are presented in **Table 6.44**.

Table 6.44 Summary of Social Impact and Opportunities Assessment and Engagement Methods

Method	Description
Phase 1 – Program Planning	Development of a stakeholder engagement strategy for the Project.
Phase 2 – Community Profiling	Examination of a range of secondary data sources, e.g. census data, social and community indicators, historical accounts of the region, local media resources, assessment of the social and economic linkages between United and Wambo and the community, and personal interviews with key stakeholders.
Phase 3 – Scoping of Issues and Opportunities	Review and analysis of historical stakeholder consultation outcomes and complaints data for United and Wambo to obtain an understanding of perceived issues and opportunities. Face-to-face meetings with neighbours of the Project to identify perceived issues and opportunities relating to the Project, followed by ranking of perceived issues and opportunities relative to frequency of response. Briefings with NGOs, business groups and other interested stakeholders to identify perceived Project issues and opportunities.
Phase 4 – Assessment of Impacts and Opportunities	Assessment of unmitigated environmental and social risks and prediction of social impacts associated with the Project.
Phase 5 – Prediction of Impact and Strategy Development	Plotting of impacts to prioritise social risk rankings and guide management strategy development. Identification and development of appropriate strategies to address predicted Project impacts and monitor change.

To determine the area of influence of the Project, Town Resource Cluster Analysis (TRC-Analysis) was used to identify the associations that exist between United and Wambo and the wider community. The TRC-Analysis included the development of a comprehensive profile of United and Wambo employees and contractors, which has illustrated the linkages between United and Wambo and communities within the region, such as the LGA of Singleton and the nearby townships of Maitland, Cessnock and Newcastle. Consequently, geographic areas of interest for the SIOA have included the:

- Project Area
- Neighbouring localities of Warkworth, Jerrys Plains, Bulga/South Wambo and Maison Dieu
- Singleton LGA
- Upper Hunter region
- State of NSW.

6.14.2 Community Engagement

Engagement with the community has been a key component of the Project and the various assessment studies and is described in detail within **Section 5.0**.

Community engagement has been used to obtain a comprehensive understanding of the issues and perspectives of neighbouring landholders in proximity to the Project and other key stakeholders with an interest in the Project; and has been structured at key phases of the assessment program. Approximately 500 stakeholders have been consulted as part of the Project.

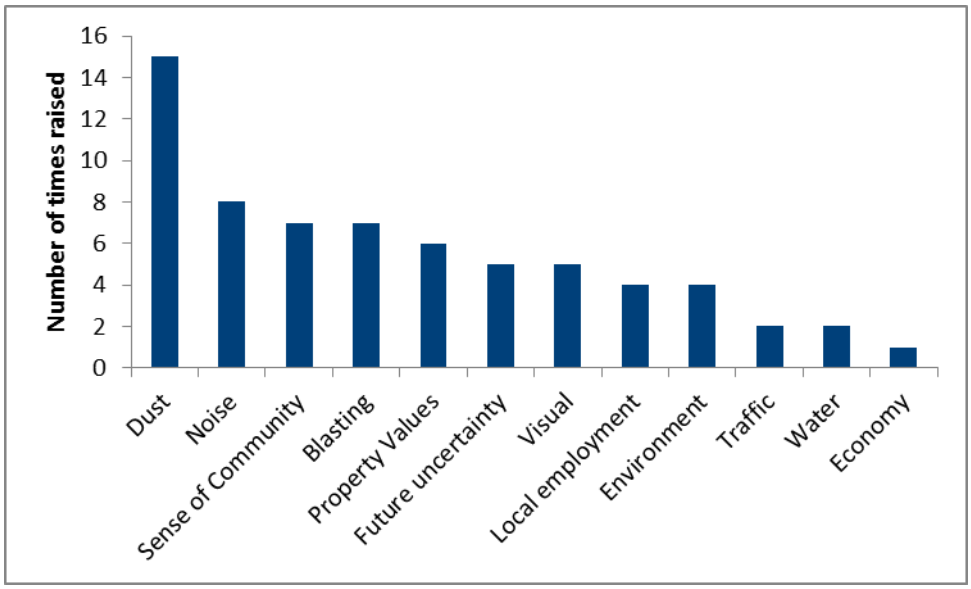
Specific engagement techniques that have been utilised include:

- face-to-face meetings with near neighbours to outline Project aspects and obtain feedback on perceived issues and opportunities
- face-to-face meetings with key local and regional stakeholders drawn from community sectors such as education, health, transport, housing and emergency services
- regular briefings and presentation of EIS material at CCC meetings
- personal meetings with local and regional NGOs and business groups
- provision of Community Information Sheets summarising key aspects and progress/outcomes of the environmental and social assessment program, distributed to neighbouring community and relevant stakeholders
- surveys with United and Wambo employees, contractors and suppliers to identify socio-economic linkages between United and Wambo and the wider region
- meetings with relevant local, State and Commonwealth government organisations and representatives to provide updates on the Project and discuss other relevant project and assessment matters
- publication of relevant Project information such as newsletters online (http://www.unitedcollieries.com.au/EN/ReportsandPublications/Pages/CommunityNewsletter.aspx).

6.14.3 Perceived Issues and Opportunities

A key component of a SIOA is understanding, from a community perspective, the perceived impacts and opportunities associated with the Project, as well as identifying broader community values and land uses associated with the assessment area.

Engagement with local landholders, community residents and key stakeholders has identified a number of issues of relevance to the Project, and in relation to the presence of mining in the area more broadly. Key issues are summarised in **Graph 6.1** and include: air quality and noise, blasting and visual impacts. Other issues raised related to sense of community, traffic, property value, future uncertainty associated with mining, local employment and other environmental issues such as water.



Graph 6.1

Landholder concerns about the Project

The communities in proximity to the United and Wambo mines have been exposed to mining since at least the 1960s, given the presence of the current operations and other mining operations in the locality. Consequently, impacts such as noise and air quality were frequently identified as important given existing and any further proposed operations.

Ensuring local employment was also raised as an area of concern regarding the Project. This concern may have been influenced by the perception that contracting work opportunities in the mining sector in the Hunter Valley in recent years have not been awarded to local contractors and businesses, but to those living outside local communities. United and Wambo are connected to the broader region through current social and economic linkages (e.g. employee place of residence, employee household expenditure, employee use of local services and participation in community life, supplier business linkages to the operations etc.). The TRC-Analysis for the Project has found that not only are United and Wambo highly linked to the township and LGA of Singleton, but they also have strong connections with other nearby towns such as Maitland, Cessnock and Newcastle. These locations tend to be where most employees and contractors live and consequently where a significant proportion of household expenditure and use of local services occurs.

In summary, the TRC-Analysis has indicated that:

- most employees and contractors of the existing United and Wambo operations live in Singleton, Maitland, Cessnock and Newcastle
- Singleton and Maitland benefit the most from employees' participation in community groups, households accessing health services, and employees' use of educational institutions
- it is estimated that employees contribute approximately $13.26 million per annum to various local, regional and state economies, with expenditure greatest in Singleton ($3.5 million per annum) followed by Maitland ($2.8 million per annum) and Newcastle ($2.3 million annum).

Further discussion of the economic impacts of the Project can be found in **Section 6.21**.

6.14.4 Evaluation of Social Impacts

To assess the social risks/impacts of the Project, social factors were rated as being of low, medium or high risk. Stakeholder perceptions of risk were also included in the assessment process, based on outcomes of the engagement program. **Table 6.45** summarises the assessed social risks associated with the Project. It is noted that following DPE's Voluntary Land Acquisition and Mitigation Policy (2014), seven significantly noise impacted private residences and one significantly dust impacted residence (also affected by noise) are likely to be afforded acquisition rights as part of any development consent for the Project. The analysis in **Table 6.45** focuses on the impacts on the community outside of the seven residences expected to be granted acquisition rights.

Table 6.45 Impact Assessment Summary

Project Aspect	Geographic scope	Stakeholders impacted	Perceived Stakeholder risk	Mitigated technical risk
Dust emissions – impact on social amenity	Local area	Local residents*	High	Medium
Noise emissions – impact on social amenity	Local area	Local residents*	High	Medium
Visual changes – impacts to social amenity	Local area	Local residents and Commuters	Medium	Medium
Blasting - impact on social amenity	Local area Singleton LGA	Residents of Warkworth	Medium	Medium
		Other local residents	Medium	Low

Project Aspect	Geographic scope	Stakeholders impacted	Perceived Stakeholder risk	Mitigated technical risk
Traffic – impacts on social amenity	Local area	Local residents Travellers	Low	Low
Land management and future land use	Local area Singleton LGA	Local Landholders and Other Land users Regional stakeholders Other mine sites	Medium	Low
Impact on Ecological values	Local area Singleton LGA Hunter region (bio-region)	Local residents Regional stakeholders Environmental NGOs Government agencies	Low	Medium
Impact on Water (ground and surface)	Local area Singleton LGA Hunter Catchment Hunter Region	Local residents Water users Wider community	Medium	Medium
Greenhouse gases	Global	Residents Business Government	Low	Low
Population Change	Singleton LGA Wider region	Regional stakeholders	High (positive)	Low
Housing and Infrastructure	Singleton LGA Wider region	Regional stakeholders	Low	Low
Sense of Community	Local area Singleton LGA	Local residents Wider community	Medium (positive)	Medium (positive)
Community sustainability	Local area	Local Residents Wider community	Low	Low
Cumulative impacts	Local area Wider region	Local Residents Wider community	Medium	Medium

* Note: Excludes residences that are expected to be granted acquisition rights.

As **Table 6.45** illustrates, the social amenity impacts of dust emissions and noise were rated as of *high* concern by stakeholders, and also rated as a *high* technical risk for residents of Warkworth, and *medium* for other local residents. Noise also rated as a *high* technical risk for residences in the Moses Crossing area.

Other social amenity impacts such as visual changes and blasting were rated as a *medium* perceived stakeholder concern, and were rated as a *medium* technical risk to residents of Warkworth (visual and blasting), and local residents and commuters (visual). Blasting was rated as a *low* technical risk to other local residents.

Traffic has been rated as a *low* perceived risk to stakeholders and as a *low* technical risk.

Land management and future land use was rated as a *medium* stakeholder concern, due to issues raised about current practices in regard to weed, pest and wild animal control; and preferences regarding return of land to grazing and farming. However, it was assessed as a *low* technical risk.

In terms of environmental assessed impacts, ecological impacts and greenhouse gases were not raised as concerns by stakeholders, and have therefore been rated as *low*. While the technical risk of greenhouse gases was also ranked *low*, the ecological technical impact has been rated as *medium.*

The impact on water (ground and surface) was ranked as a *medium* stakeholder perceived risk, as impacts to water quality and supply were noted. However, the technical assessed risk has been ranked as *low.*

With regard to population change impacts, there is anticipated to be up to a peak of 250 new operational employees and up to a peak of approximately 120 construction related employees required as part of the Project. The peak of up to approximately 250 additional operational employees will join a continuing workforce of up to 250, resulting in a total peak operational workforce of up to approximately 500 persons. Peak operational employee numbers are anticipated for the first six to seven years before decreasing to a total of 450 persons. Construction has an anticipated duration of approximately three years, with the peak occurring in years one and two.

Assuming consistent employment practices, the Project related workforce is anticipated to be demographically similar to the existing workforce, and required data to assist population modelling has been gathered through the TRC analysis summarised in **Section 6.14.3**. **Table 6.46** details the different workforce modelling scenarios showing the potential population change associated with the Project based on differing assumptions of how much of the new workforce will be made up of existing local people (ranging from 0-100 per cent local people).

Table 6.46 Workforce modelling scenarios

	100 per cent local (lowest change)	80 per cent local	50 per cent local	20 per cent local	0 per cent local (highest change)
Construction					
Approximate construction workforce to be recruited from outside the local area	0	24	60	96	120
Operational					
Approximate operational workforce to be recruited from outside the local area	0	50	125	200	250
Total persons moving into the area (operational workforce plus families)	0	175	438	700	875

In relation to the total population of the Singleton LGA and surrounding region, the technical impact of the possible quantum of incoming persons is assessed as *low*. However, as one of the key areas of interest is in relation to local employment, specifically employment of people who live in, or are related to people who live in, Jerrys Plains - stakeholder perceived concern is assessed as *high (positive).* The impact of population change on housing and infrastructure has been rated as *low* from a perceived stakeholder perspective and as a low technical risk.

Overall in relation to the sense of community within each of the neighbouring localities, it is considered that there is a perception that the Project may provide opportunities for improvement to the sense of community, largely driven by opportunities in Jerrys Plains. As such, the impact is considered *medium (positive)* from both a technical and stakeholder perspective.

With regard to community sustainability, the localities assessed, as well as the broader Singleton LGA, were considered to have a high level of community sustainability and as such, the technical risk to community sustainability as a result of the Project is considered *low*, with the perceived stakeholder risk also ranked as *low*.

Stakeholder concern about the cumulative impacts of numerous mining operations in the local area was rated as *medium*, with the assessed technical risk also ranked as *medium* primarily on the basis of dust, noise, visual and biodiversity impacts.

6.14.5 Management and Mitigation Strategies

Existing operational management strategies are discussed in the existing United Stakeholder Engagement Plan (SEP) and will be revised to incorporate the social strategies and management actions proposed to be implemented as part of the Project. The SEP will guide the implementation and evaluation of the social aspects of the Project. The SEP will also be revised to include a framework to monitor the effectiveness of the proposed strategies in mitigating negative social impacts and/or enhancing positive social impact over time.

The strategies and management actions proposed to be implemented by United through the SEP include:

- undertaking Project design to minimise impacts to near neighbours, where possible
- implementation of visual mitigation works early in the life of the Project (e.g. vegetation screening planted within the first two years of the Project)
- incorporation of productive agricultural land through rehabilitation planning
- ongoing implementation of a complaints response and management process
- ongoing operation of the United CCC
- a mechanism for ongoing management of the Project's community contribution program.

Wambo will undertake ongoing consultation regarding its operations, including ongoing operation of the Wambo CCC, ongoing stakeholder engagement and an ongoing local sponsorship program.

In addition to the Project SEP and Wambo's ongoing consultation, a number of opportunities exist that may have positive effects on the local communities surrounding the Project Area. The Project will require up to approximately 500 positions at peak production and new positions will become available as the Project develops and production increases. Recruitment for these positions will be advertised and managed as per the Glencore Recruitment Policy, with opportunities for maximising local employment to be incorporated into the Project recruitment strategy.

The Project will also negotiate a Voluntary Planning Agreement (VPA) with Singleton Council which will afford opportunities for the Project to contribute to programs designed to improve or address local community issues and perceived impacts through financial contributions to Singleton Council. Local community improvements have been highlighted in the Singleton Council Strategic Plan (2014), and further discussion will be held around prioritising the use of contributions in local areas around the project, as well as in the broader LGA. Areas of opportunity that United will actively consider for implementation as an outcome of the VPA process, through the SEP or as part of Glencore's ongoing community involvement program are provided in **Table 6.47**. These opportunities include some of those identified by local residents as part of the Project stakeholder engagement program.

Table 6.47 Areas of Community Contribution Opportunity

Opportunity	Relevant Mechanism for Evaluation
Jerrys Plains	
Effluent dumping facility for recreational vehicles	VPA
Youth services, such as sports and school programs	Glencore community involvement program
Ongoing engagement and curriculum development with Jerrys Plains School, such as school excursions of nearby mine/Project operations	Glencore community involvement program
Improving public spaces, including beautification of the main streets, funding for playground equipment, shade and seating in parks	VPA

Opportunity	Relevant Mechanism for Evaluation
Community service infrastructure and facilities, including measures such as the reinstatement or other beneficial use of the post office, sewer line connection, weather station	VPA
Provision of a medical service (such as a nurse who does weekly visits, or installation and maintenance of an Automatic External Defibrillator – AED in an accessible location)	Glencore community involvement program
Offering of community courses (such as first aid or fire safety)	Glencore community involvement program
Installing town signage	VPA
Regular cleaning of dust impacted water tanks at nearby residences	United has committed to undertake this as discussed in **Section 6.20**.
Ongoing community BBQs	SEP
Warkworth	
Contribution to maintenance of Jim Johnstone oval	VPA
Maintenance of Warkworth community hall	VPA
Development of a booklet that documents the history and heritage of Warkworth to be kept in the Singleton Library, so that important stories and heritage of Warkworth are not lost	SEP

Further details on these potential management strategies and other recommendations are provided in **Appendix 4**.

A further key aspect of any social impact assessment is the development of a framework to monitor a project's impact over time – often referred to as a social impact management plan. United will collect social data to monitor commitments made in the social impact assessment namely:

- Key areas of predicted Project impact, including:
    - perceived and experienced social impacts, through consultation with neighbouring and other nearby landowners, to ensure that experienced impacts are in line with predicted impacts of the Project
    - periodic review and evaluation of management practices on mine owned land, including the land around the Project.
- Changes in the local social and economic context, through the collection of relevant census and social indicator data at appropriate levels of analysis across the study areas.

- Monitoring of the social and economic contributions of the operation in the community through periodic implementation of workforce and supplier surveys (e.g. TRC-Analysis):
    - It is also recommended that a follow up survey of the new operational workforce be undertaken to determine the workforce flows of local and incoming workers to the site, in order to better inform future assessments.
- Evaluation of actions and investments to assess the outcomes of key projects and programs arising from:
    - commitments made within the SIOA
    - any wider community development or partnership programs at an operational or corporate level
    - the VPA for the Project.
- Development of a program for monitoring any other social impacts predicted in the current assessment and identification of any unforeseen social impacts, should they occur.
- Consideration of SIOA outcomes in the ongoing refinement of the site specific engagement strategy to ensure that relevant stakeholders, including neighbouring and nearby landholders, are properly informed regarding current and future operations.

6.15 Transport and Traffic

The SEARS for the Project require an assessment of the likely transport impacts of the development on the capacity, condition, safety and efficiency of the local and State road and rail networks, having regard to RMS's and Singleton Council's requirements and paying particular attention to the proposed realignment of the Golden Highway (refer to **Table 4.3**).

A comprehensive Traffic Impact Assessment has been prepared by Transport and Urban Planning Pty Ltd in accordance with the SEARs to assess the road traffic impacts of the Project. This report is included in **Appendix 17** and the key findings are outlined in **Section 6.15.1**. An assessment of the rail traffic impacts of the Project is provided in **Section 6.15.2**.

During the extensive consultation process undertaken for the Project, concerns regarding general increases in road traffic were raised by the community. Further details regarding the traffic issues raised in the consultation process are provided in **Appendix 4**.

6.15.1 Road Traffic

6.15.1.1 Existing Traffic Conditions/Traffic Volumes

The principal road network that provides access to the Project includes the Golden Highway, the Wambo Access Road and the United access roads (refer to **Figure 6.60**). The Project will be accessed primarily via the existing Wambo Access Road. United access roads will be used in the initial phase for construction and ancillary services with limited ongoing use as property access points.

Other minor roads in the area include Wallaby Scrub Road and Comleroi Road (refer to **Figure 6.60**). Wallaby Scrub Road has been approved for closure in 2017 (without relocation) as part of the Warkworth Continuation Project (SSD-6464). A detailed description of the existing road network is provided in **Appendix 17**.

As part of the Traffic Impact Assessment for the Project, traffic counts on the road network were undertaken to establish current traffic volumes. Daily volume and vehicle classification counts were undertaken for the seven day (week) period between 10 and 16 October 2015. This included daily volume and vehicle classification counts at two locations on the Golden Highway, east of the Wambo Access Road and west of the Wambo Access Road. The existing traffic volumes obtained from these traffic count surveys are summarised in **Table 6.48**.

Table 6.48 Two Way Traffic Volumes and Vehicle Classification

Road	5 Day Average (Weekday)			7 Day Average (ADT)		
	Light[1]	Heavy[2]	Total	Light[1]	Heavy[2]	Total
Golden Highway East of Wambo Access Road	3606	786	4392	3351	641	3992
Golden Highway West of Wambo Access Road	2583	646	3229	2515	537	3052
Wambo Access Road	1014	144	1158	827	107	934

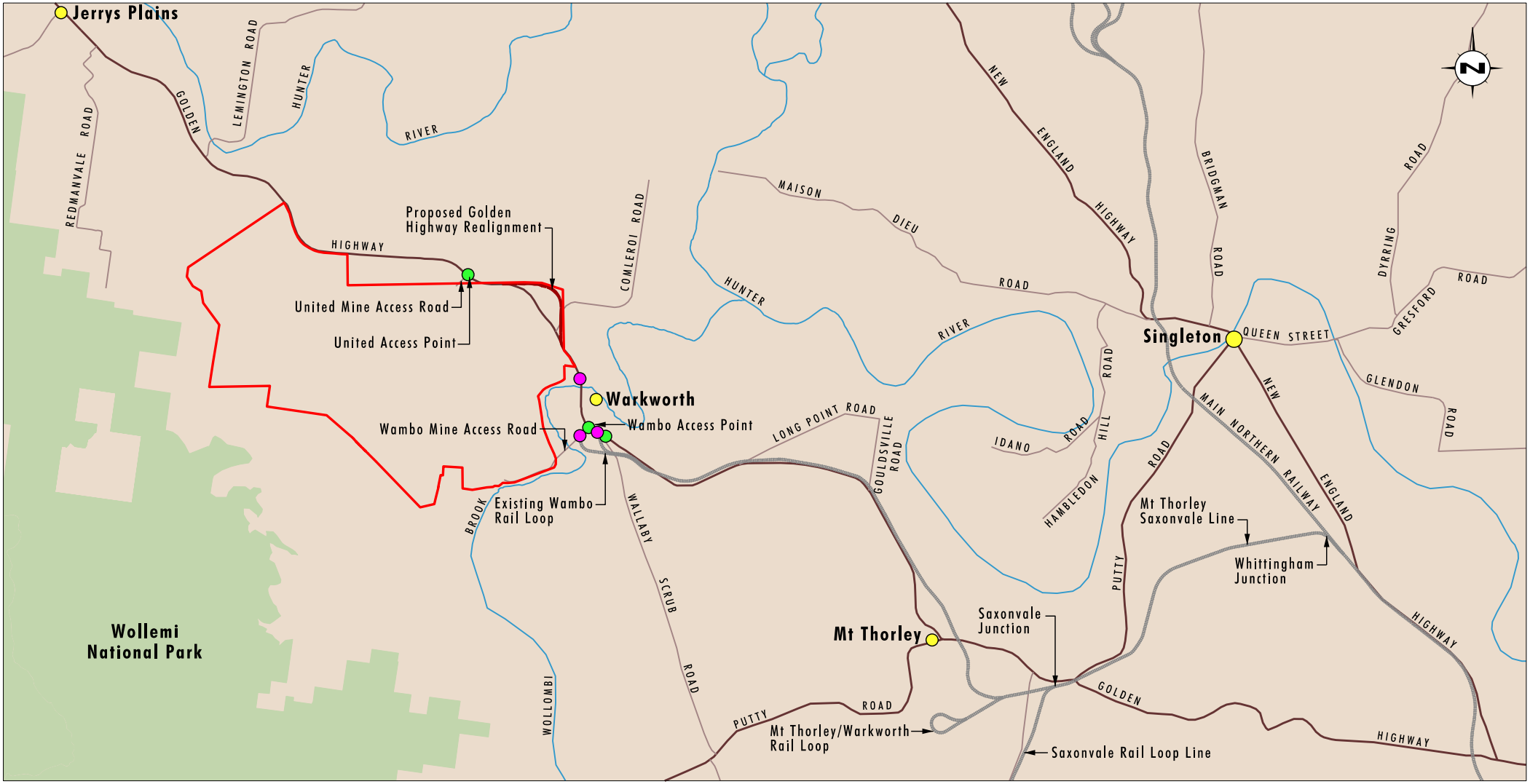
Source: Traffic Counts undertaken 10-16 October 2016

[1]Light Vehicles – Austroads 1 and 2 vehicle classification and motorbikes

[2]Heavy Vehicles – Austroads 3-12 vehicle classifications

Heavy vehicles (Austroads Class 3-12 vehicles) represent approximately 17.9 per cent – 20 per cent of the total vehicles using Golden Highway and 12.4 per cent of the total vehicles using the Wambo Access Road on an average weekday.

Weekdays have the highest traffic volumes with the existing road network experiencing peak hour flows generally between 5.30 am and 6.30 am and between 3.30 pm and 4.30 pm.



Data Source: LPMA (2009)

0 2.0 4.0 6km
1:120 000

Legend

- Project Area
- National Park
- Main Road
- Minor Road
- Railway
- AM & PM Peak Hour Traffic Counts at Intersections
- Daily Volumes and Vehicle Classifications

FIGURE 6.60

Road and Rail Network

File Name (A4): R06/3509_409.dgn
20160413 17.28

Principal Intersections and Current Performance

Intersection turning volume counts were undertaken on Tuesday 13 October 2015 from 5.30 am to 9.00 am and 2.30 pm to 6.00 pm at the intersections of:

- Golden Highway/Wallaby Scrub Road
- Golden Highway/Wambo Access Road
- Golden Highway/United Access Road.

The locations of these principal intersections are illustrated in **Figure 6.60**.

The principal intersections experience peak traffic volumes generally between 5.30 am and 6.30 am and between 3.30 pm and 4.30 pm. The morning peak hours varied between the intersections with highest hourly vehicle volumes occurring at the Wambo Access Road and Wallaby Scrub Road intersections between 5.30 am and 6.30 am and at the United Access Road between 6.30 am and 7.30 am.

The Golden Highway in this section carries relatively low east and westbound through volumes in the morning peak hours. Traffic volumes during the afternoon peak hour are slightly higher than the morning peak, however are still relatively low in real terms.

During the morning peak, the left turn into the Wambo Access Road from Golden Highway numbered 156 vehicles per hour (vph) while the right turn into the mine from Golden Highway numbered 16 vph. Turning volumes out of Wambo Access Road during the afternoon peak hour numbered 104 vph turning right to travel east and 10 vehicles turning left to travel west.

Observations during the morning and afternoon peak hours at all the above intersections confirm that traffic conditions are good with large gaps occurring in the main traffic flow along the Golden Highway to allow for traffic turning onto the highway from minor roads, or turning from the Golden Highway onto minor roads.

6.15.1.2 Potential Road Traffic Impacts of the Project

Realignment of the Golden Highway

As discussed in **Section 3.9.1**, the Project will require the realignment of a 2 kilometre section of the Golden Highway west of Comleroi Road. The realignment will affect the existing intersection of Comleroi Road with the Golden Highway and this will be taken into consideration when the detailed design for the proposed realignment works is prepared in consultation with RMS and, in regard to the Comleroi intersection, Singleton Council.

The conceptual Golden Highway realignment is shown on **Figure 3.20.** The realigned road will be designed and constructed to Austroads and RMS requirements and will include two 3.5 metre wide lanes with 2.0 metre shoulders. The proposed realignment will have minimal impact on travel distances and will retain the current 100 km/hr speed limit. The proposed realignment will be approximately 800 metres longer than the current section of the road, resulting in an increase in travel time of approximately 30 seconds.

As the proposed realignment of Golden Highway will be designed and constructed to Austroads and RMS requirements, it is expected that the realigned section will operate effectively without resulting in significant impacts on traffic.

United has consulted with RMS in relation to the proposed realignment. As part of the implementation of the Project, a detailed concept design will be prepared for the realignment of the Golden Highway in consultation with RMS and submitted to RMS for its agreement. A detailed design will then be prepared for RMS authorisation prior to construction commencing.

Additional Workforce

The Project will require a peak operational workforce of up to approximately 500 people. In the order of 250 employees/contractors of the Project's operational workforce are planned to be drawn from the existing Wambo Open Cut operations and therefore the additional operational workforce for the Project will be up to approximately 250 persons, likely reducing to up to an additional 200 persons in the latter years of the Project.

The Traffic Impact Assessment has also considered the Wambo Underground Mine and CHPP workforce which also use the Wambo Access Road.

The Project will require an additional construction workforce of approximately 120 persons for a period of approximately 18 months at the commencement of the Project. Construction traffic will typically occur between 6.00 am and 6.00 pm weekdays, with some works undertaken outside these hours where there is a requirement to sustain the operational integrity of public infrastructure.

The expected peak traffic volumes generated by the Project will be associated with shift change times, which are expected to occur at 7.00 am and 7.00 pm. These expected shift change times do not coincide with those of the Wambo Underground Mine workforce.

6.15.1.3 Operational Traffic Impacts

During the operational phase of the Project, the greatest potential for impact will occur on weekdays between 6.30 am and 7.30 am and be associated with shift change time which will occur at 7.00 am. It is noted that this does not coincide with the current morning peak hour for the Golden Highway and Wambo Access Road which occurs between 5.30 am and 6.30 am.

During the period 6.30 am to 7.30 am, the day shift workforce and contractors, plus the staff and managers, will arrive at the mine and the night shift workers will depart. It is estimated that there will be a total of approximately 238 worker trips (148 in/90 out) as well as an additional approximately two heavy vehicles entering and exiting the mine during this hour.

Not all of these trips are new trips to the mine, as a proportion of the Project's workforce will be drawn from the existing workforce of Wambo's Open Cut (refer to **Section 3.0**). These personnel currently arrive/depart the mine during the morning and afternoon peaks, between the 5.30 am to 6.30 am and 3.30 pm to 4.30 pm periods. The transfer of these personnel to the Project will result in a reduction in the volume of traffic during the existing morning and afternoon peak hours as a result of the difference in shift times.

The afternoon peak for the Project is spread over a longer period than the morning peak, with the departure of contractors, managers, administrative and operational staff spread between 3.30 pm and 7.30 pm.

Impacts on Key Intersections

To examine the impacts of the additional traffic associated with the operational phase of the Project on the principal intersections of the adjacent road network, SIDRA traffic modelling was undertaken for the Year 1 and Year 11 morning and afternoon peak periods. The modelled morning peak was 6.30 am to 7.30 am, to coincide with Project shift change times. The modelled afternoon peak hour was 5.00 pm to 6.00 pm to coincide with the departure of managers and administrative staff and higher traffic volumes of the Golden Highway.

As noted in **Section 6.15.1.1**, the Warkworth Continuation Project has approval to close Wallaby Scrub Road in 2017 without relocating it. For the purposes of this assessment it has been assumed that Wallaby Scrub Road may still be open in Year 1 of the Project (indicatively 2018), but will be closed in future years, with no intersection retained at the Golden Highway.

The modelling has adopted the existing channelisation and traffic management at the Golden Highway intersections with Wambo Access Road and Wallaby Scrub Road, as well as the morning and afternoon traffic volumes. Background traffic growth of 2.6 per cent per year has been included in the modelling.

SIDRA assesses the operational performance of intersections under traffic signal, roundabout or sign control. RMS Guidelines indicate that a Level of Service D operation or better (i.e. A, B, C or D) is desirable design criteria for intersections.

The results of the traffic modelling for the Golden Highway intersections with the Wambo Access Road and Wallaby Scrub Road in Year 1 show that both intersections will operate at a very good level of service (a Level of Service A operation) with very low vehicle delays occurring at both intersections, with the Project in place.

Modelling results for Year 11 at the Golden Highway/Wambo Access Road intersection show that traffic conditions at this intersection will continue to remain very good with a Level of Service A operation and low vehicle delays, with the Project in place.

In summary, the principal intersections on the road network adjacent to the Project will continue to operate at very good levels of service with the Project in place. The Traffic Impact Assessment found that no traffic impact mitigation measures are considered necessary to accommodate the additional traffic associated with the Project.

Impacts on the Golden Highway and the Wider Road Network

The impact on the Golden Highway east and west of the Project Area and on the wider road network is expected to be relatively minor. Two way weekday volumes in the Golden Highway east of the Wambo Access Road will increase by approximately 6.4 per cent and 1.1 per cent over the existing weekday volumes using the Golden Highway, east and west of Wambo Access Road.

Traffic conditions on this section of the Golden Highway are relatively good and the additional traffic from the Project will not alter this. Similarly the impacts on the wider road network are expected to be satisfactory.

As discussed in **Section 6.7**, blasting as part of the Project will be managed to comply with the relevant criteria so that no damage occurs to the Golden Highway or other public roads. As also discussed in **Section 6.7**, the Project will require periodic closures of the Golden Highway due to blasting near the road, with closures due to the Project to be limited to one per day. A Road Closure Management Plan will be prepared for the Project in consultation with the RMS and Singleton Council.

Cumulative Impacts

The assessment of operational traffic impacts included background traffic growth of 2.6 per cent per year. This background traffic growth is considered adequate to account for the cumulative impact of other projects in the region that have been approved, but have not yet commenced. The assumed growth rate of 2.6 per cent per year is considered conservative given that future traffic volume increases on the road network are likely to be lower than annual increases over the last decade. The Traffic Impact Assessment found that the principal intersections in the vicinity of the Project have significant spare capacity and could easily absorb higher traffic volumes if these occurred.

Road Safety

The Project is not expected to have any adverse impacts on the safety of the road network. While there will be an increase in traffic using the Wambo Access Road intersection with the Golden Highway, the increase does not coincide with the current peak hours for this intersection and the traffic conditions at this intersection are expected to remain satisfactory in terms of level of service and vehicle delays. Other adjacent intersections on the Golden Highway carry relatively low traffic volumes.

The proposed realignment of the Golden Highway and any associated changes to the Comleroi Road intersection will be designed and constructed to RMS requirements and Austroads standards and therefore are not expected to have any adverse impact on road safety.

Construction Traffic Impacts

The greatest potential for impact associated with construction will occur on weekdays before 6:00 am and after 6:00 pm. The maximum number of light vehicle trips associated with the construction workforce will be approximately 100 vehicle arrivals before 6.00 am and approximately 100 vehicle departures after 6.00 pm. Heavy vehicle trips generated during construction will be a maximum of 60 heavy vehicles per day (i.e. 60 in/60 out) during the construction of the Golden Highway realignment.

The hour between 5.30 am and 6.30 am is expected to have the highest traffic volumes during construction. These times do not coincide with the shift times for the operational workforce of the Project, however, do coincide with the existing morning peak hour for the Golden Highway and Wambo Access Road intersection.

SIDRA traffic modelling has been undertaken on the Golden Highway intersections of the Wambo Access Road and Wallaby Scrub Road to assess the impacts of the construction traffic on these intersections. Results indicate that both intersections will continue to operate at very good levels of service, retaining a Level of Service A operation and low vehicle delays. Based on this, the impacts on the adjacent principal intersections during construction are considered to be satisfactory.

There will also be some use of the United main access road intersection with Golden Highway during the early stages of construction by some construction vehicles. The use of this intersection by some construction vehicles will be easily accommodated, with minimal impact on traffic conditions at the intersection, due to the high level of capacity that is available at this intersection.

Road Traffic Management Commitments

United will prepare a detailed concept design for the proposed realignment of the 2 kilometres section of the Golden Highway west of Comleroi Road, in consultation with RMS. The proposed realignment will be designed and constructed in accordance with Austroads and RMS standards following approval by the RMS. The proposed realignment road section will retain two 3.5 metre wide travel lanes with 2 metre wide road shoulders and will be designed to retain the existing 100 km/h speed limit.

A construction road traffic management plan will be developed in consultation with Singleton Council and RMS prior to the commencement of construction activities. The plan will identify the measures to be implemented to manage potential construction related traffic impacts, including any temporary construction access points.

6.15.2 Rail Infrastructure

6.15.2.1 Existing Rail Conditions and Project Train Movements

The existing approved Wambo rail loop and train loading facility (refer to **Figure 6.60**) that are owned and operated by Wambo will be used to transport coal produced by the Project. The rail loop and train loading facility is approved to transport up to 15 Mtpa product coal until 2025. The Project does not seek to increase or change the approved maximum annual coal volumes transported via the facility. The Project does, however, seek to extend the approved life of the rail loop and train loading facility to match the life of the Project and increase the maximum number of daily train movements from six to eight trains to allow flexibility in managing rail movements on the line. As the approved maximum capacity of the train loading facility will remain unchanged, there will be no change to maximum annual train movements.

The Main Northern Railway line is located approximately 17 kilometres to the south east of the Project Area. It connects the Port of Newcastle with the Hunter and New England regions and provides the primary transport infrastructure for the movement of coal produced in the Hunter Coalfields. The existing Wambo rail loop is accessed from the Main Northern Railway line via the Whittingham Junction. From the Whittingham Junction, empty trains destined for the Wambo train loading facility travel along the Mt Thorley/Saxonvale Line and onto the existing Wambo rail spur and loop. The Mt Thorley/Saxonvale Line is shared by trains travelling to and from the Bulga Coal and MTW mining operations.

6.15.2.2 Impact on Existing Rail Network

As identified in **Section 6.15.2.1**, the Project will not result in an increase in the maximum coal volumes transported from the site or total annual train movements from the Wambo train loading facility. The Project will, however, result in an additional 14 years of coal production and transport along the Main Northern Rail Line.

The Project is not expected to have any negative impacts on the operation of the rail network, due to the increased production life of the Project already having been factored into the capacity planning for the network.

Other Rail Users

As identified in **Section 3.0**, the Project does not propose an increase in total annual train movements from the Wambo train loading facility. The Project does, however, seek to increase the maximum daily train movements from the facility from six to eight in order to match the available train paths available on the network. This will provide additional flexibility in managing train movements within the available capacity on the line.

The Project is therefore not anticipated to cause any delays to other users of the Mt Thorley/Saxonvale Line or the Whittingham Junction. Wambo, as operator of the train loading facility, will continue to consult with other users of rail infrastructure throughout the life of the Project.

Rail Safety

The Project will not directly impact on the rail network other than through the use of the network for the transport of coal in a manner that is consistent with the current approved operations of the Wambo train loading facility (i.e. no change in approved annual transport volumes). All coal will be transported using licensed operators on the ARTC network, which are required to meet all rail safety requirements. Therefore the Project is not predicted to result in any impacts on rail safety.

6.16 Hazard

As outlined in **Section 4.2.2**, SEPP 33 – Hazardous and Offensive Development provides for the strategic assessment of major hazardous and offensive developments. The SEPP requires consent authorities to consider whether a proposed development is hazardous or offensive prior to granting approval. A Preliminary Hazard Analysis has been completed for the Project and is included in **Appendix 18**. A summary of the key findings of the analysis are included below.

The types and quantities of hazardous materials to be stored on site as part of the Project are expected to be consistent with those currently used at the existing Wambo mine, however, the storage locations of these hazardous materials may change throughout the life of the Project. The potential impacts to off-site land users as a result of the relocation of the hazardous material storages therefore requires assessment. Due to the increase in annual ROM coal tonnage from the open cut operations, the Project will also result in an increase in the frequency and quantity of hazardous materials being transported to the site by approximately 25 per cent.

The assessment of the potential hazard associated with these changes was undertaken in accordance with NSW *Hazardous Industry Planning and Assessment Guidelines* (NSW Department of Planning (DoP) 2011).

Under SEPP 33 a preliminary risk screening of a proposed development is required to determine the need for further assessment via a Preliminary Hazard Analysis (PHA) (refer to **Appendix 18**). The preliminary risk screening compares the proposed hazardous material storage quantities, as well as transport frequencies and quantities, with SEPP 33 screening thresholds.

The risk screening process indicated that, for the purposes of SEPP 33, the Project is potentially hazardous due to the relocated storages for Class 1.1 explosives and Class 5.1 oxidising materials (Technical Grade Ammonium Nitrate (TGAN) and Ammonium Nitrate Emulsion (ANE)) requiring a PHA to be prepared (refer to **Appendix 18**).

In regard to the assessment of hazardous materials transport, the estimated number of traffic movements for class 5.1 materials exceeds the annual transport screening threshold and therefore triggers SEPP 33 with regard to transportation. As a result, a transport route evaluation was prepared as part of the PHA for the delivery of Class 5.1 materials to the Project.

6.16.1 Hazardous Materials Storage

United has identified that it may be necessary to relocate the hazardous materials storage facilities as the mining operation progresses. This relocation would be undertaken to provide ready access to these materials for use in the mining operations and to allow for ongoing development of the overburden emplacement areas. The facilities would be relocated into a suitable location within the Project mining area, with several relocations potentially required over the life of the Project. To ensure the risks posed to the surrounding land users associated with the relocated storages are appropriately mitigated, the hazard analysis identified the required buffer distances between the hazardous materials stores and land ownership boundary. When the hazardous materials storage facilities are relocated it will be to a location within the Project mining area that provides for the required buffer distances to be achieved.

Table 6.49 shows the required separation distances from off-site land users to ensure no off-site impacts associated with the hazardous materials storages. **Appendix 18** outlines the areas suitable for hazardous materials storage within the Project Area noting that due to operational needs, it is likely that these storage facilities will be relocated several times during the life of the Project.

Table 6.49 Minimum Separation Distances

Storage	Hazard	Minimum Distance to Off-Site Land User (m)
Class 1.1	Explosion	320 [1]
Class 5.1	Toxic release	1300 [2]

Note 1: Based on *Applying SEPP 33* Figure 5 – Class 1.1 Explosives Overpressure Effects

Note 2: Based on *Multilevel Risk Assessment* IAEA Table III – Effect Categories – Maximum Distance and Area of Effect

With the incorporation of these minimum buffer distances into the design of the relocated storages, the assessment of risk associated with the storage of hazardous materials found that the level of risk to surrounding land users is tolerable. Therefore, the Project is not hazardous as defined by SEPP 33.

6.16.2 Hazardous Materials Transport

A route selection study was undertaken following the Hazardous Industry Planning Advisory Paper 11 *Route Selection* for the transport of solid technical grade ammonium nitrate (TGAN) and ammonium nitrate emulsion (ANE) to the Project. The purpose of a route selection study is a relative ranking of each route alternative rather than comparison with a given risk criteria.

Two route options were assessed for the transport of TGAN from Kooragang Island, NSW to the Project. The first route assessed passed along the Newcastle Inner City Bypass, through Wallsend along Newcastle Road and onto Link Road to the Hunter Expressway. The second route passed along the Pacific Highway to John Renshaw Drive near Beresfield and onto the Hunter Expressway. Taking into account the exposure to different land use types, population densities, the likelihood of incidents for different road types and evacuation rates, the route selection study indicated that the alternate routes for TGAN transport posed approximately the same level of risk to the public.

ANE may be delivered from a range of alternate locations. Two alternate routes were considered for the assessment of transport of ANE to the Project (selected for assessment purposes only considering current supply locations). The supply locations assessed were Mount Thorley and Liddell. Taking into account the exposure to different land use types, population densities, the likelihood of incidents for different road types and evacuation rates, the route selection study indicated that the alternate routes for ANE transport posed approximately the same level of risk to the public. The levels of risk for transport of ANE from other supply locations are likely to be of a similar magnitude to the risk of transport from Mount Thorley and Liddell.

It is noted that the Project will not have direct control over the delivery of hazardous materials to the mining operations as it will be undertaken by a supply contractor. To assist in mitigating transport risk, the Project will select hazardous materials supply contractors that are approved carriers of dangerous goods and have suitable safety management systems to ensure the safe transport of hazardous materials.

6.16.3 Hazard Management

The control of risks is a continuous process where strategies are put into place to eliminate risks wherever possible. Where elimination is not possible, strategies are put in place to mitigate the residual risks identified using appropriate control measures, safeguards and procedures; and, lastly, strategies are put in place to manage impacts should the hazardous event occur.

The qualitative risk assessment undertaken for the Project identified a range of technical control measures and non-technical safeguards and procedures that will be put in place to eliminate or mitigate the level of risk associated with the operation of the facility.

The technical control measures that will be implemented as part of the Project include:

- locate the Class 5.1 explosives and Class 1.1 storages in accordance with the buffer distances specified in **Section 3.8.3**
- design of diesel tanks and refuelling systems in accordance with relevant standards and codes
- design of hazardous materials storage area surface drainage systems to prevent spills or runoff from storage areas entering surrounding land/waterways, and
- storage of dangerous goods in dangerous goods compliant stores (in accordance with relevant Australian Standards) and appropriate segregation of incompatible dangerous goods.

The non-technical safeguards and procedures that will be implemented as part of the Project include:

- preparation of emergency response plans and security plans in consideration of the relocated storages
- implement appropriate housekeeping to minimise combustible materials within 30 metres of Class 5.1 and Class 1.1 storages
- on site speed limits and designated traffic flow directions to consider new storage locations
- all equipment/vehicles associated with the handling of Class 5.1 and Class 1.1 materials are to be regularly inspected and maintained fit for duty in accordance with relevant standards
- all personnel involved in the handling and storage of Class 5.1 and Class 1.1 materials are to be appropriately trained
- ongoing implementation of appropriate hot work/safe work procedures for works in the vicinity of hazardous materials, and
- requiring hazardous material delivery contractors to put in place appropriate measures to minimise transport risks, including risk mitigation measures and route selection considerations, as part of the procurement process for hazardous materials.

6.17 Bushfire

The SEARs for the Project require an assessment of public safety paying particular attention to potential bushfire risks applicable to the Project Area (refer to **Table 4.3**). This section of the EIS provides a bushfire assessment, including a description of existing management practices at both Wambo and United, assessment of potential bushfire hazards applicable to the Project Area and details of the proposed bushfire management for the Project.

Bushfire risk is currently managed within the Project Area through the Wambo Bushfire Management Plan 2013 (Wambo BMP) and the United Bushfire Management Plan (United BMP). These existing management plans have been developed in consultation with the NSW Rural Fire Service (RFS) and Singleton Council. The RFS was consulted in relation to the Project (refer to **Section 5.0**).

Substantial vegetation clearing has previously been undertaken across the Project Area due to the existing approved mining operations and a history of mining and agricultural land uses. Parts of the Project Area are identified as containing bushfire prone land by Singleton Council's Bushfire Prone Land map (Singleton Council 2013b) (refer to **Figure 6.61**). It is noted that active operational areas in the Wambo Open Cut continue to be mapped as bushfire prone, although they have now been cleared of vegetation and the approved Wambo Surface Development Area will be subject to further clearing activities. The most significant potential bushfire threat to the Project Area is from the west of the Project Area within the Wollemi National Park, which supports forest vegetation and a potentially significant fuel load capable of sustaining and spreading bushfire. Areas of forest/woodland vegetation formations to the east and southeast of the Project Area also represent a potential linkage between vegetated areas within and adjoining the Project Area, which has the potential to support the spread of bushfire.

6.17.1 Existing Bushfire Management

The objectives of the Wambo BMP are to:

- mitigate the risk of a bushfire outbreak
- mitigate the risk to all personnel, contractors and associated people on Wambo land from bushfires
- ensure that Wambo assets are to all possible extent protected from damage from fires starting either in or outside the mine site
- take steps to mitigate the risk of bushfire outbreak migrating to adjacent properties, and communities from Wambo owned lands
- mitigate the risk of a bushfire outbreak impacting on Aboriginal and European heritage sites, and threatened or endangered flora and fauna located within the mine site from fire damage
- document preventative strategies to reduce the risk of occurrence of unplanned bushfires.

The United site is currently managed in accordance with the United BMP which incorporates the following bushfire management measures:

- conducting regular surface slashing around critical infrastructure
- maintaining roadways and tracks around the operations in order to provide an effective fire break
- provision of on-site surface water facilities for bushfire management as required
- providing a ring main fire system to respond to any fires that occur on the surface.

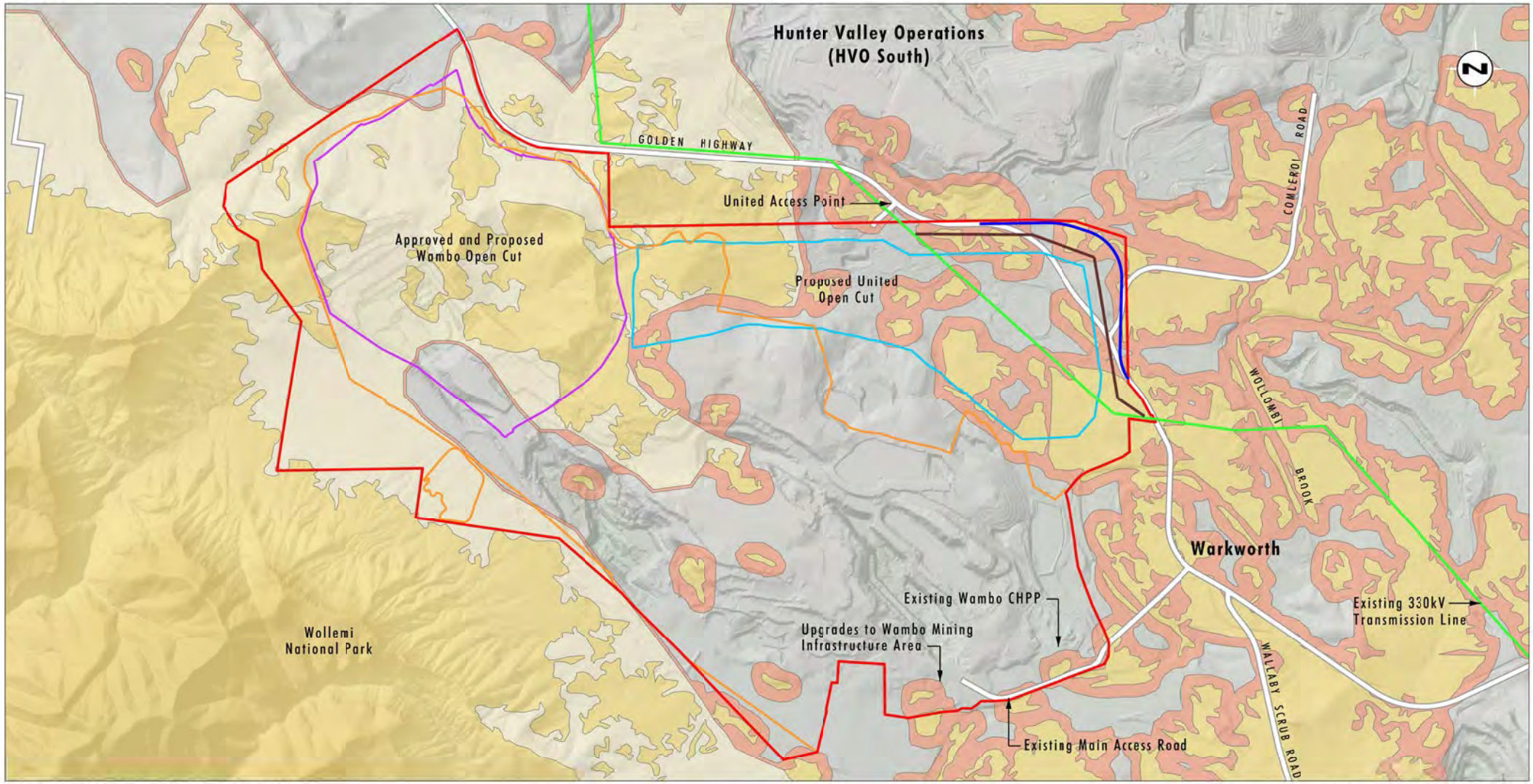


Image Source: AAM (2012), United (2015)
Data Source: Glencore (2015), Singleton Council (2013)

0 1.0 2.0 2.5km
1:50 000

Legend

- Project Area
- Approved Wambo Surface Development Area
- Proposed Conceptual United Open Cut Pit
- Proposed Conceptual Wambo Open Cut Realignment
- Proposed Golden Highway Realignment
- Existing 330kV Transmission Line
- Proposed Relocated 330kV Trarsmission Line
- Bushfire Buffer
- Category 1 Bushfire Prone Land
- Category 2 Bushfire Prone Land

FIGURE 6.61

Singleton Council Bushfire Prone Land Map

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6.17.2 Bushfire Threat Assessment

A bushfire threat assessment identifies the bushfire threat across the Project Area based on the likely response of fire to fuel loads, slope and aspect. The assessment involves assessing the vegetation formations and the slope of the land to determine the appropriate Asset Protection Zones (APZs) for the Project as required in accordance with the methods prescribed in Planning for Bushfire Protection (PBP) 2006 (NSW Rural Fire Service 2006). It is noted that PBP 2006 was developed to provide a guide to the necessary planning considerations when developing areas for residential use which are likely to be affected by bushfire. Similarly, no specific set back distances are prescribed for industrial buildings in bushfire prone areas, nor does the Building Code of Australia (BCA) provide any bushfire performance requirements for Class 5 – 8 and 10 buildings (including offices, car park, trade buildings, non-habitable buildings etc.). Notwithstanding, all development is required to be consistent with the aims and objectives of PBP. While the requirements of PBP 2006 do not specifically apply to a Project of this nature, the methods for calculating APZs have been used as a guide in the assessment for the Project.

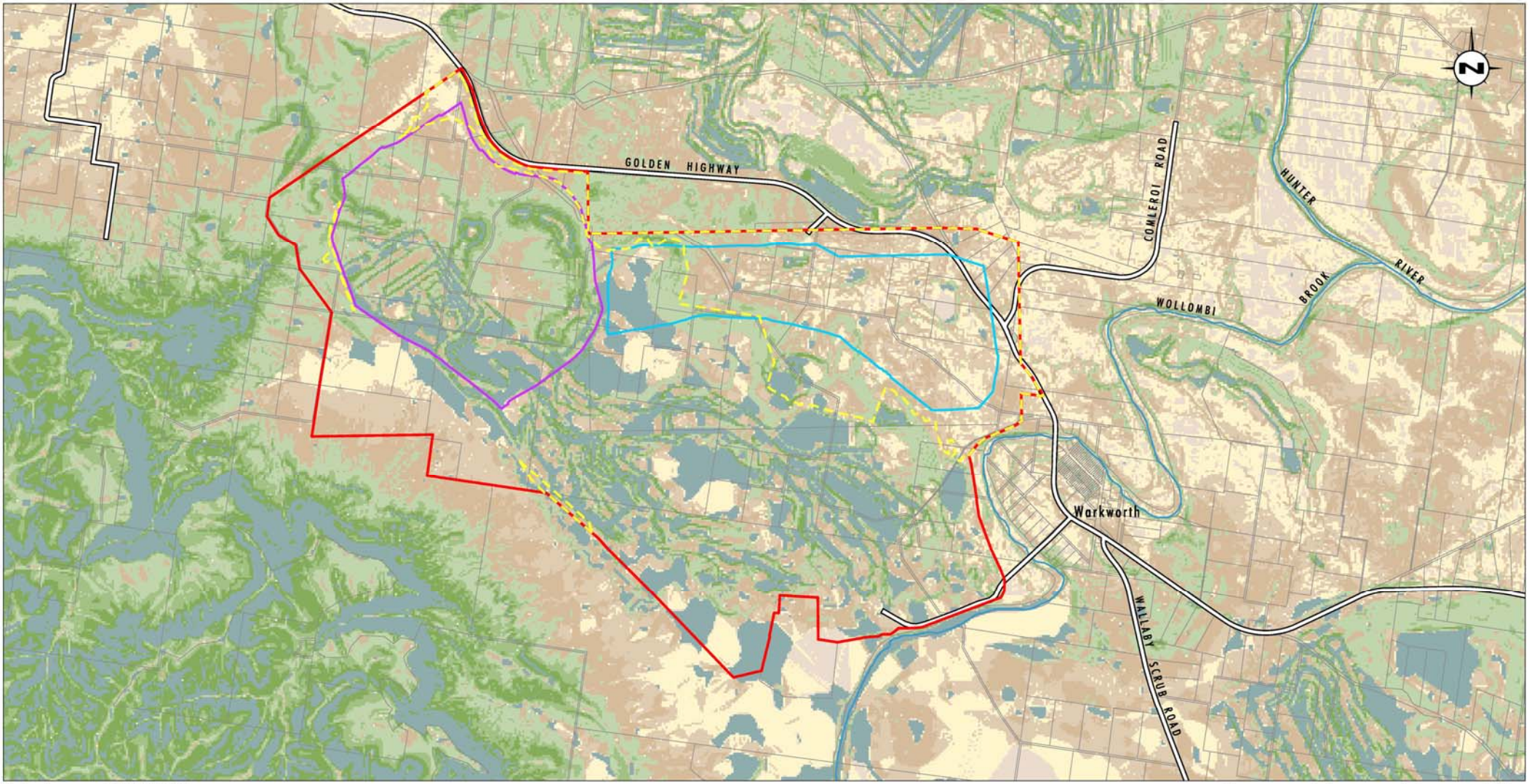
6.17.3 Vegetation Formations

As previously discussed, the majority of the Project Area has been subject to extensive vegetation clearing as a result of the existing mining operations, infrastructure corridors and agricultural clearing. The existing infrastructure areas at Wambo and United are surrounded by cleared areas/grassland and remnant woodland/forest vegetation formations (refer to **Section 6.9**). The remainder of the Project Area is subject to existing mining operations with forest vegetation in the northwest and along the western/southern boundary which joins the Wollemi National Park. Vegetation formations play a key role in bushfire behaviour, with woodland and forest vegetation formations representing a large fuel load due to the presence of understory vegetation, leaf litter and treed vegetation, and providing a significant connection between the trees within the canopy. It should be noted that the existing vegetation within the disturbance area will be subject to extensive clearing as part of the Project which will reduce fuel loads across the Project Area.

6.17.4 Slope Analysis

The gradient of a slope directly influences the rate of spread of a bushfire. Bushfire will accelerate when travelling uphill due to the fire preheating the fuel source through radiation and convection. The speed of a bushfire will increase as the slope of the land increases.

The topography across the majority of the Project Area is generally undulating to hilly with 0 to 5 degree slopes, with the exception of some areas with steep slopes associated with drainage lines and existing operational areas. The existing infrastructure area at United is located on the northeast side of the Project Area in an area generally ranging in slope from 0 to 5 degrees (refer to **Figure 6.62**). It is noted that this infrastructure will be removed as mining progresses on site. The existing infrastructure areas at Wambo are generally located within areas which have a 0 to 5 degree slope with the exception of drainage lines and areas modified by mining operations.



Data Source: OEH (2013)

0 1.0 2.0 3.0km
1:60 000

Legend

- Project Area
- Conceptual Additional Disturbance Area
- Proposed Conceptual United Open Cut Pit
- Proposed Conceptual Wambo Open Cut Realignment

Slope Ranges:

- <1%
- 1-3%
- 3-5%
- 5-10%
- 10-20%
- 20-33%
- 33-50%
- >50%

FIGURE 6.62

Slope Analysis of Project Area based on Existing Topography

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6.17.5 Asset Protection Zones

PBP 2006 states that 'where a bushfire hazard exists on or adjacent to a development site, an Asset Protection Zone (APZ) is to be established between the hazard and the asset'. Essentially, an APZ is a fuel reduced area surrounding a built asset or structure which minimises the impact of fire on that asset. APZs should be maintained so that bushfire fuels are minimised. PBP 2006 determines the minimum distances required for APZs based on the Fire Danger Index (FDI). The FDI for any particular region is based on a combination of the dominant air temperature, relative humidity, wind speed and drought. PBP 2006 assumes a worst case scenario and applies FDI 100 (catastrophic) to the Hunter Region.

Using the methods included in PBP 2006 the minimum setback (APZ) is determined by comparing the dominant vegetation formation and effective slope. The required setbacks comparing grassland, woodland and forest vegetation on slopes of 0 to 5 degrees are 10, 15 and 25 metres respectively. The existing separation distances between the infrastructure areas at United and surrounding vegetation are considered sufficient to ensure these assets are protected from bushfire threat, exceeding the minimum APZ distances recommended within PBP 2006. These APZs will be maintained during the construction and operational phases of the Project until such time as the infrastructure is removed to accommodate the proposed mining areas.

APZs of varying distances are currently established and maintained around key infrastructure within the Wambo site including administration buildings, remote assets, rail loop infrastructure (including train loading facility), overhead powerlines, open cut and underground facilities and the CHPP. The APZs will be maintained following the proposed upgrades to the Wambo MIA. An APZ is also maintained around the Wambo Homestead Complex and a water spray system installed around the perimeter of the property that is connected to the Wambo fire system to protect the building from fire.

The Project Area is currently maintained at varying levels of bushfire risk management to reduce fuel loads and restrict the movement of bushfire across the site, in accordance with the current Wambo BMP and the United BMP. Appropriate APZs will be maintained for the Project in accordance with a Project specific BMP to be prepared and implemented by United.

The proposed road realignment works and the relocation of the 330 kV and 66 kV transmission lines will include the removal of vegetation to establish appropriate easements. These easements will need to be maintained by the asset owner to reduce the risk of bushfire to this relocated infrastructure.

6.17.6 Access

All infrastructure areas within the Project Area are accessible by all weather access roads. The Project Area has multiple access points with internal roads and bushfire trails providing access for four wheel drive vehicles. Both Wambo and United operational areas are inspected regularly in accordance with the Wambo BMP and the United BMP to assess the need for maintenance of existing roads and fire trails. Access across the Project Area will continue to be assessed and maintained as the Project progresses in accordance with a Project specific BMP to be prepared and implemented by United.

6.17.7 Water Supply

The Project Area has an extensive network of dams which supply water for the existing mining operations. Both Wambo and United have a number of dams which are easily accessible for fire fighting purposes and hydrants installed at the Wambo MIA, train loading facility and the CHPP.

Further detail regarding the existing and proposed water supply system and water management works as part of the Project is provided in **Section 6.8**. The water management network will provide adequate water supply for fire fighting purposes. The infrastructure areas used for the Project will be supplied with adequate water supply, fire fighting facilities and equipment in accordance with the Building Code of Australia and relevant Australian Standards.

6.17.8 Emergency Response

A Project specific BMP will be developed and implemented by United in consultation with the RFS to manage bushfire threat and to document emergency response procedures in relation to the Project.

The RFS has a Fire Control Centre at Bulga where the response time to the Project Area would be approximately 10 minutes. This would be the primary response with backup personnel located at Singleton and Muswellbrook. Muswellbrook has resources to respond to a HAZMAT emergency event should it be required.

With the continued implementation of the current bushfire management controls under the Wambo BMP and the implementation of a new Project specific BMP prepared in consultation with the RFS, it is considered that bushfire risk can continue to be appropriately managed as part of the Project.

6.18 Electromagnetic Field

The Project will require the relocation of sections of 330 kV transmission lines and several other transmission lines (including 66 kV and 11 kV transmission lines) within the Project Area (refer to **Figures 3.21** and **3.22** and **Section 3.9.2**). These existing transmission lines, as with all electrical equipment, produce electromagnetic fields (EMF). The relocated lines will also produce EMF and therefore an assessment of the potential for the EMF of the relocated transmission lines to impact on the public is required.

The proposed 330 kV transmission line relocation is approximately 980 metres from the nearest private residence at its closest point and 590 metres from the Hunter Valley Gliding Club. The proposed 66 kV transmission line realignment is approximately 980 metres from the nearest private residence at its closest point and approximately 550 metres from the Hunter Valley Gliding Club.

The proposed 330 kV transmission line realignment is no closer than the existing transmission line to the nearest private residence and approximately 360 metres closer to the Hunter Valley Gliding Club. The proposed 66 kV transmission line realignment is no closer than the existing transmission line to the closest residence and approximately 300 metres closer to the Hunter Valley Gliding Club. As discussed below, the Project is not predicted to be likely to result in any measurable increases in EMF at any residence or sensitive receiver.

EMF are part of the natural environment and are present in the Earth's core and the atmosphere. EMF are also produced wherever electricity or electrical equipment is in use. Powerlines, electrical wiring, household appliances and electrical equipment all produce EMF.

The electric field is proportional to the voltage (which can be considered as the pressure with which electricity is pushed through the wires). The magnetic field is proportional to the current, that is, to the amount of electricity flowing through the wires. Both electric and magnetic fields are also dependent on the source geometry (i.e. conductor heights, cable depths, phase separations and so on). All fields decrease rapidly with distance from the source. Generally, the smaller the object or closer the conductors producing the field, the more rapidly the field will decrease with distance from the source (Umwelt 2008).

6.18.1 Typical Magnetic Fields

Power frequency magnetic fields are created whenever electricity flows and therefore they are not something unique to powerlines or substations. They occur wherever an electric current flows in a conductor or wire. Because of the large number of sources, people move from one EMF source to another for much of the time.

Magnetic fields found in homes, away from appliances, are typically between 0.1 and 2 milliGauss (mG) (ARPANSA 2015). However, in some instances, the magnetic fields may be higher, depending upon the wiring in the house, the earthing system and the appliances in use at the time. Wide variations can occur from house to house and from room to room.

In relation to magnetic fields in the home, the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA 2015) advises:

Magnetic fields within homes can vary at different locations and also over time. The actual strength of the field at a given location depends upon the number and kinds of sources and their distance from the location of measurement. Typical values measured in areas away from electrical appliances are of the order of 0.1 - 2 mG

To provide an idea of the relative strengths of magnetic fields in Australian homes, **Table 6.50** shows typical magnetic field strengths measured at normal user distance from some common domestic electrical appliances. At the surface of the source, the magnetic field strength is likely to be much higher. It should be noted that as a result of variations in designs and loadings magnetic fields may vary from those shown in the **Table 6.50**.

Table 6.50 Typical Magnetic Field Measurements around Common Domestic Electrical Appliances

Source	Range of Measurements (mG)
Domestic Electrical Appliances	
Electric Stove	2 - 30
Refrigerator	2 - 5
Electric Kettle	2 - 10
Toaster	2 - 10
Television	0.2 - 2
Personal Computer	2 - 20
Electric Blanket	5 - 30
Hair Dryer	10 - 70
Pedestal Fan	0.2 - 2

Source: ARPANSA, accessed 2 March 2016, <http://www.arpansa.gov.au/radiationprotection/FactSheets/is_magFields.cfm>

The typical magnetic field measurements around elements of the Electricity Network in Australia are shown in **Table 6.51**. The power lines that are present in typical Australian neighbourhoods are called 'distribution' lines and they usually carry less voltage than 'transmission' lines, which carry very high voltages. As stated earlier, it is the current and not the voltage that is associated with the strength of a magnetic field.

Table 6.51 Typical Magnetic Field Measurements around Elements of the Electricity Network

Source	Location of Measurement	Range of Measurements (mG)
Distribution Line	Directly underneath	2 - 30
Distribution Line	10 metres away	0.5 - 10
Substation	At substation fence	1 - 8
Transmission Line	Directly underneath	10 - 200
Transmission Line	At edge of easement	2 - 50

Source: ARPANSA, accessed 2 March 2016, <http://www.arpansa.gov.au/radiationprotection/FactSheets/is_magFields.cfm>

6.18.2 EMF and Health

In recent years, scientific research has focussed on magnetic fields rather than electric fields, and the remainder of this assessment reflects that focus.

Available research has been extensively reviewed over the last 30 years by Australian and international inquiries and expert panels established for the purpose of trying to determine whether or not human exposure to EMF is related to adverse health effects.

It is well accepted by scientists that no study considered in isolation will provide a meaningful answer to the question of whether or not EMF can contribute to adverse health effects. In order to make an informed conclusion from the available research, it is necessary to consider the science in its totality. Over many years, governments and regulatory agencies around the world have commissioned independent scientific review panels to provide such an overall assessment.

The ARPANSA is a Federal Government agency charged with responsibility for protecting the health and safety of people, and the environment, from EMF. ARPANSA advises that:

> *Currently there is no evidence that exposure to electric fields is a health hazard (excluding electric shock). Whether exposure to magnetic fields is equally harmless remains a more open question.*
>
> *A large number of scientific studies performed on animals and cells have not found a health risk. Some studies of exposed populations, however, have suggested there might be a weak association between prolonged exposure to higher than normal level of magnetic fields and an increased risk of childhood leukaemia.*
>
> *The scientific evidence does not firmly establish that exposure to 50 Hz electric and magnetic fields found around the home, the office or near power lines is a hazard to human health. The scientific research done so far shows that if any risk exists, it is small.*

6.18.3 Exposure Limits

Since 1989 the Australian electricity industry has followed interim guidelines for exposure to EMF as developed by the National Health and Medical Research Council (NHMRC). Under these guidelines the recommended magnetic field public exposure limit is 1000 mG (24 hour exposure). These interim guidelines were based on the internationally recognised International Commission on Non-Ionizing Radiation Protection (ICNIRP) guideline that specified an allowable public exposure limit of 1000 mG. The ICNIRP has since released a revised guideline in 2010 with a new public exposure limit of 2000 mG. In 2002, the Institute of Electrical and Electronics Engineers (IEEE) published electric and magnetic field exposure guidelines for the general public and workers. Under this standard the recommended magnetic field public exposure limit is 9040 mG.

As discussed below, the transmission lines relocated as part of the Project would readily meet the above guidelines.

6.18.4 Potential Impacts

6.18.4.1 Transmission Line Realignments

As detailed in **Section 3.9.2**, the Project will require the relocation of sections of 330 kV transmission lines and several other transmission lines (including 66 kV and 11 kV transmission lines) within the Project Area (refer to **Figures 3.21** and **3.22**). The proposed 330 kV transmission line relocation is approximately 980 metres from the nearest private residence and 590 metres from the Hunter Valley Gliding Club. The proposed 66 kV transmission line realignment is approximately 980 metres from the nearest private residence and 550 metres from the Hunter Valley Gliding Club.

Modelling of EMF impacts for a 330 kV transmission line by Gillespie Power Consultancy (2012), modelled the magnetic field directly under a 330 kV transmission line at approximately 88 mG, and at 60 metres from the centreline (edge of easement) at 33 mG.

Modelling of EMF impacts for a 66 kV transmission line was carried out by Ausgrid for another coal mine project (Umwelt 2008). The modelling indicated that directly beneath the transmission line the magnetic field would be approximately 5 mG. At approximately 5 mG, the magnetic field for the 66 kV transmission line is equal to that of a conventional refrigerator (refer to **Table 6.50**).

At the distances of 550 (gliding club) – 980 (nearest private residence) metres, there are unlikely to be any measurable EMF impacts on sensitive receivers associated with the relocated lines. Further, the use of the Hunter Valley Gliding Club is intermittent, only operating on weekends and public holidays, further reducing any potential for exposure to EMF. The predicted levels of EMF associated with the relocated transmission lines are expected to be well within the recommended magnetic field public exposure limit of current Australian and International guidelines discussed in **Section 6.18.3**, directly underneath the lines would be substantially smaller, if present at all, at the nearest sensitive receptor.

The proposed realignment of the 330 kV transmission line will cross the existing alignment of the Golden Highway, but not the proposed realignment of the Golden Highway. The realigned section of the Golden Highway will be approximately 60 metres from the 330 kV easement at the closest point. As outlined above, the predicted levels of EMF at the edge of the transmission line easements will be approximately 33 mG and well within current Australian and International guidelines.

The proposed realignment of the 66 kV transmission line crosses the existing alignment of the Golden Highway and will cross the proposed realignment of the Golden Highway. Based on previous modelling, directly beneath the proposed 66 kV transmission line will likely have a magnetic field of approximately 5 mG, well within current Australian and International guidelines.

6.18.5 Conclusion

Considering the currently available information on EMF worldwide, the following conclusions may be drawn:

- the proposed transmission line relocations will readily comply with relevant local and international health guidelines or standards for public exposure to EMF
- EMF are created whenever electricity flows, they are not something unique to transmission lines
- the body of scientific literature on the issue is both complex and voluminous, and public policy initiatives should be based on independent and authoritative reviews and reports
- conventional science cannot guarantee absolute safety for exposure to environmental factors such as EMF
- there is no basis to establish human exposure limits for EMF other than those which presently exist, and, in particular there is no scientific basis to support arbitrary exposure limits below the guidelines as a prudent avoidance measure
- power network authorities should continue to act prudently in relation to the issue of EMF. This includes implementing prudent avoidance measures.

The Project is not predicted to be likely to result in any measurable increases in EMF at any residence or other sensitive receptors including at the Hunter Valley Gliding Club.

6.19 Waste Management

The SEARs for the Project identify waste management as an issue to be considered in the EIS (refer to **Table 4.3**). There are several different types of wastes that will be produced by the Project. **Section 3.6** outlines the approach for the ongoing management of reject material and tailings from coal processing, while the management of waste water from the water management system is discussed in **Section 6.8.1** overburden management is discussed in **Section 3.5.3**. The focus of this section is to identify and discuss the management of other waste material that will be produced as part of the Project.

6.19.1 Waste Management Principles and Processes

In order to provide a standardised approach to waste management across its NSW operations, Glencore developed a Waste Management Guideline, which has been prepared in accordance with all relevant legislation and guidelines. The Waste Management Guideline outlines the measures required to be undertaken by all Glencore operations in regard to waste management. In accordance with the requirements of the Glencore Waste Management Guideline, a site specific Waste Management System will be developed and implemented for the Project.

As an existing operation, United currently has a well developed and implemented waste management plan. This plan is based on the following waste management principles that will continue to be applied in the management of waste materials generated by the construction and operation of the Project:

- waste avoidance through the minimisation of waste generation
- waste re-use
- waste recycling
- waste removal and disposal (all waste that cannot be reused with the exception of inert wastes which may be disposed of on-site in open cut mining areas, with the approval of the EPA and used large tyres which will be buried in controlled areas within open cut mining areas with the approval of the EPA, refer to **Section 3.9.3.3**).

The underpinning strategies for management of waste are focused on minimisation through cleaner production and the aforementioned principles, as well as the appropriate training, segregation, storage and disposal of waste generated on site. The minimisation of waste will be achieved through the following processes:

- consideration of potential waste streams in procurement of materials
- identification and segregation of re-usable and recyclable materials
- education of workforce on waste avoidance, waste stream segregation and recycling
- processing materials for recycling
- considering environmental impacts for waste removal and disposal processes
- waste monitoring and inspection regimes.

6.19.2 Predicted Waste Streams

The waste that will be generated during the construction and operation of the Project will fall into the following waste classes (DECCW 2009 Waste Classification Guidelines):

- General Solid Waste (putrescible and non-putrescible) including construction waste, general office waste and domestic waste
- Liquid Waste, of which ablution (e.g. waste water from bathhouses, sinks etc) and operational wastes (e.g. oils and coolant fluids following maintenance) are included
- Hazardous Waste, which includes aspects of construction and operational waste (e.g. coal tar or containers that have previously contained a substance of Class 1 or 5 under the definition of the Transport of Dangerous Goods Code) (National Transport Commission 2011)
- Special Waste, e.g. waste tyres, clinical/first aid and asbestos (potentially present in old buildings on site).

The following sections discuss the key waste streams that will be generated as a result of the construction and operational phases of the Project.

6.19.2.1 Construction Waste

The construction of the Golden Highway realignment and the 330 kV powerline may generate inert waste such as concrete, steel and electrical cabling. These waste materials will be recycled where practicable or disposed of at an appropriate facility, with some inert wastes (e.g. clean concrete waste) to be disposed of in appropriate locations in on-site mining voids.

The construction of new, and modification of existing, infrastructure outside of the Golden Highway and transmission line works will involve predominantly modular/prefabricated components, which are assembled off site and transported to the site for installation. These construction activities are therefore not expected to generate a significant amount of waste materials. The excavated material generated during the earthworks phase of construction will be re-used on site. Inert waste such as concrete will be disposed of at appropriate locations in on-site mining voids.

Other waste that may be generated during the construction phase of the Project will include office, domestic and ablution waste, as well as a small amount of waste associated with general maintenance and workshop activities.

6.19.2.2 Operational Waste

Records of waste disposal for the existing United operations show that in 2015 the operations disposed of 31.2 tonnes of waste to landfill, with 4.2 tonnes of waste (or approximately 12 per cent of the waste generated at United) was recycled or reused. As United is in care and maintenance, it has relatively minor waste generation compared to an active mining operation.

Records of waste disposal for the existing Wambo Open Cut operations (including the open cut, administration and general surface operations and excluding the underground and CHPP) show that the operations disposed of 152 tonnes of waste to landfill with 580 tonnes of waste (or approximately 79 per cent of the waste generated at Wambo) was recycled or reused (excluding effluent recycling).

It is expected that the quantity of waste generated by the Project will likely be approximately double that generated by the Wambo Open Cut due to the larger size of the operation, excluding the waste associated with decommissioning the United mine infrastructure area.

The key components of operational waste are discussed below.

Office Waste

There will be minimal office waste generated by the Project. However, waste that is generated will consist of waste paper (comprising general office paper, photocopy paper), office stationery and paper from other sources. Other wastes will include cardboard and packaging, and toner cartridges from printers, photocopiers and facsimile machines. Much of this waste will be recycled in accordance with the waste management principles outlined above; the remainder will be disposed of appropriately.

Domestic Waste

Domestic waste will be generated by employees and contractors at the site and will include food scraps, aluminium and steel cans, glass, plastic and paper containers and putrescible waste. The quantity of this waste is relatively small in comparison to total waste. These wastes will be recycled, where practicable.

Hazardous Waste

Hazardous wastes will include those generated from workshop and equipment maintenance activities, such as rags, gloves, packing materials, machinery components, waste metal, empty drums, oils, lubricants, hydrocarbons and paints. These wastes will be recycled where practicable and otherwise disposed of via a licensed landfill facility or in approved areas on site.

Sediment Dams

Sediment from some dams in the mine water management system have the potential to contain elevated levels of hydrocarbons and carbonaceous material as a result of activities carried out in the catchments for these dams. These dams will be regularly cleaned of sediment to maintain their capacity to handle runoff from large rainfall events (refer to **Section 6.8.1**). Prior to disposal, a risk assessment will be undertaken and dams with an increased risk of containing hydrocarbons or other potential environmental pollutants will be tested for these contaminants. Sediment that is not contaminated will be co-disposed with overburden in overburden emplacement areas. Any identified contaminated sediment material will either be treated on site and disposed of with overburden, or will be disposed off-site at an appropriately licensed facility.

Ablution Waste

Waste from toilets, bathhouses, kitchen sinks and basins are included as ablution waste with all sewage wastewater managed using the proposed and existing treatment facilities. Upgrades to the treatment facilities, including additional facilities, may be constructed for the Project as part of upgrades to the Wambo MIA.

Special Waste

Special wastes are those that have unique regulatory requirements. Special wastes associated with the Project will include tyres associated with the mining equipment. Large waste mining equipment tyres are proposed to be disposed of in controlled areas onsite within the open cut pits, subject to the approval of the EPA.

Should any asbestos be identified on site United will commission an appropriately licensed contractor to remove and dispose of this material in accordance with legislative requirements.

6.19.3 Ongoing Waste Management

To manage waste generated by the Project, United will develop and implement a site specific Waste Management System based around the Glencore Waste Management Guideline. The Glencore Waste Management Guideline is based on the waste management principles described in **Section 6.19.1**. Under this system, waste generation will be avoided or minimised as a first principle, then reused or recycled where possible. Wastes will continue to be separated on site to allow different waste streams to be appropriately managed. The majority of wastes that cannot be reused or recycled will be transported off site by licensed waste management contractors. Where appropriate, United may continue to dispose of inert waste within existing open cut voids during the construction, operational and mine closure phases of the Project.

Ongoing management of waste as part of the Project will be through the implementation of the site specific Waste Management System, and will include details regarding:

- waste streams and their disposal requirements

- storage and treatment requirements
- re-use, recycling and waste minimisation opportunities
- mechanisms for monitoring waste volumes and performance
- training and induction requirements
- the requirement to consider waste management practices within the site Environment and Community Operational Risk Assessment
- reporting requirements
- incident and complaint management
- accountabilities for waste management.

The Waste Management System will also detail the methods for monitoring waste volumes and will include measurable indicators and targets for waste reduction as part of the Project.

6.20 Public Safety and Health

The SEARs for the Project identify public safety as an issue to be considered in the EIS (refer to **Table 4.3**) including an assessment of the likely risks to public safety, paying particular attention to potential bushfire risks, blasting impacts and the handling and use of any dangerous goods. Hunter New England Local Health District in its submission on the SEARs also identified human exposure to acute and cumulative impacts of noise, particulates and contamination of drinking water as issues for assessment. The focus of this section is to outline the process undertaken to identify and assess potential impacts on public safety, including human health, detail the key assessment finding in relation to these issues and identify where these issues are addressed in further detail within the EIS. United met with Hunter New England Local Health to discuss the approach to the public safety and health assessment for the Project.

A risk screening based assessment approach to identifying potential adverse impacts on public safety, including health, was utilised during the assessment scoping phase and throughout preparation of this EIS. If a potential risk to public safety or human health was identified, further detailed assessment was completed as part of this EIS. The detailed assessment of each potential risk has been undertaken in accordance with relevant legislation and guidelines, and by appropriately qualified specialists. Where relevant, potential risks to public safety or human health have been assessed against accepted safety or health based assessment criteria established by the NSW government. Where relevant criteria are predicted to be met or where NSW government policy stipulates mitigation measures that are to be implemented (e.g. imposition of voluntary acquisition clauses in any development consent granted), no further detailed health risk assessment was determined to be required. This screening type evaluation of public safety and health risks using published guidelines was undertaken considering the tiered assessment approach outlined in *Environmental Health Risk Assessment – Guidelines for Assessing Human Health Risks from Environmental Hazards* (enHealth 2012).

The identified risks to public safety, including health, and a summary of the key assessment findings relevant to the identified risk is provided in **Table 6.52**.

Table 6.52 Identified Risks to Public Safety and Associated Assessment Findings

Issue Identification	Description of Risk to Public Safety or Health	Relevant Assessment	Summary of Key Findings
Noise	Human exposure to noise during construction.	**Section 6.6** **Appendix 9**	Predicted noise levels resulting from the construction phase of the Project are well below the EPA's construction noise management criteria at all private residences.
	Human exposure to acute and cumulative impact of noise during operation.	**Section 6.6** **Appendix 9**	Predicted operational noise levels are expected to exceed target noise levels set in accordance with current EPA policy at a number of surrounding residences. Following the implementation of reasonable and feasible noise mitigation measures, for the residences where the target noise levels are predicted to be exceeded the Noise Impact Assessment found that: • negligible impacts are expected at 13 private residences • moderate impacts are expected at 18 private residences • significant impacts are expected at 7 private residences. Following DPE's Voluntary Land Acquisition and Mitigation Policy (2014), the seven significantly impacted private residences are likely to be afforded acquisition rights as part of any development consent for the Project. Moderately impacted residences will form part of an active noise management zone where proactive noise management will be used to guide operations to minimise the potential impacts of the Project. These private residences will also be offered receiver based noise mitigation measures such as double glazing, insulation and/or air conditioning to minimise the potential effects of noise impacts from the Project. It is also noted that noise impacts will occur at mine owned properties in Warkworth and other surrounding areas. These properties are mine owned as they are within the affectation zones of the existing mining operations in the local area. United will consult with the owners, and as

Issue Identification	Description of Risk to Public Safety or Health	Relevant Assessment	Summary of Key Findings
			relevant with the tenants of these properties regarding the Project related impacts at these properties.
	Human exposure to low frequency noise causing annoyance.	**Section 6.6** **Appendix 9**	Predicted low frequency noise levels outside of those private residences within the noise affectation zone (i.e. the seven residences likely to be afforded acquisition rights as part of any development consent for the Project) were found to be generally close to the threshold of hearing and therefore unlikely to be intrusive or cause annoyance.
	Sleep disturbance from transient noises often with tonal characteristics.	**Section 6.6** **Appendix 9**	Sleep disturbance is usually only assessed in the night-time period (10.00 pm to 7.00 am), however, due to the presence of shift workers in the local community the assessment of sleep disturbance was undertaken for the day, evening and night periods. Maximum transient noise levels were predicted to readily comply with the EPA's sleep disturbance criteria at all private residences with the exception of one residence in Warkworth. This residence (R19) has existing acquisition rights under the Wambo mine, Wambo train loading facility and MTW development consents due to noise impacts from these operations, and is expected to be afforded acquisition rights due to noise affectation associated with the Project.
Air Quality	Human exposure to particulates (PM_{10} and $PM_{2.5}$)	**Section 6.4** **Appendix 7**	Refer to discussion in **Section 6.20.1**.
	Human exposure to NO_2 from blasting	**Section 6.4** **Appendix 7**	Modelling indicates that with the implementation of appropriate blast practices so as to avoid potentially adverse weather conditions, blast related NO_2 emissions comply with EPA criteria at all sensitive receivers. These criteria have been set by the NSW government to protect human health.

Issue Identification	Description of Risk to Public Safety or Health	Relevant Assessment	Summary of Key Findings
	Human exposure to diesel emissions	**Section 6.4** **Appendix 7**	Modelling of NO_2 concentrations associated with diesel exhaust emissions indicate compliance with EPA criteria at all sensitive receivers. These criteria have been set by the NSW government to protect human health.
Water contamination	Contamination of drinking water and health risks associated with human exposure	**Section 6.8** **Appendices 11** and **12**	Groundwater quality in the area has been compared to guideline values from the ANZECC (2000) guidelines for long-term irrigation, livestock watering (beef cattle) and the Australian Drinking Water Guidelines (ADWG) (NHMRC 2011). The groundwater within the area is not suitable for human consumption (i.e. drinking water), including the 'highly productive' alluvium. The Groundwater Assessment has not predicted any impacts to groundwater quality as a result of the Project. No surface water users are known to occur downstream of the Project Area on Wollombi Brook (or its tributaries) or Waterfall Creek. The Surface Water Assessment has not predicted adverse impacts on downstream water quality as a result of the Project and therefore there is minimal risk of contamination of surface waters. The Project presents a low risk of potential drinking water contamination. However, to address any residual concern about potential dust deposition impacts on drinking water tanks, United has committed to provide for the inspection and, as necessary, cleaning of drinking water tanks every 2 years for all private residences and Joint Venture owned residences within 4 kilometres of the mining area for the Project.
	Contamination of surface water and health risks associated with human exposure	**Section 6.8** **Appendix 11**	As discussed above, the Project is not predicted to result in adverse impacts on downstream water quality and therefore there is negligible risk of contamination of surface waters such that human health impacts could occur.
	Contamination of	**Section 6.8**	There is limited potential for groundwater contamination to occur as a

Issue Identification	Description of Risk to Public Safety or Health	Relevant Assessment	Summary of Key Findings
	groundwater and health risks associated with human exposure	**Appendix 12**	result of hydrocarbon and chemical contamination. All refuelling activities will occur in areas with adequate bunding and/or provision for immediate clean-up of spills. All chemicals will be transported, handled and stored in accordance with relevant Australian Standards. These controls represent standard practice and a legislated requirement at mine sites for preventing the contamination of the groundwater regime. The Groundwater Assessment has not predicted any impacts to groundwater quality as a result of the Project and therefore there is negligible risk of contamination of groundwater such that human health impacts could occur.
Bushfire	Direct and indirect health risks associated with bushfire including risk to life	**Section 6.17**	Safety is the number one priority for United and Wambo as part of implementing the Project, and bushfire risk has been identified as a key risk area that requires appropriate management. The Project has been assessed in accordance with the aims and objectives of Planning for Bushfire Protection (NSW Rural Fire Service 2006) and appropriate asset protection zones identified around key infrastructure. The Project Area has multiple access points with internal roads and bushfire trails providing access for four wheel drive vehicles. There is also an extensive network of dams which are easily accessible for fire fighting purposes and hydrants installed at the Wambo MIA, train loading facility and the CHPP. The Project will be managed in accordance with a bushfire management plan to be prepared and implemented by United in consultation with the RFS. The proposed bushfire management measures have been designed to appropriately manage bushfire risk as part of the Project.
Contaminated land	Health related risks from human exposure to	**Section 6.2**	The Project Area does not contain any areas of known contamination that may cause a significant risk of harm to human health or the environment. As with all activities that involve earthworks and mining, activities carried

Issue Identification	Description of Risk to Public Safety or Health	Relevant Assessment	Summary of Key Findings
	contaminated land		out at United and Wambo mines have the potential to cause contamination if not properly managed. Both mines have a range of controls in place to manage this risk including appropriate chemical handling and storage procedures, appropriate waste management systems, spill and emergency response procedures and equipment, and regular inspection and reporting processes.
EMF	Health related risks associated with exposure to levels of EMF that exceed the levels specified in Australian and International guidelines.	**Section 6.18**	The Project is not predicted to result in any measurable increases in EMF at any residence or other sensitive receptor including at the Hunter Valley Gliding Club. The relocated transmission lines will readily comply with relevant local and international health guidelines or standards for public exposure to EMF.
Blasting	Direct and indirect health risks associated with blasting including risk to life, air quality impacts and noise impacts	**Section 6.7** **Appendix 10**	Blasting associated with the Project will be managed within applicable human comfort criteria for airblast overpressure and ground vibration at all private residences. Any impacts in excess of these criteria would only occur where a negotiated agreement is in place with the resident or owner of the property. A blast notification system will be established for the Project so that the surrounding community can be notified of and prepared for blasts that occur. Blasting related impacts at mine owned residences will be managed in consultation with the owners of the properties and to provide for the safety of any occupants. Risks to public safety associated with flyrock will be managed via the application of appropriate exclusion zones and road closures. All residences, including mine owned residences, are located greater than 500 metres from the United Open Cut and Wambo Open Cut. On this basis, the

Issue Identification	Description of Risk to Public Safety or Health	Relevant Assessment	Summary of Key Findings
			Blasting Assessment found potential risks associated with flyrock are considered negligible.
Dangerous goods	Health risks associated with the storage, handling and disposal of dangerous goods	**Section 6.16** **Appendix 18**	A Preliminary Hazard Analysis has been undertaken for the Project in accordance with NSW government guidelines. The types and quantities of hazardous materials to be stored on site as part of the Project are expected to be consistent with those currently used at the existing Wambo mine, however, the storage locations of these hazardous materials may change throughout the life of the Project. The potential impacts to off-site land users as a result of the relocation of the hazardous material storages have been considered. To ensure the risks posed to the surrounding land users associated with the relocated storages are appropriately mitigated, the hazard analysis identified the required buffer distances between the hazardous materials stores and land ownership boundary. United has committed to design the relocated facilities to incorporate these buffer distances. With these minimum buffer distances, the Preliminary Hazard Analysis found that the level of risk to surrounding land users is tolerable.
Waste	Health risks associated with the handling and disposal of waste including hazardous waste	**Section 6.19**	Waste management will be undertaken in accordance with Glencore's Waste Management Guideline. Hazardous wastes will include those generated from workshop and equipment maintenance activities, such as rags, gloves, packing materials, machinery components, waste metal, empty drums, oils, lubricants, hydrocarbons and paints. These wastes will be recycled where practicable and otherwise disposed of via a licensed landfill facility or in approved areas on site. The majority of wastes that cannot be reused or recycled will be transported off site by licensed waste management contractors. All licensed waste management contractors are required to have appropriate

Issue Identification	Description of Risk to Public Safety or Health	Relevant Assessment	Summary of Key Findings
			controls in place to manage risks in accordance with NSW government guidelines. With these controls in place and considering the nature of hazardous wastes associated with the Project, the risk to human health associated with waste is expected to be low.
Social	Health risks associated with impact to the social wellbeing of the community including social equity issues such as employment, impacts to access and amenity.	**Section 6.14** **Appendix 4**	Overall, the health and well-being of residents in Singleton LGA is comparatively good, relative to residents in NSW broadly. With regards to health indicators: • The rate of respiratory system disease (including asthma and chronic obstructive pulmonary disease) is slightly lower in Singleton LGA than in NSW (PHIDU 2014). • Fewer people rate themselves as having fair or poor health in Singleton (ASR 14.1 per 100) than the state average (ASR 15.5 per 100). • Adults in Singleton LGA report lower levels of psychological stress than the NSW average. • The proportion of the adult population that has at least one of four health risk factors such as smoking, harmful use of alcohol, physical inactivity and/or obesity is lower than the NSW average (ASR 56.6 per 100) in Singleton (ASR 55.6 per 100) (PHIDU 2014). It is considered unlikely that there will be negative impacts associated with changes in population including housing availability, infrastructure capacity, economic growth, changes to sense of community or community sustainability. It is considered that the numbers of persons potentially moving into the area for the Project are unlikely to affect changes to sense of community or community sustainability at a regional or LGA scale of analysis.

6.20.1 Particulate Matter

The World Health Organisation identifies air pollution as a major environmental risk to health. The measurement and monitoring of air pollution in Australia is governed by the National Environment Protection Measure for Ambient Air Quality (Ambient Air NEPM) (NEPC 1998). The Ambient Air NEPM provides goals for carbon monoxide, lead, nitrogen dioxide, ozone, sulphur dioxide and particulate matter. A key focus of the community, academia, industry and government agencies in Australia over the last five years, including a particular focus in the upper Hunter Valley, is particulate matter.

Particulate matter in air can be dust, smoke, plant spores, bacteria and salt. Human activities resulting in particulate matter include mining, burning of fossil fuels, transportation, agriculture, hazard reduction burning, incinerators, and the use of solid fuel for cooking and heating.

The size of particulate matter determines its potential impact on human health. Larger particles are usually trapped in the nose and throat and swallowed, whereas smaller particles ($PM_{2.5}$) may reach the lungs. Exposure to particle pollution is known to have an impact on human health, particularly for people with pre-existing health conditions. There is no known safe level of exposure where there is no potential for an impact on human health (WHO 2005).

The air quality guidelines adopted in NSW are those recommended by the EPA and are specified in the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (DEC 2005). These criteria were set to be consistent with the Ambient Air NEPM (NEPC 1998). The Ambient Air NEPM stated that its desired environmental outcome was '*ambient air quality that allows for the adequate protection of human health and well-being*'. It is noted that in early 2016 the NEPM was amended, including amendments to some of the particulate matter criteria, however, at the time of preparation of this report the NSW government has not prescribed a change to the air quality criteria for NSW.

The Voluntary Land Acquisition and Mitigation Policy for State Significant Mining, Petroleum and Extractive Industry Developments (VLAMP) (NSW Government 2014) identifies that the policies and guidelines established by the NSW Government include '*assessment criteria to protect the amenity, health and safety of people*'. In regard to particulate matter, these criteria are those set in the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (DEC 2005a). These criteria set by the NSW Government have been used as the basis of the assessment of the potential impacts of health associated with particulate matter. It is noted that as discussed above, there is no known safe level of exposure where there is no potential for an impact on human health.

There have been a number of studies into air quality, in particular related to particulate matter, in the Hunter Valley. A recent paper titled *Investigating the Health Impacts of Particulates associated with coal mining in the Hunter Valley* (Dalton, C. et.al., 2014) prepared for the Air Quality and Climate Change Journal focuses on calls for epidemiological investigations into the potential health impacts of coal mining in the Hunter Valley and the challenges that such studies face. The paper identifies some key findings relating to health impacts of particulates in the Hunter Valley including (excerpts below from Dalton, C. et. al., 2014):

- While there has been much community concern about the health effects of pollution arising from coal mining in the Hunter Valley, it is apparent that, apart from small villages in close proximity to mines that are subject to heavy PM_{10} impacts, the pollution sources that are of greater concern for health are residential wood smoke, industrial and agricultural diesel combustion, and power generation, which contribute substantially to fine particle pollution.

- The major impact of mining on this source of emissions may be the increasing use of diesel in mining vehicles and in coal transport including trucks, trains, port shipping and associated infrastructure.

- Air quality in the most populous areas of the Upper Hunter is good relative to international standards. However, it is important to safeguard the air shed against any deterioration in air quality. There is no clearly established threshold for adverse health impacts within the range of particulate levels encountered in the Upper Hunter.

6.20.1.1 Assessment

PM_{10} and $PM_{2.5}$ are the components of air borne particulate matter which are relevant to human health impacts. As discussed above, the NSW government has set criteria for PM_{10} and $PM_{2.5}$ that are intended to protect human health.

Cumulative annual average PM_{10} concentrations with the Project are predicted to comply with the EPA cumulative air quality criteria of 30 $\mu g/m^3$ at all surrounding private residences, with the exception of one private residence in Warkworth. As discussed previously, this residence (R19) has current acquisition rights and is expected to be afforded acquisition rights for the Project.

Cumulative maximum 24-hour PM_{10} concentrations are expected to continue to exceed the EPA's 50 $\mu g/m^3$ criterion on at least one occasion each year for most of the modelled locations, as is currently occurring. The number of days above 50 $\mu g/m^3$ is expected to increase at Warkworth and remain well above the recommended goal of 5 days per year during the life of the Project.

One additional private residence located to the northwest of the Project Area may experience a short term increase in the number of days above 50 $\mu g/m^3$, warranting continued monitoring and a proactive and reactive dust control approach to confirm and manage impacts in this location. It is noted, however, that this residence is within the noise affectation zone for the Project and is expected to be granted voluntary acquisition rights in any development consent granted for the Project.

Cumulative maximum 24-hour $PM_{2.5}$ concentrations are predicted to comply with the NEPM advisory reporting goal at all surrounding private residences, with the exception of the one private residence (R19) in Warkworth. All other private sensitive receiver locations are predicted to comply with both the 24-hour and annual average advisory reporting goals for $PM_{2.5}$.

The potential health risks associated with the existing air quality environment in Warkworth have been acknowledged in the development consents for the surrounding mining operations, with all of the residences within Warkworth being either mine owned or subject to acquisition rights. United will work with the mines that own these residences to provide for appropriate management of risk to the tenants of these properties, including ongoing monitoring of air quality in Warkworth. This will include providing tenants and owners with information regarding the dust levels in proximity to the residence and for properties owned by United, including within the lease appropriate clauses relating to the tenants ability to terminate the lease without penalty should the dust criteria be exceeded.

The Air Quality Impact Assessment considered the overall conclusions of the assessment in the context of the National Clean Air Agreement, finding that the overall findings of the assessment will not change as a result of the proposal to establish an annual average standard for PM_{10} of 25 $\mu g/m^3$.

It is also noted that the impacts of the Project on air quality have been valued in terms of the estimated health costs attributable to particulate matter emissions, relative to existing approved operations (refer to **Appendix 19**). These estimated health costs have been considered in the cost benefit analysis of the Project (refer to **Section 6.21**).

6.21 Economic

A key benefit of the Project includes the economic benefit to the state and region associated with job creation, capital expenditure, ongoing operational expenditure, and employee expenditure associated with the Project. As discussed in **Section 5.7**, employment and economic benefits were the most common response from landholders when they were asked to identify the benefits and costs of the Project during consultation.

As outlined in **Table 4.3**, the SEARs require a detailed assessment of the likely economic impacts of the Project to be completed, paying particular attention to '*the costs and benefits of the project; identifying whether the development as a whole would result in a net benefit to NSW, including consideration of fluctuation in commodity markets and exchange rates*'.

In accordance with the SEARs, a detailed Economic Assessment has been completed for the Project in accordance with the following guidelines:

- *NSW Government Guidelines for Economic Appraisal* (NSW Treasury 2007) (Treasury Guidelines)
- *Guidelines for the economic assessment of mining and coal seam gas proposals* (NSW Government 2015) (Economic Assessment Guideline).

The Treasury guidelines provide a high level framework for cost benefit analysis (CBA) while the Economic Assessment Guidelines provide a framework specific for application of CBA and Local Effects Analysis (LEA) for mining developments. The CBA is accompanied by a LEA to assess likely effects of the Project on the locality (that is, Lower Hunter Statistical Area 3 which includes the populations of Singleton, Cessnock and Dungog), including Computable General Equilibrium (CGE) modelling to analyse the secondary impacts of the Project on the regional and NSW community, as measured by changes in economic activity and employment.

The following section provides a summary of the key findings of the economic assessment with the full assessment included in **Appendix 19**.

6.21.1 Cost Benefit Analysis

A CBA is a method of obtaining a consolidated estimate of the net economic value of a Project by identifying the incremental costs and benefits of the Project relative to the base case (i.e. no Project), placing a quantitative value on these items wherever possible and deriving the share of each item that is attributable to NSW.

To carry out the Project economic assessment, a base case representing business as usual was compared to a Project case. The base case in the CBA involves continued production of 8 Mtpa from the approved Wambo Open Cut operations until 2017 with rehabilitation activities undertaken upon cessation of mining and no mining at United. The Project case essentially involves undertaking additional capital investment and operating expenditure to commence the Project including mining in the United Open Cut and continued mining activity in the Wambo Open Cut under a modified mine plan. In the Project case, an additional 150 Mt of ROM coal is produced (additional to the base case) including 110 Mt at the United Open Cut and 40 Mt accessed from increasing depth of mining at the Wambo Open Cut, generating gross revenue of approximately $5.2 billion in Net Present Value (NPV) terms. The Project case also incorporates a total of $322 million in capital investment in present value (approximately $380 million in undiscounted terms) which for economic assessment purposes has been assumed to be spent between 2017 and 2021, with a peak capital investment of $282 million in 2017.

In recognition of the broad range of economic impacts of the Project, costs and benefits have been separated into eight categories according to the part of the community that they accrue to. For instance, the Project owners will receive the net producer surplus (defined as an economic measure of the overall benefits to the owner of a project, based on the overall revenue of the project less all capital, operating, regulatory and taxation related costs), while royalties and company income tax will be paid to the NSW and Australian Governments respectively. Other third parties that may be impacted by the Project include landholders, workers, suppliers, residents in the local community and Singleton Council. This categorisation assists in apportioning the share of the net benefits of the Project to the NSW community.

The costs and benefits considered in the analysis are provided in **Table 6.53**.

Table 6.53 Benefit and cost items considered in the CBA

Item	Benefit components	Cost components
Net producer surplus	Gross mining revenue Residual value of land Residual value of capital	Operating costs Capital costs Decommissioning costs Environmental mitigation costs Transport management costs Rehabilitation expenses Purchase costs for land Local contributions Taxes (Australian, state and local) Royalties
Royalties	Royalties payable to NSW Government	
Company income tax	Company income tax payable to the Australian Government	
Economic benefit to existing landholders	Payments to existing landholders	Opportunity cost of land
Economic benefit to workers	Wages paid to workers	Reservation wage for workers in the mining sector
Economic benefit to suppliers	Revenue paid to suppliers	Opportunity cost of supplier goods and services

Item	Benefit components	Cost components
Net environmental, social and transport-related costs		Greenhouse gas emissions Air quality Traffic and transport Ambient noise Biodiversity* Water* Aboriginal heritage* Non-Aboriginal heritage* Visual amenity*
Net public infrastructure costs		Incremental costs for government associated with provision of public infrastructure, net of payments made by the Joint Venture*

* Item has been considered qualitatively as per the Treasury Guidelines

As recommended in the CBA guidelines (e.g. NSW Treasury 2007), where it is difficult to place a value on a particular cost or benefit of the Project, a qualitative analysis has been undertaken. In some cases these items have been considered qualitatively because there is expected to be no significant difference in outcomes under the baseline and Project case (such as water resources) or because there is no reliable method available to value them in these particular circumstances (such as visual amenity and heritage impacts). The Economic Assessment includes a detailed discussion of the various valuation methods considered, and ultimately used, in the CBA analysis (refer to **Appendix 19**).

The overall finding of the CBA is that the Project is estimated to contribute a total net economic benefit for the NSW community of approximately $414 million (in present value terms – i.e. how much a future sum of money is worth today). That is, the benefits for NSW in present value terms are estimated to exceed the costs of the Project borne by NSW. **Table 6.54** presents the overall results of the CBA for the NSW community. Each estimate is measured in NPV terms, calculated using a 7 per cent discount rate, in 2015 price terms, discounted back to the start of 2016.

Table 6.54 Overall CBA results for NSW community

Summary Item	Value ($m, NPV)
Incremental benefits to NSW	437.3
Incremental costs to NSW	23.8
Overall net benefit of Project for NSW community	413.5

The additional royalties to the NSW Government is the main incremental benefit to NSW of the Project in relation to the base case. The Project is estimated to generate around $369 million (in present value terms) ($817 million in undiscounted terms) in additional royalties for the NSW Government, relative to the base case. The key incremental costs of the Project (within the NSW community) are the additional external costs, such as the cost of greenhouse gas emissions.

As recommended in CBA guidelines such as NSW Treasury (2007), where it is difficult to place a value on a particular cost or benefit of the Project, a qualitative analysis has been undertaken. The results indicate that these non-quantified externalities would need to generate costs of around $39 million per year (in real terms) for NSW from 2017 to 2039 to fully offset the estimated net benefits of the Project.

The CBA therefore shows that when all potential costs and benefits are considered, the Project will deliver a net benefit to the NSW community.

Sensitivity Analysis

The CBA results are subject to the assumptions and valuations applied to each cost and benefit. A sensitivity analysis was completed in order to test the sensitivity of the estimate of net economic benefit by also considering upper and lower bound discount rates, and varying the size of a number of parameters of interest.

Based on the recommendations in the Guidelines, sensitivity analysis has been undertaken using a lower bound discount rate of 4 per cent and an upper bound discount rate of 10 per cent. In all three scenarios, the Project is estimated to deliver a net benefit for the NSW community, that is, the benefits for NSW are estimated to exceed the costs of the Project borne by NSW, including the quantifiable externality costs. The estimate of net economic benefits for NSW range from around $310 million to $567 million (in present value terms), a respective 25 per cent decrease and 37 per cent increase on the central estimate produced using the standard discount rate of 7 per cent.

The second necessary component of a sensitivity analysis is to also vary the estimates for different inputs. The sensitivity ranges for the export coal prices were arrived at through an analysis of data over the period from January 1995 to January 2016. The alternative prices for the cost of carbon have been identified in the *Review of the NSW Energy Savings Scheme* (NSW Government 2015). Under all scenarios assessed, the Project results in a net economic benefit to the NSW community. A comparison of the total net benefits obtained in each of these scenarios, using a 4 per cent, 7 per cent and 10 per cent discount rate is presented in **Appendix 19**.

6.21.2 Local Effects Analysis

LEA assesses employment effects of the Project with reference to the locality. The LEA is intended to be complementary to the CBA for NSW and translates the effects estimated at the State level to the impacts on the communities located near the mine site.

There are a number of important points when considering the results of the LEA, including:

- the results of the LEA are not additive to those in the State level CBA, rather, the results presented are largely already covered in the CBA
- it is not intended that the components of an LEA can be added together to provide a single summary measure – each item reported presents a different local effect
- the LEA does not measure economic welfare outcomes.

The Project is situated entirely within the Lower Hunter Statistical Area 3 (SA3). SA3 includes the localities of Singleton, Cessnock and Dungog. The population of the entire SA3 has been used to model the impact of the Project as labour and other expenditure is likely to be concentrated throughout this area.

The LEA assesses effects on:

- local employment
- non-labour expenditure
- other local industries
- environment and social.

The results provide an average for the Project during the construction phase and the ongoing operations phase. For the purposes of the Economic Assessment, the construction phase was defined as being from 2017 to 2021 while the ongoing operations phase was defined as being from 2022 to 2039.

Overall the Project is expected to directly employ in the local area around 132 full time equivalent (FTE) per year during the establishment phase (which includes both construction and the early phases of operations) and 230 FTE per year during ongoing operations. This direct local area employment is expected to result in an increase in income in the local area of $5 million a year during the construction phase and $9 million a year during ongoing operations (assuming that these individuals would earn the average wage in the locality if they weren't employed at the Project). In addition to local area employment the Project is expected to directly spend $66 million a year in the locality on non-labour inputs during the construction phase and $89 million a year in the locality during ongoing operations.

The Project does create external costs for the locality as well. The largest external cost is expected to be from traffic and transport impacts, total value of quantifiable external effects estimated to be around $800,000 per year during the construction phase and $1.1 million a year during ongoing operations.

6.21.3 Flow on Effects

Computable General Equilibrium (CGE) modelling has been undertaken to analyse the secondary impacts of the Project on the regional and NSW community, as measured by changes in economic activity and employment. A CGE model uses real world data combined with economic relationships drawn from economic theory to estimate how an economy will react to external changes such as government policy, new investment or technology improvements. The model produces measures of economic activity that are commonly used (such as gross domestic product and employment).

Based on the capital and operational expenditures, the modelling gauges the wider economic impacts of the development and operation of the Project at two levels:

- Direct impacts — the economic gains associated with 'core' commercial operations, namely the coal extraction and processing, and revenues generated by the sale of coal exports from the mine.
- Indirect, induced and crowding out impacts — the economic gains in related upstream or downstream industries where the benefits associated with increased resource activity are typically the highest. As outlined above, the CGE modelling also captures any crowding out of activity in other sectors of the economy as a result of the Project.

Gross Regional Product (GRP) is projected to increase by $108 million in 2018 as a result of the peak in construction activity for the Project. The GRP impacts increase further in subsequent years as the positive impact of incremental coal production flows through, peaking at over $263 million in 2022 in the locality.

In NPV terms, over the modelling period, total locality GRP is projected to increase by just below $2.1 billion. There is also an impact on the rest of the NSW economy with an increase of $884 million in NPV terms over the period to 2039. Therefore, NSW Gross State Product (GSP) is projected to be $3.0 billion greater over the modelling period under the Project scenario. GSP impacts peak at around $109 million in 2026.

The locality employment includes the incremental effects of direct employment at the Project, flow on effects throughout the economy and any crowding out that might occur in other sectors of the economy. This means that the results take into account the fact that many of those directly employed by the Project would find employment elsewhere in the economy if the Project did not go ahead.

While the total operational employment will be up to approximately 500 people, the total projected incremental employment in the locality (i.e. the local area) is expected to peak in 2022, at 130 people. Employment impacts in the locality are predicted to remain positive throughout the modelling period. The incremental NSW employment impact of the Project is expected to also peak at 228 people in 2022. Total NSW employment is projected to be higher in all years of the modelling period under the Project scenario. That is, after accounting for persons that would be employed elsewhere in the economy if the Project did not go ahead, the net employment effect is positive in the locality and in NSW over the life of the Project.

Growth in employment associated with the Project is also accompanied by an increase in real wages. This occurs because there is increased competition for labour resources brought about by the Project which puts upward pressure on wages in the locality. The Project is predicted to have a negligible impact on wages in NSW as a whole.

6.21.4 Net Benefit for the Local and NSW Community

The Economic Assessment concluded that overall, the Project is expected to generate net benefits, and is also expected to generate increased economic activity and employment within the NSW community. The Project will have a positive economic impact, for the region and the State of NSW. In total, the Project is anticipated to:

- contribute a total net economic benefit for the NSW community of approximately $414 million (in present value terms)
- generate royalties of an estimated $369 million in NPV terms to the NSW Government ($817 million in undiscounted terms)
- increase the GRP by a projected approximately $2.0 billion in NPV terms, over the life of the Project
- increase the NSW GSP (including the Hunter region) by approximately $3.0 billion (in NPV terms) over the life of the Project
- total operational employment of up to approximately 500 people with total construction phase employment of up to approximately 120 people, including direct employment in the local area of approximately 130 people during the establishment phase and 228 people during ongoing operations.

Section 7.0

Matters of National Environmental Significance

7.0 Matters of National Environmental Significance

As discussed in **Section 4.1.1**, on 7 December 2015 the Project was determined to be a Controlled Action which requires approval under the EPBC Act from the Commonwealth Minister for the Environment due to its potential impact on the following matters of national environmental significance:

- Central Hunter Valley Eucalypt Forest and Woodland (a CEEC listed under the EPBC Act)
- regent honeyeater (a threatened species listed in the EPBC Act)
- swift parrot (a threatened species listed in EPBC Act)
- spotted-tailed quoll (a threatened species listed in the EPBC Act)
- a water resource.

Detailed assessments have been undertaken as part of this EIS to assess the Project's potential impacts on these matters of national environmental significance (MNES). The following section provides a summary of the key MNES assessment findings in relation to Attachment 3 of the SEARs which outlines DoE's assessment requirements. The following summary should be read in conjunction with:

- the UHSA Statement of Consistency Report (refer to **Appendix 13**) and **Section 6.9** of this EIS which discusses biodiversity impacts
- the Surface Water Assessment (refer to **Appendix 11**) and **Section 6.8.1** of this EIS which discusses surface water impacts
- the Groundwater Impact Assessment (refer to **Appendix 12**) and **Section 6.8.2** of this EIS which discusses groundwater impacts.

7.1 Department of the Environment Assessment Requirements

A checklist of DoE's assessment requirements as outlined in Attachment 3 of the SEARs and where they have been addressed in the EIS is outlined in **Table 7.1**. It should be noted that Attachment 3 of the SEARs refers to the NSW Framework for Biodiversity Assessment (FBA), however, as discussed in **Section 4.1**, the Project is being assessed under the UHSA and therefore does not require an FBA assessment. This issue was discussed with DPE and DoE, confirming that an FBA assessment is not required for the Project.

Table 7.1 Department of the Environment Assessment Requirements

Requirement	Relevant Section of the EIS
General Requirements	
4. the precise location and description of all works to be undertaken (including associated offsite works and infrastructure), structures to be built or elements of the action that may have impacts on MNES	Refer to **Section 3.0** which describes the Project
5. how the works are to be undertaken and design parameters for those aspects of the structures or elements of the action that may have relevant impacts on MNES	Refer to **Section 3.0** which describes the Project
6. an assessment of the relevant impacts of the action on (i) threatened species and communities and (ii) water resources; including: • a description and detailed assessment of the nature and extent of the likely direct, indirect and consequential impacts, including short term and long term relevant impacts • a statement whether any relevant impacts are likely to be known, unpredictable or irreversible; analysis of the significance of the relevant impacts • any technical data and other information used or needed to make a detailed assessment of the relevant impacts • a comparative description of the impacts of alternatives, if any, on the threatened species and communities	Refer to **Section 7.3** below Further detail is provided in **Appendix 13 –** UHSA Statement of Consistency
7. Information on proposed avoidance and mitigation measures to manage the relevant impacts of the action including: • a description of the proposed avoidance and mitigation measures to deal with the relevant impacts of the action • assessment of the expected or predicted effectiveness of the mitigation measures • the cost of the mitigation measures • a description of the outcomes that the avoidance and mitigation measures will achieve • a description of the offsets proposed to address the residual adverse significant impacts and how these offsets will be established	Refer to **Section 7.2** below Further detail is provided in **Appendix 13** – UHSA Statement of Consistency

Requirement	Relevant Section of the EIS
Key Issues – Biodiversity	
8. The EIS must address the following issues in relation to Biodiversity including separate: • identification of each EPBC Act listed threatened species and community likely to be significantly impacted by the development. Provide evidence why other EPBC Act listed threatened species and communities likely to be located in the project area or in the vicinity will not be significantly impacted in accordance with the *Matters of National Environmental Significance – Significant Impact Guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999*	Summary provided below in **Section 7.2** Further detail is provided in **Appendix 13** – UHSA Statement of Consistency The EPBC Referral provided evidence on why other EPBC Act listed species and communities not assessed in **Section 7.2** did not require further assessment.
9. For each of the relevant EPBC Act listed threatened species and communities likely to be significantly impacted by the development the EIS must provide a separate: • description of the habitat and habits (including identification and mapping of suitable breeding habitat, suitable foraging habitat, important populations and habitat critical for survival), with consideration of, and reference to, any relevant Commonwealth guidelines and policy statements including listing advice, conservation advice and recovery plans, threat abatement plans and wildlife conservation plans • details of the scope, timing and methodology for studies or surveys used and how they are consistent with (or justification for divergence from) published Australian Government guidelines and policy statements • description of the impacts of the action having regard to the full national extent of the species or community's range	Summary provided below in **Section 7.2** Further detail is provided in **Appendix 13** – UHSA Statement of Consistency

Requirement	Relevant Section of the EIS
10. For each of the relevant EPBC Act listed threatened species and communities likely to be significantly impacted by the development the EIS must provide: • details of how the current published NSW Framework for Biodiversity Assessment (FBA) has been applied in accordance with the objects of the EPBC Act to offset significant residual adverse impacts • identification of significant residual adverse impacts likely to occur after the proposed activities to avoid and mitigate all impacts are taken into account • details of the offset package to compensate for significant residual impacts including details of the credit profiles required to offset the development in accordance with the FBA and/or mapping and descriptions of the extent and condition of the relevant habitat and/or threatened communities occurring on proposed offset sites	As agreed with DPE and DoE, an FBA assessment is not required for the Project as the UHSA is being applied. Summary provided below in **Section 7.2** Further detail is provided in **Appendix 13** – UHSA Statement of Consistency
11. Any significant residual impacts not addressed by the FBA may need to be addressed in accordance with the EPBC Act Environmental Offset Policy	**Section 7.2.3**
Key Issues – Water Resources	
12. The EIS should provide a description of the location, extent and ecological characteristics and values of the identified water resources potentially affected by the Project	Summary provided below in **Sections 7.2** and **7.3** Further detail is provided in **Sections 6.9** and **6.8** **Appendix 11** – Surface Water Assessment **Appendix 12** – Groundwater Impact Assessment **Appendix 13** – UHSA Statement of Consistency

Requirement	Relevant Section of the EIS
13. The assessment of impacts should include information on: • any substantial and measurable changes to the hydrological regime of the water resource, for example a substantial change to the volume, timing, duration or frequency of ground and surface water flows • the habitat or lifecycle of native species, including invertebrate fauna and fish species, dependent upon the water resource being seriously affected • substantial and measurable change in the water quality and quantity of the water resource—for example, a substantial change in the level of salinity, pollutants, or nutrients in the wetland; or water temperature that may adversely impact on biodiversity, ecological integrity, social amenity or human health	Summary provided below in **Sections 7.2** and **7.3** Further detail is provided in **Sections 6.8.1.6** and **6.9** **Appendix 11** – Surface Water Assessment **Appendix 13** – UHSA Statement of Consistency
14. The EIS must provide adequate information to allow the Project to be reviewed by the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development, as outlined in the *Information Guidelines for Independent Expert Scientific Committee advice on coal seam gas and large coal mining development proposals (2015)*	Summary provided below in **Section 7.3** Further detail is provided in **Section 6.8** **Appendix 11** – Surface Water Assessment **Appendix 12** – Groundwater Impact Assessment **Appendix 13** - UHSA Statement of Consistency
Environmental Record of person proposing to take the action	
15. The information provided must include details of any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against the person proposing to take the action; and for an action for which a person has applied for a permit, the person making the application.	Refer to **Section 7.4**
16. If the person proposing to take the action is a corporation, details of the corporation's environmental policy and planning framework must also be included.	Refer to **Section 7.4**

7.2 Key Issues – Biodiversity

The Commonwealth and NSW Governments have entered into an agreement to undertake a strategic assessment of a Biodiversity Plan for Coal Mining in the Upper Hunter Valley, NSW. This assessment is referred to as the Upper Hunter Strategic Assessment (UHSA). The UHSA is being undertaken in accordance with the relevant provisions of the EPBC Act. The NSW Biodiversity Certification Assessment Methodology (BCAM) (DECCW 2011a) is being used to assess the impacts of the Project on biodiversity in accordance with the UHSA process.

As outlined in **Section 4.1**, a Referral was submitted under the EPBC Act in October 2015. The Project was deemed to be a Controlled Action on 7 December 2015 due to the potential for significant impacts on matters protected under the EPBC Act. The Controlled Action decision was based on DoE's assessment that the Project is likely to have a significant impact on matters of national environmental significance, including the following ecological matters:

- Central Hunter Valley Eucalypt Forest and Woodland CEEC
- regent honeyeater (*Anthochaera phrygia*)
- swift parrot (*Lathamus discolor*)
- spotted-tailed quoll (*Dasyurus maculatus maculatus*).

Potential impacts on these matters are detailed further below.

Central Hunter Valley Eucalypt Forest and Woodland CEEC

One threatened ecological community (TEC), being Central Hunter Valley Eucalypt Forest and Woodland critically endangered ecological community (CEEC), has been recorded in the additional disturbance area.

Approximately 223.5 hectares of Central Hunter Valley Eucalypt Forest and Woodland CEEC will be impacted by the Project. Components of the following vegetation communities present in the Project Area conform to the CEEC:

- HU905 Narrow-leaved Ironbark – Grey Box Grassy Woodland of the Central and Upper Hunter
- HU816 Spotted Gum - Narrow-leaved Ironbark Shrub - Grass Open Forest of the Central and Lower Hunter
- HU869 Grey Box - Slaty Box Shrub - Grass Woodland on Sandstone Slopes of the Upper Hunter and Sydney Basin
- HU906 Bull Oak Grassy Woodland of the Central Hunter Valley, and
- derived native grasslands forms of the above-mentioned distribution of vegetation communities.

An Assessment of Significance according to the *Significant Impact Guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999* (Significant Impact Guidelines, DoE 2013) was undertaken to determine the significance of the potential impact on the CEEC. The assessment of significance identified that the loss of 223.5 hectares of the community is likely to have a significant impact on the Central Hunter Valley Eucalypt Forest and Woodland CEEC as it will reduce the extent of the community, adversely impact some areas of critical habitat of the ecological community and interfere with the recovery of the ecological community.

Regent honeyeater

The Controlled Action decision by the Commonwealth Government assessed that the Project involves clearing of 212 hectares of the Central Hunter Valley Eucalypt Forest and Woodland CEEC (note due to minor Project changes and revised mapping of the CEEC is now 223.5 hectares) that the DoE considers potentially provides high quality foraging habitat for the regent honeyeater.

Of the ten key tree species listed for the regent honeyeater by the Draft National Recovery Plan for the species (DoE 2015) only one (spotted gum (*Corymbia maculata*)) has been recorded in the additional disturbance area. Approximately 29 hectares of Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest occurs in the additional disturbance area in plantation/rehabilitation form. Needle-leaf mistletoe (*Amyema cambagei*), when occurring on river oak (*Casuarina cunninghamiana*) is listed as one of the ten tree species for the regent honeyeater. The mistletoe has been recorded in the additional disturbance area, however, river oak itself does not occur in the additional disturbance area.

The Draft National Recovery Plan for the regent honeyeater (DoE 2015) identifies that mature trees tend to be more important as they are more productive, particularly on highly fertile sites and in riparian areas. However, the largest vegetation zone containing a key tree species for the regent honeyeater, the approximate 29 hectares of Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest, does not contain any mature trees. The vegetation zone contains a young canopy with trees between 5 and 11 metres in height.

The regent honeyeater is unlikely to occur in the additional disturbance area, as identified by six years of targeted winter bird surveys failing to identify the species and as the preferred habitats of this species are absent. **Appendix 13** details an assessment of the impacts of the Project on the regent honeyeater according to the Significant Impact Guidelines (DoE 2013), which identifies that the Project is unlikely to have a significant impact on the regent honeyeater.

Swift parrot

The Controlled Action decision by the Commonwealth Government assessed that the Project involves clearing of 212 hectares of the Central Hunter Valley Eucalypt Forest and Woodland CEEC (note due to minor Project changes and revised mapping of the CEEC is now 223.5 hectares) that the DoE considers potentially provides high quality foraging habitat for this species. The swift parrot is an ecosystem credit species under the UHSA and does not generate credits specifically for the species; that is, the offsetting of suitable vegetation communities and habitat types is considered to appropriately meet the offset needs for the swift parrot.

Of the ten key tree species listed for the swift parrot as important foraging habitat in NSW during autumn and winter by the National Recovery Plan for the species (Saunders and Tzaros 2011) only two (spotted gum (*Corymbia maculata*) and forest red gum (*Eucalyptus tereticornis*)) have been recorded in the additional disturbance area. Approximately 29 hectares of Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest occurs in the additional disturbance area in plantation/rehabilitation form. A total of only approximately 0.29 hectares of Forest Red Gum grassy open forest on floodplains of the lower Hunter occurs in the additional disturbance area.

The National Recovery Plan for the swift parrot (Saunders and Tzaros 2011) identifies that during foraging on the mainland swift parrots have been found to preferentially forage in large, mature trees that provide more reliable foraging resources than younger trees. The approximate 29 hectares of Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest that occurs in the additional disturbance area in plantation/rehabilitation form contains a young canopy with trees between 5 and 11 metres in height. No mature spotted gum trees occur in the vegetation zone.

Following is a comparison of the priority habitat areas identified for the swift parrot by Saunders and Tzaros (2011) against the known occurrence of the species in the additional disturbance area:

- Habitat used for nesting. Nesting does not occur on the mainland and does not occur in the Project Area.

- Habitat used by large proportions of the swift parrot population. The swift parrot has not been recorded in the additional disturbance area despite five years of targeted monitoring (refer to **Appendix 13** in relation to regent honeyeater and swift parrot surveys). No proportion of the swift parrot population is known to forage in the additional disturbance area.

- Habitat used repeatedly between seasons (site fidelity). The swift parrot has not been recorded in the additional disturbance area despite five years of targeted monitoring (refer to **Appendix 13**). The swift parrot has not repeatedly used any parts of the additional disturbance area.

- Habitats used for prolonged periods of time (site persistence). The swift parrot has not been recorded in the additional disturbance area despite five years of targeted monitoring (refer to **Appendix 13**). The swift parrot has not been recorded in the additional disturbance area on a single occasion.

The potential extent of mainland foraging habitat is not identified in the National Recovery Plan for the swift parrot. However, the potential foraging range is large, comprising most of Victoria (excluding northwest), eastern NSW and parts of southeastern Queensland. The removal of 212 hectares of potential habitat for the species represents a minute fraction of the species' mainland foraging range.

The swift parrot is unlikely to be significantly impacted as:

- the swift parrot has not been recorded in the additional disturbance area despite six years of targeted monitoring

- there is less than 30 hectares of vegetation zones within the additional disturbance area that contain key foraging tree species (Saunders and Tzaros 2011) for the swift parrot in NSW

- there are no mature trees (favoured for foraging) in the approximately 29 hectares of Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest in the additional disturbance area, and

- none of the potential habitat areas in the additional disturbance area are consistent with the characteristics of priority habitat areas for the swift parrot.

Appendix 13 provides a detailed assessment of the impacts of the Project on the swift parrot according to the Significant Impact Guidelines (DoE 2013) that identifies that the Project is unlikely to have a significant impact on the swift parrot.

Spotted-tailed quoll

The Controlled Action decision by the Commonwealth Government assessed that the Project involves clearing of 464 hectares of habitat that DoE considers could be critical to the survival of the spotted-tailed quoll and that it is therefore likely to result in a significant impact on the species. The spotted-tailed quoll is an ecosystem credit species under the UHSA and does not generate credits specifically for the species. The UHSA methodology caters for the impact on this species through generating and offsetting ecosystem credits; that is, the offsetting of suitable vegetation communities and habitat types is considered to appropriately meet the offset needs for the quoll.

As discussed above, the record of the spotted-tailed quoll was made using a baited (i.e. a food source to attract animals) remote camera in an area of swamp oak vegetation during 2013, set at a pig trap by United personnel. This species has not been recorded prior to this event or since this point of time despite subsequent targeted survey.

The Survey Guidelines for Australia's Threatened Mammals (DSEWPAC 2011) recommends the use of remote cameras and hair tubes to survey for the spotted-tailed quoll. Survey during February and March 2013 using 140 terrestrial hair tubes and 120 arboreal hair tubes (targeting terrestrial and arboreal mammals) set for 14 consecutive nights (as per minimum survey night requirement of DSEWPAC (2011)) failed to record the spotted-tailed quoll. The use of 20 remote cameras in March 2014 set for a minimum of three and a maximum of four nights also failed to record the spotted-tailed quoll.

There are relatively few recent records of this species occurring on the floor of the Hunter Valley, with most occurring around the fringes of the valley. It is considered unlikely that the spotted-tailed quoll breeds within the additional disturbance area, however it is likely that the spotted-tailed quoll utilises the habitats available as part of a wider territory.

It is likely that the additional disturbance area forms part of a large home range area for one or a small number of spotted-tailed quolls that forage within the additional disturbance area on an occasional basis. The spotted-tailed quoll recorded in the additional disturbance area is likely to belong to a local population of the spotted-tailed quoll that predominantly occurs in Wollemi National Park and extends occasionally onto the valley floor. The spotted-tailed quoll has not been recorded in adjacent habitat areas of Wambo mine and has only once been recorded in the MTW Mine associated habitat areas to the south of the Project Area, recorded as a 1979 scat record.

Habitat areas of the additional disturbance area and surrounds are likely to provide sub-optimal habitat for the species given the level of surrounding disturbance from mining, agriculture and infrastructure. The disturbance of the Project may reduce the ability of individuals in Wollemi National Park to disperse or move to suboptimal habitat areas within the additional disturbance area for the period of mining, leaving only a narrow connection of riparian vegetation along Wollombi Brook. In the medium term (i.e. 20 to 30 years) these habitat linkages will be restored through mine rehabilitation. Additional areas of woodland habitat occur to the south and east of Wollombi Brook that may also provide a connection between the areas east of the additional disturbance area and Wollemi National Park.

The Commonwealth Listing Advice for the spotted-tailed quoll (TSSC 2004) identifies the national area of occupancy as less than 2000 km^2. The clearing of 464 hectares of potential habitat from the additional disturbance area represents approximately 0.2 per cent of the species' national area of occupancy.

The spotted-tailed quoll is unlikely to be significantly impacted because:

- based on a single record of the species, the additional disturbance area is unlikely to provide resident habitat for the species, and the species is only likely to forage within the additional disturbance area on an occasional basis
- targeted survey effort and several years of non-target monitoring surveys has failed to record the species or any signs of its presence
- it is considered unlikely to breed in the additional disturbance area
- the area of potential impact represents less than 0.2 per cent of the species' estimated national area of occupancy.

Appendix 13 provides a detailed assessment of the impacts of the Project on the spotted-tailed quoll according to the Significant Impact Guidelines (DoE 2013) which identifies that the Project is unlikely to have a significant impact on the spotted-tailed quoll.

7.2.1 Relevant Impacts of the Action on Biodiversity

The construction and operation of the Project will result in a range of direct impacts on biodiversity values within the additional disturbance area. Direct impacts include loss of native vegetation and fauna habitats as a result of direct clearance works and works associated with the construction and operation of the Project.

The Project is not expected to result in any substantial indirect impacts on the biodiversity values of surrounding lands during the construction or operational phases of the Project. Some minor indirect impacts associated with habitat connectivity, fugitive light emissions, dust, noise, surface water flow changes, groundwater changes, weeds and feral animals may occur during the construction and operational phases.

The relevant impacts of the Project (referred to by DoE as the Proposed Action) are considered to be well known and predictable based on the extensive knowledge of the ecological values of the Project Area and a sound understanding of the impacts of the Project (e.g. clearing of vegetation, earthworks and water management). The direct impacts of the Project, as they relate to the clearing of threatened and migratory species habitat are predicted to be permanent; however, a detailed rehabilitation program has been proposed as part of the Project in order to compensate for the residual impacts of habitat loss that cannot be adequately avoided or minimised. The proposed rehabilitation and reinstatement of habitat (described in **Section 6.13**) will mean that, over time, impacts will not be completely irreversible as most key ecological features will be recovered.

The detailed assessment of the relevant impacts of the Project was based on a thorough review of technical data and other relevant information, including but not limited to:

- results from the comprehensive ecological surveys
- detailed fauna monitoring results from within the Project Area
- outcomes from detailed assessment and monitoring of mine rehabilitation at United and other Glencore sites
- relevant national and NSW recovery and threat abatement plans
- DoE Protected Matters Database and OEH Atlas of NSW Wildlife database records.

The technical data and other information considered in determining the relevant impacts of the Project on listed threatened species and communities is provided in the Statement of Consistency Report (refer to **Appendix 13**).

For those threatened species recorded in proximity to the Project Area or considered to be potentially impacted by the Project, an Assessment of Significance was undertaken in accordance with the EPBC Act *Policy Statement 1.1 – Significant Impact Guidelines – Matters of National Environmental Significance* (October 2009) to determine whether the Proposed Action would result in a significant impact on threatened species. These assessments are provided in **Appendix 13**.

As described in **Section 7.2** above, the Project is likely to have a significant impact on the Central Hunter Valley Eucalypt Forest and Woodland CEEC as it will reduce the extent of the community, adversely impact

some areas of critical habitat of the ecological community and interfere with the recovery of the ecological community. This impact is addressed by the proposed biodiversity offset for the Project.

The Project is not expected to have a significant impact on any other Commonwealth listed threatened species and communities.

7.2.2 Biodiversity Impact Avoidance and Mitigation

A number of design changes were implemented during the early stages of designing the Project that ameliorated the impacts of the Project on biodiversity entities, including threatened species, endangered ecological communities, and/or their habitats. As discussed in **Section 3.4**, United has undertaken detailed studies which considered numerous alternative mine and infrastructure plans. A key alternative considered was to develop the United Open Cut as a standalone mining operation which would have resulted in substantially more disturbance to biodiversity than the Project due to the need to develop standalone coal processing facilities, mine infrastructure (workshops etc) and transportation infrastructure (rail line, rail loop and train loading facility). The decision to proceed with the Joint Venture and therefore make available the Wambo infrastructure for the Project, negated the need to build new mining infrastructure, substantially decreasing the potential biodiversity impacts of the Project.

The impact mitigation measures proposed are based on best available practices and are widely used to mitigate the impact of coal mining developments in the Hunter Valley and elsewhere. United has committed to the design and implementation of a comprehensive biodiversity mitigation strategy to mitigate the unavoidable impacts of the Project. During the preparation of the mitigation strategy, the UHSA Guidelines for the Mitigation of Coal Mining Impacts on Biodiversity (OEH 2015c) were consulted.

Consideration was given to State and Commonwealth Recovery Plans and Threat Abatement Plans, where relevant.

Further detailed assessment of impact avoidance and mitigation measures proposed as part of the Project are provided in the UHSA Statement of Consistency report provided in **Appendix 13**.

In regard to the cost of the mitigation measures, these costs have been included within the operating costs of the Project. This includes the costs of mitigation measures, biodiversity monitoring and rehabilitation costs. There will also be additional costs associated with establishing and managing biodiversity offsets for the Project.

7.2.3 Biodiversity Offset Strategy

As described in **Section 6.9.6** United is committed to delivering a biodiversity offset strategy that appropriately compensates for the unavoidable loss of ecological values as a result of the Project, in accordance with the UHSA. As discussed above, United has altered the Project to substantially avoid and minimise ecological impacts in the project planning stage, and a range of impact mitigation strategies have been included to mitigate the impact on ecological values prior to the consideration of offsetting requirements.

The biodiversity offset strategy proposed as part of the Project is summarised in **Section 6.9.6** and detailed in **Appendix 13**.

There are no significant residual impacts not addressed by the UHSA that need to be addressed in accordance with the EPBC Act Environmental Offset Policy.

7.3 Key Issues – Water Resources

The summary information below should be read in conjunction with **Section 6.8** and **Appendices 11** and **12** of the EIS (that is, the Surface Water Assessment and the Groundwater Impact Assessment).

Water Context

The Project exists within a well-regulated water resource management system that has been designed by the NSW government to provide for the sustainable management of the State's water resources. This includes licensing of allowable water take from both surface water and groundwater with consideration of the environmental flow requirements of watercourses and the needs of other water users; control of water pollution, including management of sustainable salt loads associated with all water sources, including mine water discharges; and guidelines that govern the appropriate design of water management systems for mines to provide for appropriate water quality in accordance with pollution control requirements.

Both the Project Area and the surrounding areas have been subject to open cut mining operations for over 55 years. Recent and existing mining at the site include the United underground and open cut pits and Wambo underground and open cut pits. In the local region other mining operations include Mt Thorley Warkworth Open Cut, Lemington underground and open cut pits and HVO South open cut pits.

The Project Area is located within the catchments of Wollombi Brook and Waterfall Creek, both tributaries of the Hunter River. Wollombi Brook is located to the east of the Project Area and flows into the Hunter River approximately 5 kilometres northeast of the Project Area (refer to **Figure 1.7**). Waterfall Creek is a minor tributary of the Hunter River and flows into the Hunter River approximately 4 kilometres northwest of the Project Area.

The Hunter River is a regulated river with releases from Glenbawn Dam and Glennies Creek Dam managed by WaterNSW under a Water Sharing Plan. Glenbawn Dam is located in the upper reaches of the Hunter River upstream of the Project Area. Glennies Creek Dam is located on Glennies Creek upstream of Singleton. The confluence of Glennies Creek with the Hunter River is located downstream of the Project Area.

The majority of the Project Area lies within the Wollombi Brook catchment. The existing mining operations at United and Wambo are also located within these catchment areas. The catchment area of Wollombi Brook is substantial (approximately 1850 km^2) and approximately 99 per cent of the catchment area lies upstream of the Project Area.

Wollombi Brook catchment in the vicinity of the Project Area includes sub-catchments of Wambo Creek, North Wambo Creek and Redbank Creek (refer to **Figure 6.12**). Waterfall Creek, a sub-catchment of the Hunter River, is located in the north of the Project Area. The existing United and Wambo Water Management Systems (WMS) are also located within the Project Area. The extent of the existing WMSs is shown on **Figure 1.7**.

The two main aquifer systems identified as occurring within and surrounding the Project Area are the Quaternary alluvium (including 'highly productive' and 'less productive' alluvium) and the Permian coal measures. The quaternary alluvium in the vicinity of the Project Area occurs along Wollombi Brook and parts of its tributaries and along the Hunter River to the north (refer to **Figure 6.22**). The Hunter River alluvium flows in an easterly direction, while groundwater within the Wollombi Brook alluvium flows in a north to northeasterly direction towards the Hunter River. Recharge to the Quaternary alluvium occurs via 'diffuse' recharge from rainfall and 'focussed' recharge through the stream bed. The available data indicates that the alluvial groundwater is largely restricted to the thicker sequences of sand and gravel (highly productive alluvium) along the Hunter River and Wollombi Brook. Groundwater levels within the

Quaternary alluvium along Wollombi Brook and Hunter River within the vicinity of the Project Area are generally 4 metres and 10 metres below surface, respectively.

The Permian coal measures are are generally confined above and below by impermeable overburden and interburden layers of sandstone, siltstone or clays. These aquifers are recharged by downward leakage from the upper strata within the escarpment areas of Wollemi National Park, from the area where the measures outcrop (i.e. reach the surface) to the north of the Project Area and from localised downward leakage from the Quaternary alluvium. The Wittingham Coal Measures are saturated across their extent with groundwater levels generally 30 metres below the surface, ranging between 80 mAHD to the southwest beneath the escarpment down to 50 mAHD near the Hunter River.

Water Management System and Water Impacts

Both United and Wambo mines have extensive existing WMSs in place which include mine dewatering systems, water storages, sedimentation and retention basins, and water diversions and catch drains. Both WMSs have similar key objectives. The key objectives are to:

- prevent the contamination of clean water by mining activities
- segregate clean waters away from active mining areas to reduce the volume of mine affected water requiring subsequent storage and treatment
- minimise the discharge of pollutants from mining affected areas into the environment
- quantify the water used, stored and imported/exported
- maximise recycling and water sharing opportunities.

The conceptual water management strategy for the Project has been designed to integrate water management of the Project with the existing WMSs. The key drivers for the strategy are the separation of clean and dirty water; seeking to prevent the contamination of clean water by mining activities; maximising water recycling and reuse opportunities; effectively managing water across United and Wambo; and managing compliance with statutory obligations. A detailed description of the proposed conceptual WMS for the Project is provided in **Appendix 11**.

Water management for the existing mines and for the Project considers three categories of water, each with different potential to cause environmental harm. The target design criteria for each of the three categories of water are summarised in **Table 7.2**.

Table 7.2 Design Criteria for Components of the Project WMS

Water Category	Water Description	Target Design Criteria
Clean	Runoff from undisturbed or established rehabilitation areas	Intercept, convey and/or release, where practicable, to downstream environment
Dirty	Runoff from disturbed areas	Managed in line with the Blue Book (Managing Urban Stormwater: Soils and Construction Volumes 1 and 2E)

Water Category	Water Description	Target Design Criteria
Mine	Runoff from areas exposed to coal, groundwater inflow, water used in coal processing or from coal stockpile areas	Mine water storages to have sufficient freeboard to contain runoff for events up to and including the 1 per cent 24 hour AEP (annual exceedance probability) storm event.

As described above, the intent of the WMS is to convey clean water around the mining operations or, when runoff water from the rehabilitated areas becomes clean, enable runoff from these rehabilitated areas to flow directly to the downstream environment instead of being managed as part of the WMS.

Dirty water (i.e. runoff from disturbed areas outside the mining pit and infrastructure areas, such as overburden emplacement areas (both active and under rehabilitation) captured in the sediment dams) is pumped to the mine water management system. Mine water (i.e. runoff from areas exposed to coal, groundwater inflows and water used in coal processing or from coal stockpile areas) is also managed as part of the mine water management system.

Pollution in NSW is regulated by the POEO Act with discharges from the mine water management system required to be licensed by an EPL if the discharge would otherwise constitute a pollution of waters (section 120 of the POEO Act). The quantity and quality of water discharges from mining operations in the Hunter Region are managed in accordance with relevant EPLs and consistent with the provisions of the Hunter River Salinity Trading Scheme (HRSTS). As part of the development of the HRSTS, the NSW Government has determined the sustainable salt load for the Hunter River, considering the impacts on the environment. The HRSTS is managed such that discharges from industrial operations can only occur in suitable conditions. Wambo has a licence and salt credits to discharge water in accordance with the HRSTS into Wollombi Brook. United also holds salt credits under the HRSTS but does not currently have a licence to discharge saline water. Water within the mine water management system will continue to be either reused on site or shared within the Wambo Underground, CHPP and train loading facility. Surplus water within the mine water management system will be managed under the EPL and HRSTS and discharged in accordance with these controls.

The site water balance indicates average inflows are predicted to total 6316 ML per year, while average outflows total 6962 ML per year indicating a net average inventory reduction of approximately 96 ML per year.

All water take predicted for the Project, including take of surface waters, alluvial groundwater and groundwater from the Permian aquifer, is within the existing licensed allocations held by United and Wambo for each of the relevant water sources. As noted above, the water policy framework in place in NSW is designed to ensure that licensed take of waters does not exceed the sustainable yield of the water systems.

The Project will not require any alteration to the existing regulatory arrangements at the site and will not result in any increase in discharges over what is already permitted to occur in the Wambo EPL.

Surface Water and Groundwater Monitoring and Water Quality

Surface water and groundwater monitoring programs are currently being implemented at United and Wambo with the content of these monitoring programs being approved by the NSW Government.

Surface water flow monitoring is limited to some short term flow gauges on North Wambo Creek. Both Wollombi Brook and the Hunter River have long term flow gauging data available from gauges operated by NSW DPI Water.

The surface water quality monitoring programs have developed over the period of historical mining to provide indicators of any increased risk or environmental harm. As such, these monitoring programs focus on the key risks associated with the water management system to downstream received waters, being spills from sediment dams in the dirty water system to the downstream environment. Monitoring of licensed discharges is also undertaken to confirm that discharge criteria are met (volume and quality). The key routine water quality monitoring parameters are pH, electrical conductivity (EC), total dissolved solids (TDS) and total suspended solids (TSS). Monitoring of other analytes, including metals and metalloids, also occurs on a campaign basis or if routine monitoring results indicate that additional investigations are required.

The monitoring data shows that the water quality parameters are highly variable across the monitoring network, as would be expected within ephemeral drainage systems. Wollombi Brook, being more perennial, exhibits notably less variation in its water quality. Surface water runoff captured in the existing WMSs tends to exhibit notably more variation in TDS, TSS, EC and pH than the waters of Wollombi Brook. In addition, the concentration of these parameters in contained runoff tends to be of a greater magnitude than that observed in downstream Wollombi Brook. The water quality in Wollombi Brook shows little variation at monitoring locations upstream and downstream of the existing operations, indicating that Wollombi Brook is not exhibiting any measurable impacts due to the existing mining operations.

The ephemeral creek systems within and adjacent to the Project Area also generally exhibit similar water quality results upstream and downstream of the existing operations. Again, this suggests little to no measurable impact on the surrounding ephemeral watercourses as a result of the mining operations. Notably, the measured TSS load actually decreases downstream of the existing operations in Redbank Creek and Stony Creek, and is similar in North Wambo Creek, indicating that the existing WMS is generally effective at managing TSS within the site.

Analysis of the concentrations of various metals and metalloids reveals a generally wider spread in the concentrations detected in the samples from the existing operations compared with the samples from the Hunter River. There are several parameters monitored within the existing WMSs for which the mean and median values exceed the ANZECC 95th percentile guideline value for the protection of freshwater ecosystems including cadmium, chromium, copper, lead, nickel and zinc. However, these exceedances are not reflected in downstream receiving waters, supporting the contention that metals and metalloids are not a significant environmental risk due to the effective operation of the existing WMSs.

United and Wambo have a combined groundwater monitoring network that has evolved since 2000. The network comprises 77 bores and 24 vibrating wire piezometers (VWPs), of which 27 bores and 11 VWPs (55 sensors) are currently monitored as part of ongoing groundwater monitoring programs (refer to **Figure 6.22**). This extensive network combined with data from the past and current mining operations provide a sound understanding of the local groundwater environment.

Water quality monitoring results for the alluvium ('highly productive' and 'less productive') indicate that groundwater is not suitable for long-term irrigation according to the ANZECC (2000) guideline levels for total manganese. The results indicate that groundwater within the 'highly productive' alluvium is suitable for stock water supply. Overall, the results indicate that groundwater within the 'less productive' alluvium is not suitable for stock water supply (excluding sheep) in accordance with the ANZECC (2000) guidelines. However, alluvial groundwater is occasionally used for stock (cattle) water supply and some domestic applications (i.e. gardens) within the region.

Water quality monitoring results for the Permian coal measures (and interburden) indicate that the groundwater is not suitable for stock water supply due to elevated salinity levels and total aluminium concentrations. Groundwater monitoring within the Permian coal measures also records total manganese concentrations above the ANZECC (2000) long term irrigation trigger. Total selenium and concentrations above the ANZECC (2000) guideline level for short-term irrigation is recorded for the groundwater occurring in the coal seams. The results also indicate that groundwater within the Permian coal measures and spoil is not suitable for stock water supply or irrigation according to the ANZECC (2000) guidelines.

The Groundwater Assessment for the Project concluded that the Project is not predicted to impact on groundwater quality in either the Quaternary alluvium or Permian aquifer.

Water Users

Water extraction/abstraction both in and surrounding the Project Area is regulated by the NSW Government by water sharing plans (WSP). Water Access Licences (WALs) are held by both United and Wambo under the *Water Sharing Plan for the Hunter Regulated River 2004* and the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009.*

There are no known water extraction points for other parties on Wollombi Brook downstream of the Project Area. There are no known licensed water users on waterways directly downstream of the Project Area along Wollombi Brook, its tributaries (Wambo Creek, North Wambo Creek and Redbank Creek) or Waterfall Creek.

Water extraction from the Hunter River downstream of the confluence of Waterfall Creek is undertaken by mining operations, irrigator, for stock and domestic purposes. Water supply for townships on the Hunter River downstream of the Project Area is sourced from Glennies Creek Dam.

Under NSW legislation, basic landholder rights allow take of surface water runoff and take of water from rivers, estuaries and lakes from land which has frontage to these sources under harvestable rights provisions and domestic and stock rights respectively. The majority of land adjacent to Wollombi Brook downstream of the Project Area to the Hunter River is owned by mining operations. There are also a number of parcels of Crown land as well as land held by Singleton Council, Wanaruah Local Aboriginal Land Council and private landholders around the township of Warkworth. Similarly the land adjacent to Wambo, North Wambo and Redbank Creek is, in majority, owned by mining companies.

The majority of land adjacent to Waterfall Creek downstream of the Project Area to the Hunter River is also owned by mining operations. There is also a parcel of Crown land adjacent to the Hunter River.

The National Groundwater Information System (NGIS) database identifies 68 registered bores within 4 kilometres of the proposed extraction area associated with the Project (refer to **Figure 6.23**). Of the 68 identified bores, 23 have been abandoned and destroyed, and nine have been abandoned but are in a usable condition. Of the remaining 36 existing bores, 18 are located on land owned by the Joint Venture, and two are used for groundwater monitoring on Coal & Allied land (GW30740 and GW080963) (refer to **Figure 6.23**). The remaining 16 are private bores largely used for stock water supply, with some also used for irrigation and domestic use (garden and toilets).

The majority of private bores take water from the Quaternary alluvium. The NGIS database and the bore census undertaken for the Project indicates that the main use of groundwater is for stock, with minor irrigation and domestic use (gardens and toilets).

Based on the Groundwater Assessment, predicted impacts on private groundwater bores are less than the Level 1 minimal impact considerations specified in the NSW Aquifer Interference Policy except for the impact on one private bore (refer to **Section 6.8.2**). The modelling indicates potential for drawdown of more than 2 metres at one private bore which will exceed the Level 1 minimal impact considerations. The impacted bore is not currently serviceable and is located on a property within the predicted noise affectation zone for the Project. The property is likely to be subject to voluntary acquisition clauses should the Project be approved.

Project Design to Minimise Impacts on Water Resources

Environmental studies have been used to inform the proposed conceptual design for the Project. Specifically in relation to minimising the impact on water resources this has included:

- The extent of existing and approved open cut and underground mining within and surrounding the Project Area, with mining already significantly altering the water environment.

- The management of impacts from the Project within the regime established by NSW water and pollution control legislation, which provides for sustainable water take from water sources, management of water quality by imposition of discharge quality criteria and management of salt loads within sustainable targets by managing water discharges to the environment.

- By maintaining substantial buffer distances to Wollombi Brook (approximately 370 metres) and the Hunter River (approximately 1.7 kilometres) when compared to the recommended 200 metre offset in the NSW Aquifer Interference Policy.

- Design of the water management system to meet legislative requirements and relevant guidelines (e.g. guidelines for treatment of runoff from disturbed areas) (as described above).

- Minimisation of works within the flood prone areas of Wollombi Brook to minimise the potential to impact on flood behaviour.

- Maximised water recycling and sharing across the Integrated WMS to minimise import of water to the complex and to minimise discharges of excess water from the complex.

These factors reduce the potential for the Project to result in a significant impact on existing water resources.

It is important to note that coal mining will always impact the groundwater regime, as dewatering of the mine workings is essential to the safe extraction of coal. The *Significant Impact Guidelines 1.3: Coal seam gas and large coal mining developments - impacts on water resources* (DoE 2013) have been interpreted to mean that this unavoidable impact is only considered significant where there is a consequence from this impact; that is, that groundwater users or the environment are affected by changes in the quality or quantity of groundwater.

A summary of the potential water impacts against the *Significant Impact Guidelines 1.3: Coal seam gas and large coal mining developments – impacts on water resources* (DoE 2013) is included in **Table 7.3**.

Table 7.3 Assessment against Significant Impact Guidelines: Coal Seam Gas and Large Coal Mining Developments – Impacts on Water Resources

Aspect	Impact
Flow Regimes	The footprint of mining operations will increase with the Project and water from this increased area will be captured, treated and reused within the water management system. The Project includes placement of a flood levee adjacent to the United Open Cut to provide protection from flooding associated with flood flows in Wollombi Brook and backflows into Redbank Creek. The assessment indicates that the Project will have minor to negligible impacts on flow regimes including flood flow velocities and depths, and associated potential impacts on downstream landholders and watercourse stability in Wollombi Brook and its tributaries when compared to the existing approved operation. The potential impacts on flow regimes, including flood flows in Waterfall Creek, are considered to be minor when compared to the existing approved operation. Flow to alluvial aquifers and baseflows in streams is predicted to be reduced during mining. However, the predicted reduction is comparatively low compared to cumulative impacts. A more detailed summary of the assessment of impacts on flow regimes is included in **Section 6.8.1**. The detailed assessment of potential impacts on flow regimes includes assessment of impacts on catchment areas and annual flow volumes (refer to Section 6.1 of **Appendix 11**), including flow duration impacts as a result of changes to catchment areas and baseflow contributions at flow monitoring locations on both Wollombi Brook and the Hunter River, and flood modelling of Wollombi Brook and Waterfall Creek (refer to Section 6.2 of **Appendix 11**).
Recharge Rates; Aquifer pressure or pressure relationships between aquifers; Groundwater table levels	Recharge rates will potentially increase in the open cut mining area and recharge to alluvium and streams (baseflow contributions) will potentially decrease in some locations. Pressures will reduce in the Permian aquifer and in some relatively small sections of the alluvium during the Project life but will recover post mining. The groundwater table for the Permian aquifer and in some relatively small sections of alluvium will decline during mining but partially recover post mining. A more detailed summary of the assessment of impacts on aquifer pressures and groundwater tables is included in **Section 6.8.2.2**. The detailed assessment of potential impacts on aquifer pressures, interactions between aquifers and groundwater table levels, including predicted drawdown zones, is included in **Appendix 12**.

Aspect	Impact
Groundwater/surface water interactions	Water table drawdown within the alluvium will reduce base flow to the interconnected streams, however, these reductions will be managed through licences for take already held by United and Wambo. The surface water assessment indicates that the predicted worst case impacts on baseflows will not have a significant impact on flows in either Wollombi Brook or the Hunter River. In addition, the assessment of the final voids indicates that the voids will be self-contained systems which will act as a sink in perpetuity, with no surface spills predicted to downstream watercourses. A more detailed summary of the impacts on groundwater/surface water interactions is included in **Section 6.8.1**. Interactions between groundwater and surface water, in regard to baseflow impacts, have been assessed by way of flow duration curves for flow gauges on Wollombi Brook and the Hunter River, and are included in Section 6.1.1 of **Appendix 11**. This assessment identified a negligible level of impact. The detailed assessment of the proposed final voids is included in Section 6.3.3 of **Appendix 11**.
River/floodplain connectivity	The Project is not expected to have an impact on river/floodplain connectivity as no mining is proposed in flood plain areas. The Project is located on the edge of the flood prone land associated with Wollombi Brook. The assessment indicates that the Project will have negligible influences on flood behaviour in Wollombi Brook and as such it is considered that the Project will not influence river/floodplain connectivity. A more detailed summary of the impacts on groundwater/surface water interactions is included in **Section 6.8**. The detailed assessment of flood behaviour and potential impacts on flooding regimes, including impacts on river/floodplain connectivity is included in Section 6.2 of the **Appendix 11**.
Inter-aquifer connectivity	There are no changes predicted to inter-aquifer connectivity as a result of the Project. The predicted changes in aquifer pressure are discussed above.
Coastal Processes	No impacts on coastal process are predicted as a result of the Project which is located well inland, being approximately 80 kilometres from the coast.

Aspect	Impact
Impact on water users	The assessment of impacts on water users indicates that there will be negligible impact on surface water users. There is one potentially impacted private bore as a result of groundwater drawdown associated with the Project, however, as noted above, this bore is currently not serviceable. United has committed to make good arrangements should the potential impact be realised. All water take associated with the Project will be licensed in accordance with the *Water Management Act 2000*, with predicted take within the capacity of the water licence allocations currently held by United and Wambo. A more detailed summary of the impacts on water users is included in **Sections 6.8.1.6** and **6.8.2.2** for surface water users and groundwater users respectively. The detailed assessment of impacts on surface water users is included in **Appendix 11**. The detailed assessment of impacts on groundwater users is included in **Appendix 12**.
State Water Resource Plans	The surface water and alluvial water sources within the Project Area are managed under the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009*. In addition, water extraction from the Hunter River is managed under the *Water Sharing Plan for the Hunter Regulated River Water Source 2003*. Both the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009* and the *Water Sharing Plan for the Hunter Regulated River Water Source 2003* are State Water Resource Plans and are subject to the WM Act. The NSW Government Water Sharing Plans provide a regional water balance for these water sources and consider cumulative water use. The *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016* is currently on exhibition and is scheduled to commence on 1 July 2016. The coal measure aquifers in the Project Area will be covered by this WSP. The coal measure aquifers are currently governed by the *Water Act 1912* and there is an embargo in place on issuing of new water licences under this Act. This embargo will be lifted when the WSP commences on 1 July 2016. Water take for the Project will comply with the above listed water sharing plans and Acts which are designed to provide for the sustainable use of NSW's water resources. As noted above, the predicted water take for the Project is within the capacity of the water licence allocations currently held by United and Wambo.

Aspect	Impact
Water Quality	Both United and Wambo have comprehensive WMSs in place to manage the potential impacts of the existing mining operations on water resources. The WMS for the Project will be designed in accordance with relevant government standards to limit potential impacts on downstream water qualities by managing water that has the potential to cause environmental harm. To manage water quality during construction, operation and rehabilitation phases of the Project, erosion and sediment control measures and other water quality control measures in accordance with the relevant government standards will be implemented to minimise any potential impact on water quality. Monitoring results will be assessed against the relevant ANZECC trigger values. The Project proposes to continue to discharge surplus water from the WMS in accordance with relevant approvals. The quality of such discharges will be in accordance with EPL limits and consistent with the provisions of the HRSTS. Discharges from the WMS will be monitored prior to release to ensure compliance with the requirements of the HRSTS. With these measures in place and considering the management of cumulative salt loads under the HRSTS, discharges of water from the Project are not considered likely to result in significant cumulative impacts on downstream environments. The risks to downstream environments associated with sediment laden water are mitigated by the design of the Project's WMS in accordance with design criteria established by the NSW Government specifically for sediment control at mining and quarry operations. These controls will effectively manage this risk. Through management of sediment laden (dirty) water and mine water within the WMS over the life of the Project, and based on flood assessment findings that indicate no changes to velocities and associated scour potential in Wollombi Brook, it is not anticipated that water quality in downstream waterways will be adversely impacted by the Project. As noted above, all discharges of saline water will be undertaken in accordance with the HRSTS, ensuring that they remain within the sustainable salt level for the Hunter River determined by the NSW Government. The Project is therefore considered to have a low potential to impact on water quality in downstream watercourses. A more detailed summary of the impacts on water quality is included in **Sections 6.8.1.6** and **6.8.2.2** for surface water and groundwater respectively. The detailed assessment of impacts on surface water quality is included in **Appendix 11**. The detailed assessment of impacts on groundwater quality is included in **Appendix 12**.

7.4 Environmental Record of Person Proposing to take the Action

United is owned 95 per cent by Abelshore Pty Limited, a wholly owned subsidiary of Glencore, and 5 per cent by the CFMEU and is managed by Glencore. The Project will be managed by United on behalf of the Joint Venture. The proponent for the Project is United.

Wambo is the other party to the Joint Venture. Wambo is a subsidiary of Peabody Energy Australia Pty Limited (Peabody).

7.4.1 United

The following statement of environmental record has been provided by United.

United has an EMS in place for its existing mining operation in Care and Maintenance. The EMS is developed to meet Glencore requirements and is generally in accordance with ISO 14001. As discussed in **Section 2.1**, the EMS provides a risk based platform on which relevant environment and community controls, procedures and management plans have been established and are regularly reviewed.

As part of its EMS, United conducts regular environmental monitoring and auditing to gauge performance, compliance with regulatory requirements, and to minimise impacts on the surrounding community and the environment.

United has not been convicted of any breach of any environmental protection legislation. No approvals under environmental protection legislation or other relevant legislation have been revoked or suspended in the five years immediately prior to this application being lodged.

Glencore Values and Code of Conduct policies are available on the Glencore plc website (www.glencore.com). The following statement is an excerpt from the Code of Conduct:

Our managers are required to:

1. *Identify, assess and monitor environmental impacts.*

2. *Comply with applicable regulatory requirements and monitor relevant regulations for changes.*

3. *Implement appropriate environmental management programmes and controls, including appropriate measures for emergency preparedness.*

4. *Ensure competent staff and sufficient resources for environmental management.*

5. *Involve contractors and service providers where appropriate.*

6. *Implement programmes and targets for continuous improvement of our:*

    - *Efficient use of resources (e.g. energy, water and land).*
    - *Protection of biodiversity.*
    - *Climate change impact.*
    - *Pollution prevention (by addressing management of fresh water and effluent, waste, air emissions, hazardous materials and rehabilitation of land).*

7. *Track actual environmental performance.*

7.4.2 Wambo

The following statement of environmental record has been provided by Wambo.

Wambo has a strong record of compliance with its environmental obligations for its mining operations under the Wambo mine development consent and Controlled Action Approval (EPBC 2003/1138). Wambo has established and is committed to continuing open and constructive dialogue with the local community and stakeholders regarding environmental management as part of its operations.

The Annual Environmental Management Reports are available on the Wambo Coal Mine website (http://www.peabodyenergy.com/content/422/australia-mining/new-south-wales/wambo-mine/approvals-plans-and-reports-wambo-mine).

The environmental monitoring program results over recent years have shown that Wambo's management of its operations at the Wambo mine provides effective management of potential impacts from the mine's operations and achieves compliance.

On 1 August 2014, Wambo was convicted in the Singleton Local Court for an offensive odour offence under section 129(1) of the NSW *Protection of the Environment Operations Act 1997* for a blast fume incident associated with the open cut mining operations which occurred on 24 July 2012. Wambo was ordered to pay a fine of $13,000 and the NSW EPAs costs in the amount of $24,000.

Wambo also pleaded guilty to an offensive odour offence under section 129(1) of the *Protection of the Environment Operations Act 1997* for a blast fume incident associated with the open cut mining operations which occurred on 14 May 2014. The proceedings in respect of this offence were brought by the NSW EPA in the Land and Environment Court of NSW. A sentencing hearing was held on 17 December 2015, and the Court has reserved its judgment in respect of the matter.

No approval under environmental protection legislation has been revoked or suspended in the 5 years immediately prior to this application being made.

Section 8.0

Summary of Environmental Management and Monitoring Measures

8.0 Summary of Environmental Management and Monitoring Measures

The SEARs for the Project require that the EIS include a summary of all the proposed environmental management and monitoring measures, highlighting commitments included in the EIS.

If development consent is granted under Division 4.1 of Part 4 of the EP&A Act for the Project, United will commit to the controls outlined below.

Wambo will continue to operate its underground operations, the CHPP and train loading facility in accordance with the relevant development consents and associated environmental management plans. Where relevant, the existing Wambo environmental management plans will be updated in regard to the Harmonisation Modification and to remove reference to open cut operations.

Hours of Operation

- Mining and associated activities for the Project will be undertaken 24 hours per day, 7 days per week.
- Blasting will be undertaken 9.00 am to 5.00 pm on Monday to Saturday, with no blasting to be undertaken on Sundays or public holidays.
- Construction of the Golden Highway realignment works will generally occur during standard construction hours of 7.00 am to 6.00 pm, Monday to Friday and 8.00 am to 1.00 pm on Saturday. Construction activities may also be required outside these times, as required by RMS. Construction activities undertaken outside these hours will be managed to meet the relevant construction noise criteria.
- Construction of infrastructure including the 330 kV powerline realignment will be undertaken 24 hours per day, 7 days per week as required. All construction work undertaken outside the standard construction hours will be managed to provide for compliance with Project noise criteria unless otherwise agreed with affected landholders.
- All other on site construction activities will be undertaken 24 hours per day, 7 days per week.

Social and Economic

- To address the Project impacts identified as part of the SIOA, United proposes to implement a number of strategies and programs to mitigate and/or enhance Project impacts. The measures to be implemented as part of the Project are outlined in **Section 6.14.5**.
- United will develop and implement a Stakeholder Engagement Plan for the Project. The plan will guide the implementation and evaluation of the social aspects of the Project and will outline the social monitoring program for the Project.
- United will implement an ongoing community engagement program for the Project, including periodic community BBQs/information days as well as community newsletters.
- United will update and implement the existing United complaints response and management program as part of the Project.

- United will continue to operate the United Community Consultative Committee following relevant DPE guidelines.

- United will enter into a Voluntary Planning Agreement with Singleton Council for the Project to contribute funds to meet local community needs.

Rehabilitation and Closure

- United will implement an approach to the design and development of the final landform for the Project to achieve a more natural landform. The final landform will be designed to:
    - be safe, stable and non-polluting
    - incorporate micro relief
    - incorporate drainage lines consistent with topography and natural drainage where reasonable and feasible
    - sustain the intended land use for the post-mining domains
    - minimise the visual impacts of the development
    - be in keeping with the natural terrain features of the area
    - be integrated with the rehabilitated landforms of surrounding mines where practicable
- The revegetation strategy for the Project will involve the revegetation of the site to achieve three broad types of rehabilitation vegetation (refer to **Figure 6.57**):
    - approximately 878 hectares of ecological rehabilitation, consisting of native woodland conforming to the Central Hunter Valley Eucalypt Forest and Woodland CEEC, as part of the biodiversity offset strategy for the Project and to provide biodiversity function in the rehabilitated landscape
    - native woodland
    - agricultural pasture land.
- A Rehabilitation Management Plan or MOP will be prepared for the Project in consultation with DPE, DRE and OEH which will include:
    - the details of the proposed development of a rehabilitation and revegetation strategy for the Project to re-establish native vegetation communities consistent with the concept strategy described in this EIS and considering the Ecological Rehabilitation Guidelines (OEH 2015c)
    - the approach to developing agricultural pasture land, with the primary focus being on the northwest portion of the Project Area and near North Wambo Creek (refer to **Figure 6.57**). The objective will be to rehabilitate these areas to Land and Soil Capability Class IV agricultural land
    - completion criteria, determined in consultation with relevant agencies, that will be utilised to demonstrate achievement of rehabilitation objectives
    - monitoring of rehabilitated areas on an annual basis.

- United will undertake a rehabilitation monitoring program as part of the Project in accordance with Glencore standards. The objectives of the program will be to:
    - assess the long term stability and functioning of re-established ecosystems on mine affected land
    - assess rehabilitation performance against the closure criteria
    - facilitate continuous improvement in rehabilitation practices.
- United will develop and implement a management approach to address any areas of potential acid forming materials that may be identified as part of the Project.
- A detailed mine closure plan will be developed at least two years prior to the anticipated mine closure date (i.e. cessation of mining).

Air Quality

- United will develop and implement an Air Quality Management Plan for the open cut operations. The Plan will outline the range of proactive and reactive dust control strategies to be implemented as part of the Project. The controls to be implemented are outlined in **Sections 6.4.1** and **6.4.6** and in **Appendix 7** and include the following key measures:
    - Proactive air quality management involving the planning of activities in advance of potentially adverse conditions, including
        - implementation of a system to provide relevant personnel with a daily forecast of expected dust conditions in the vicinity of the operation
        - discussion of the weather conditions and dust considerations at daily pre-shift meetings
        - modifying the planned mining activities, as appropriate, to minimise dust impacts.
    - Reactive air quality management measures including modification or suspension of activities in response to identified triggers including
        - visual conditions, such as visible dust from trucks above wheel height. Visual conditions will be established from both observations by site personnel and from a camera network to be established on site to cover the main dust sources of the operation
        - meteorological conditions, such as dry, windy conditions, with winds blowing towards sensitive receptors
        - ambient air quality conditions (that is, elevated short-term PM_{10} concentrations).
    - Development of an Air Quality Monitoring Program for the Project that supports the proposed proactive and reactive air quality management system. The monitoring program will be designed to allow evaluation of the effectiveness of the air quality management system and compliance with air quality operating conditions.
- The proposed dust management measures for the Project will be prepared in consideration of the NSW Coal Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining (Katestone 2011).

- United will implement Glencore blasting procedures relating to fume management as part of the Project, including a pre-blast review of weather conditions so as to avoid blasting in adverse conditions. A site specific Blast Management Plan will also be developed and implemented during operations, including key fume management actions, such as defining the potential risk zone based upon weather patterns prior to blasting based on an assessment of real-time weather conditions.

- United will develop and implement a Spontaneous Combustion Management Plan for the Project which will provide guidelines for eliminating or minimising the risk of incidents as a result of spontaneous combustion.

Greenhouse Gas and Energy

- United will implement reasonable and feasible energy management controls as part of the Project including the management controls identified **Section 6.5.5** and **Appendix 8**.

- At an operational level, United will aim to improve energy efficiency and reduce greenhouse emissions from the Project via:

    - limiting the length of haulage routes (where feasible) and associated fuel consumption

    - considering energy and fuel efficiency when selecting new equipment

    - scheduling activities so that equipment and vehicle operation is optimised.

Noise

- United will develop and implement a Noise Management Plan for the open cut operations. The Noise Management Plan will detail the implementation of monitoring and management controls to be utilised to manage noise impacts associated with the Project, and will include the key aspects outlined in **Section 6.6.10.2**.

- United will seek to achieve the predicted noise levels detailed in **Section 6.6.3.4** through the implementation of a performance based adaptive management approach focused on implementing appropriate operational controls and management strategies to minimise noise impacts. The approach will vary during different mine stages, weather conditions and consider technological improvements and associated equipment noise levels. A range of controls and strategies may be adopted as required to meet noise performance requirements for the Project as outlined in **Section 6.6.10.1**.

- United commits to the implementation of the following key proactive noise management measures:

    - Incorporation of reasonable and feasible noise attenuation on key items of plant and equipment that will be re-used from the current Wambo Open Cut operations or other controls achieving the same overall noise outcome.

    - Incorporation of reasonable and feasible noise attenuation measures on new plant and equipment that has the potential to contribute to the Project's noise level.

    - Using 'silent horns' to communicate with trucks and smart broadband 'Quacker' reversing alarms.

    - The inclusion of bunds in strategic locations along haul roads, where practicable, to shield trucks and equipment on exposed sections of the haul road ramps.

- Locating key haul roads below ground surface or behind topographical features to maximise shielding to surrounding receiver areas, where practicable.

- Designing emplacement areas to create sheltered dumping locations that can be used during adverse weather conditions where feasible and practicable.

- Managing the drop height of the first load into truck bodies to minimise impact noise from the material.

- United will implement reasonable and feasible receiver based noise mitigation measures which may include measures such as double glazing, insulation or air conditioning to residences located within the Active Noise Management Zone (refer to **Section 6.6.3.4**) upon written request.

- United will implement an appropriate continuous Noise Monitoring Program that will enable the proactive and real time management of operations during adverse noise propagating conditions, as outlined in **Section 6.6.10.3**.

Blasting

- United will implement the blast management controls necessary to meet the relevant criteria for private residences (except where a negotiated agreement exists), infrastructure and other sensitive receivers.

- United will manage blasting to meet the existing agreed vibration and overpressure criteria at the Wambo Homestead Complex.

- Blasting activities will be undertaken in accordance with a Blast Management Plan to be prepared and implemented for the Project which includes controls to manage safety to people, property and livestock, vibration and airblast emissions and dust and fume emissions. The cumulative effects of blasting will be managed through:

    - a pre-blast assessment protocol that outlines the process for designing blasts to meet the relevant criteria

    - continued operation of the existing multi-station blast monitoring system for the Wambo Open Cut and installation of an additional monitoring station located to the northeast in the Maison Dieu area

    - operation of a weather monitoring system which allows for the assessment of pre-blast meteorological conditions as part of the pre-blast assessment protocol

    - implementation of appropriate exclusion zones to manage the risk of flyrock.

- Blasting will be undertaken between 9.00 am and 5.00 pm Monday to Saturday, with no blasting to be undertaken on Sundays or public holidays.

- Blasting associated with the Project will be limited to a maximum of 15 blasts per week and three blasts per day, with an allowance for additional blasts where there are low vibration blasts or misfires.

- Blasting related closures of the Golden Highway associated with the Project will be limited to a maximum of one per day.

- United will develop and implement a Blasting Road Closure Management Plan in consultation with RMS and Singleton Council prior to any blasting within 500 metres of any public road.

- United will liaise with the operators of adjacent mines in relation to the coordination of blasts to seek to avoid concurrent blasting.

- United will liaise with HVO regarding blasting within 500 metres of the Riverview Pit Dam wall.

- United will offer all private landholders located within 2 kilometres of the Project extraction areas a property inspection prior to the commencement of blasting for the Project in order to establish the condition of private structures.

- A condition assessment will also be completed on all historical sites (excluding those that will be removed or subject to archival recording by the Project and the Dog leg fence) located within 2 kilometres of the extraction areas prior to the commencement of blasting for the Project.

Water Resources

- United will prepare and implement a Water Management Plan (WMP) for the Project in consultation with DPI Water and DPE. Subject to the requirements of the conditions of consent, the WMP will include:
    - a water balance including details of water supply, use, management and transfers
    - an Erosion and Sediment Control Plan that is consistent with the requirements of Managing Urban Stormwater: Soils and Construction – Volume 1 and Volume 2E Mines and Quarries, or its latest version
    - a Surface Water Management Plan, including
        - relevant baseline data on channel stability and water quality
        - a description of the water management system on site including design objectives and performance criteria
        - trigger levels for investigating any potentially adverse impacts
        - a surface water monitoring program
    - a Groundwater Management Plan, including
        - relevant baseline data on groundwater levels, yield and quality
        - groundwater assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts
        - a groundwater monitoring program.
- The WMP will include a revised surface water and groundwater monitoring program, building on the existing monitoring program in place at United and Wambo.

- United will construct a flood levee to protect the United Open Cut from flood inundation along Redbank Creek from Wollombi Brook.

- United will consult with the private bore owner that is predicted to have a drawdown of greater than 2 metres as a result of the Project to determine appropriate management and mitigation measures.

- A Construction Erosion and Sediment Control Plan will be prepared to guide the implementation of appropriate erosion and sediment controls as part of the construction phase of the Project.

Biodiversity

Impact Mitigation Strategy

- The Project will avoid direct impacts on the 0.1 hectare stand of Hunter Valley Weeping Myall Woodland of the Sydney Basin Bioregion within the Project Area. The stand will be managed for the recovery of the community and will be fenced to exclude grazing stock and unauthorised intrusions (with an approximate 20 metre buffer between the stand and the fence, where practicable given the location of existing infrastructure).

- United will prepare and implement a Biodiversity Management Plan for the Project including a detailed impact mitigation strategy prepared generally in accordance with the *UHSA Guidelines for the Mitigation of Coal Mining Impacts on Biodiversity* (OEH 2015b). The impact mitigation strategy will address the following key elements:

    - landform establishment

    - implementation of clearing procedures to minimise the impacts of the clearing process and maximise the recovery of any valuable biodiversity resources (e.g. seed collection, re-use of hollow logs and tree hollows where appropriate)

    - feral animal and noxious weed control

    - fencing and access control

    - management of domestic stock

    - pathogen management

    - bushfire management

    - ensuring appropriate environmental management measures are in place as part of the mining operations to minimise the potential for indirect impacts including

        - water management systems that seek to minimise the potential for damage to flora and fauna and their habitats from erosion and unnatural flooding events

        - noise control systems to minimise noise impacts

        - dust control measures to minimise dust impacts

        - lighting controls to minimise night light impacts

        - blasting controls to minimise blast overpressure and vibration impacts

    - employee education and training.

- The Biodiversity Management Plan will include a biodiversity monitoring program for the Project. The monitoring program will be used to assess and inform the ongoing improvement of management actions.

Biodiversity Offset Strategy

- United will implement a comprehensive Biodiversity Offset Strategy for the Project as outlined in **Section 6.9.6**, including:
    - establishment of proponent-managed offset sites possibly including the Highfields Offset Site, Mangrove Offset Site and Wambo Offset Site
    - mine site ecological rehabilitation contributing 25 per cent of the overall biodiversity offset requirement (estimated at around 878 hectares of ecological rehabilitation)
    - Payments into the Upper Hunter Offsets Scheme fund and/or establishment of further offset sites for the residual credits that need to be retired.
- The proposed offset sites will be established as BioBank sites under BioBanking Agreements, providing for in-perpetuity conservation and reporting consistent with the NSW BioBanking scheme.
- The retirement of credits/staging of offsets will be in accordance with the staging of progressive disturbance of native vegetation areas during the development of the Project. This staging will be consistent with the staging of the MOPs for the Project, as governed by the *Mining Act 1992*.

Aboriginal Cultural Heritage

- United will update and implement the Aboriginal Cultural Heritage Management Plan for the Project. The updated Plan will be prepared in consultation with the RAPs and will include the Aboriginal Cultural heritage management measures to be implemented as part of the Project. These management measures will be based on the proposed measures outlined in **Table 6.36**.
- Salvage (excavation, analysis and collection) of the 128 sites to be impacted by the Project will be undertaken as per the recommendations of the Archaeological Values Assessment Report.

Historic Heritage

- The Dog-leg fence will be subject to a detailed survey and photographic/archival recording in accordance with Heritage Division, OEH guidelines *Photographic Recording of Heritage Items Using Film or Digital Capture* (2006) prior to any impact as a result of the Project. The recording will include the full surviving alignment of the Dog-leg, including the section located outside the Project Area (subject to the agreement of the landholder for the section north of the Project Area). As part of the archival recording additional research will be undertaken to identify (if the information is available) an exact date of construction and who may have built the fence.
- In addition to the detailed recording, an interpretation strategy will be developed for the Dog-leg fence. A selection of stone blocks will be salvaged and combined with logs from the fence or cut from within the Project Area to allow for a section of Dog-leg fence to be reconstructed. The location of the proposed reconstruction will be determined in consultation with interested members of the community, local historical society and Singleton Council when preparing the interpretation strategy for the Dog-leg fence.

- Archaeological investigation of the former House Site (refer to **Section 6.11**) will be undertaken to relevant professional standards prior to the commencement of works that impact the site, including ground preparation/clearing works. The investigations will comprise (subject to consultation with the Heritage Division, OEH) a program of archaeologically monitored machine stripping of the grass cover focusing around the known former building locations. Any archaeological remains exposed in this area during the monitored machine stripping would be recorded and hand excavated as part of the archaeological works.

- In the unlikely event that unexpected archaeological remains or potential heritage items not identified as part of this report are discovered during the Project, all works in the immediate area will cease. The remains and potential impacts will be assessed by a qualified archaeologist or heritage consultant and, if necessary, the Heritage Branch, OEH notified in accordance with Section 146 of the *Heritage Act 1977* (NSW).

- If potential human remains are located following any surface disturbance, works will be halted in the immediate area to prevent any further impacts to the remains. The NSW Police will be contacted immediately and no action will be undertaken until police provide written notification to the Proponent. If the remains are confirmed as non-Aboriginal (historical) remains, the site is to be secured and the NSW Heritage Branch is to be contacted.

Visual

- To assist in minimising the visual impacts of the Project, United will implement the following controls:

    - progressive rehabilitation of disturbed areas with a particular focus on overburden emplacement areas, to reduce the duration of visible soil exposure, including the use of temporary rehabilitation as appropriate

    - subject to the agreement of RMS and relevant landholders, additional roadside tree planting will be undertaken along the existing Golden Highway to screen views of the Project

    - incorporation of roadside tree planting into the detailed design for the realigned section of the Golden Highway to assist in screening views of the Project from the road

    - consultation will be undertaken with potentially affected landholders in the Moses Crossing and South Wambo areas regarding the potential for additional tree screening/landscaping to minimise the visibility of the Project

    - ongoing management of mobile lighting to reduce the impacts of lighting at night, positioning lights so they are not pointing off site, and are shielded by walls, overburden emplacement areas and/or vegetation where practicable

    - all fixed lighting associated with the Project will be installed and maintained in accordance with Australian Standard AS4282 (INT) 1995 – Control of Obtrusive Effects of Outdoor Lighting.

Traffic and Transport

- United will prepare a detailed concept design for the proposed realignment of the 2 kilometres section of the Golden Highway west of Comleroi Road, in consultation with RMS.

- United will prepare a detailed concept design for the proposed intersection of the Golden Highway realignment and Comleroi Road, in consultation with RMS and Singleton Council.

- The proposed Golden Highway realignment will be designed and constructed in accordance with Ausroads and RMS standards following approval by the RMS.

- The realigned section of the Golden Highway will be constructed prior to closure of any section of the Golden Highway.

- United will prepare and implement a Construction Traffic Management Plan prior to construction of the Project commencing to minimise the effect of construction related traffic and works on the Golden Highway realignment. The Plan will also address the management of temporary construction access points. The Construction Traffic Management Plan will be prepared in consultation with RMS and Council.

Hazard

- Class 5.1 explosives and Class 1.1 storages will be located in accordance with the buffer distances specified in **Section 6.16.**

- Diesel tanks and refuelling systems will be designed in accordance with relevant Australian Standards and codes.

- Surface drainage systems will be designed to prevent spills or runoff from hazardous materials storage areas entering surrounding land/waterways.

- Dangerous goods will be stored in dangerous goods compliant stores (in accordance with relevant Australian Standards) with appropriate segregation of incompatible dangerous goods.

- United will implement the safeguards and procedures outlined in **Section 6.16.3**.

Bushfire

- United will prepare a Bushfire Management Plan for the Project in consultation with the Rural Fire Service (RFS) and DPE.

Waste

- No waste will be disposed of onsite except for inert wastes and waste tyres buried in the open cut mining areas. Waste will continue to be separated on site to allow different waste streams to be appropriately managed. Waste that cannot be reused or recycled will be transported off-site by licensed waste management contractors.

Cumulative Impacts

- United will consult with representatives from Wambo (relating to the Wambo underground, CHPP and train loading facility), HVO South and MTW regarding measures to address issues of common concern in relation to cumulative impacts.

Section 9.0

Conclusion

9.0 Conclusion

This section provides a conclusion discussing the justification for the Project, taking into consideration the environmental, social and economic impacts of the Project and the suitability of the site, to assist the consent authority to determine whether or not the Project is in the public interest. Other matters considered in the development of the Project design are discussed in **Section 3.3**.

9.1 Environmental Impacts

As detailed in **Section 6.0**, the environmental, social and economic impacts of the Project have been identified and subject to a detailed environmental assessment based on:

- assessment of the site characteristics (existing environment)
- focused consultation with relevant government agencies
- engagement with local community and other stakeholders
- environmental risk analysis
- application of the principles of ecologically sustainable development, including the precautionary principle, inter-generational equity and conservation of biological diversity and ecological integrity
- expert technical assessment.

The key issues identified, including those specified in the SEARs, were subject to comprehensive specialist assessment to identify the potential impacts of the Project on the existing environment. These assessments are detailed in **Section 6.0** and the appendices to this document.

Whilst there are many complex aspects which must be read in their entirety to fully understand these assessments, **Table 9.1** provides a very broad overview of the key outcomes of the environmental, social and economic impact assessment.

Table 9.1 Broad Overview of Environmental, Social and Economic Outcomes

Environmental/ Social Issue	Overview of Key Outcomes (after proposed Management, Mitigation, Offsets)
Air Quality	• Comprehensive air quality management controls have been incorporated into the design of the Project to minimise the contribution of the Project to impacts on local and regional air quality. • With the Project, cumulative dust levels and other air quality parameters are predicted to comply with the relevant criteria at all surrounding private residences, with the exception of a single private residence in Warkworth village. This residence has current acquisition rights for Wambo and is expected to be afforded acquisition rights for the Project. • A proactive and reactive dust control strategy will be implemented to minimise dust emissions over the life of the Project.
Noise	• As part of the design of the Project, United has incorporated a range of noise controls to minimise noise impacts. • Operational noise levels are predicted to exceed the noise impact criteria at a number of surrounding private residences. • Seven private residences are predicted to be significantly affected (i.e. more than 5 decibels (dB) above the criteria) - this includes the private residence at Warkworth noted above, which has existing acquisition rights. • Moderate impacts (i.e. 3 to 5 dB above criteria) are expected at 18 private residences. • The Project also has potential to contribute to cumulative noise impacts in Warkworth, Maison Dieu and at the nearest private residences to the northwest of the Project Area. • Noise impacts will be managed through the implementation of a proactive noise management and monitoring program which will be used to adaptively manage mining operations as required to minimise noise impacts.
Blasting	• Blasting activities will be managed so that relevant blast criteria are not exceeded at private residences or at blast sensitive infrastructure. Any impacts in excess of these criteria would only occur where a negotiated agreement is in place. • Blasting impacts will also be managed to avoid adverse effects on the State Significant Wambo Homestead heritage site.

Environmental/ Social Issue	Overview of Key Outcomes (after proposed Management, Mitigation, Offsets)
Land Use and Agriculture	• The primary existing land use of the Project Area is mining. A small portion (30 hectares) of the mine owned land is currently used for low intensity grazing. • The mine owned grazing land impacted is primarily low productivity land, with the exception of approximately 4 hectares of biophysical strategic agricultural land (BSAL) which will be subject to relatively minor impacts as a result of construction of water management infrastructure. The BSAL will not be mined. • Much of the surrounding land is mine owned land significantly reducing the potential for impacts on private land uses. The existing mining operations have coexisted with the surrounding land uses since the 1960s without substantial land use conflict, and this is expected to continue. • The Project will have a minimal impact on surrounding land uses.
Water Resources	• A comprehensive WMS has been designed for the Project to manage water in accordance with legislative requirements and relevant guidelines. • The WMS for the Project will be integrated with the existing WMS at Wambo to maximise water recycling, reducing external water import and releases. • The Project is not predicted to have significant impacts on downstream water quality, flows, flooding or water users. • The Project will make a minor contribution to impacts on alluvial groundwater systems. The Joint Venture has adequate water licences for the predicted groundwater take for the Project. • One private bore has the potential to be impacted as a result of the Project, however, this bore is not currently serviceable. United has committed to make good arrangements with the owner of the bore should the potential impact be realised.
Biodiversity	• Impacts to key biodiversity values have been avoided where practical through Project design. • The biodiversity impacts of the Project are being assessed, managed and offset under the framework of the Upper Hunter Strategic Assessment (UHSA). The UHSA is a joint Commonwealth/State government initiative. • Approximately 464 hectares of native woodland/forest vegetation will be removed from the additional disturbance area over the life of the Project. • Approximately 223.5 hectares of the Commonwealth listed Central Hunter Valley Eucalypt Forest and Woodland CEEC will be impacted by the Project. • Four State listed endangered ecological communities will also be impacted by the Project. • United has committed to a biodiversity offset strategy under the UHSA to offset the biodiversity impacts of the Project.

Environmental/ Social Issue	Overview of Key Outcomes (after proposed Management, Mitigation, Offsets)
Cultural Heritage	• A comprehensive Aboriginal Cultural Heritage Assessment process was completed for the Project in consultation with the 83 registered Aboriginal parties for the Project (including 3 Native Title claimant groups). • The Project will impact on 128 sites (81 artefact scatters, 45 isolated finds and 2 potential archaeological deposits) of which 122 were assessed as having low scientific significance and 6 were assessed as low-moderate scientific significance. • The Aboriginal Cultural Heritage Assessment found that the surrounding area is held to be of higher significance to many members of the Wonnarua community, however, the sites and/or places within the Project Area were considered to be of lower significance. • United will implement an impact mitigation strategy as part of the Project in consultation with the registered Aboriginal parties.
European Heritage	• The State Heritage Register listed Wambo Homestead occurs to the south of the proposed open cut mining operations. A detailed assessment found that the Project will not adversely impact on Wambo Homestead. • Several other heritage sites have been identified within and surrounding the Project Area. This includes a 'Dog-leg' fence which has been assessed as having State level significance. Part of the Dog-leg fence will be removed/impacted by the Project. A detailed survey and photographic/archival recording of the Dog-leg will be undertaken following relevant guidelines. An interpretation strategy will also be implemented. • Local heritage values impacted by the Project will be managed by archival recording.
Visual	• Views of the existing mining operations are currently available from residences to the south, northwest, northeast and along the Golden Highway. • Similar views will remain with the Project, with overburden emplacement areas increasing in height in some areas and remaining visible as the Project progresses. • The active mining face within the approved Wambo Open Cut will be the most visible element for residences to the northwest and from the Golden Highway as mining progresses through the main ridgeline. This mining activity is currently approved. • The progressive rehabilitation of emplacement areas and shaping of the final landform using natural landscape principles is expected to reduce the visual impact of emplacement areas. Additional tree planting is proposed to assist in screening views of the Project from the Golden Highway.

Environmental/ Social Issue	Overview of Key Outcomes (after proposed Management, Mitigation, Offsets)
Rehabilitation	• The rehabilitation strategy for the Project aims to minimise environmental impacts throughout the life of the Project as well as upon completion of the Project. • Ecological rehabilitation on the site will contribute to the biodiversity offset strategy for the Project. • The strategy will improve local and regional biodiversity outcomes through establishment of strategic habitat corridors, while also providing areas for managed agriculture.
Greenhouse Gas	• A range of energy and greenhouse gas management initiatives will be implemented as part of the Project to improve energy efficiency and reduce greenhouse gas emissions.
Transport	• The Project will require the realignment of a 2 kilometres section of the Golden Highway. The realignment will be designed in accordance with RMS and Austroads requirements and will be constructed prior to the closure of the section of the Golden Highway impacted by the Project to minimise the potential for disruption. • The predicted changes in traffic resulting from the Project are well within the capacity of the existing road network. • With the Project, the total approved maximum annual tonnage of coal transported by train from the Wambo train loading facility will remain unchanged.
Waste	• A comprehensive waste management system will be implemented, including waste recycling, waste disposal onsite and use of licensed waste contractors for any necessary off-site waste disposal.
Social and Economic	• The Social Impact and Opportunities Assessment found that from a technical social perspective, it is unlikely that the Project will result in significant change across any of the key community capitals (natural, economic, human, physical and social), thus affording a risk ranking of 'low' for impact on community sustainability. • A range of strategies will be implemented to seek to minimise social impacts and maximise benefits. • The Project will provide significant ongoing benefits for local and wider communities through employment, local and regional expenditure and payment of royalties and taxes. • A cost benefit analysis of the Project indicates that the overall net benefits of the Project (after full incorporation of costs, including environmental costs) would be in the order of $414 million in current terms.

The impacts of the Project have been kept to a minimum through:

- obtaining a detailed understanding of the issues and impacts by scientific evaluation and stakeholder engagement
- an assessment of Project alternatives based on consideration of maximum resource recovery efficiency developed from detailed geological exploration, engineering design and detailed analysis of potential environmental and community impacts
- active engagement with stakeholders, including the neighbouring community, to identify key concerns and issues early in the Project design process
- commitment to proactive and appropriate strategies to avoid, minimise, mitigate, offset or manage a range of potential environmental impacts (refer to **Sections 6.0** and **7.0**).

9.2 Suitability of the Site

The Project is located in an area that has a long history of coal mining, with the Project Area itself subject to over 55 years of mining activity. The Project Area is also surrounded by a number of other mining operations including the Wambo underground, HVO South and Mount Thorley Warkworth, with the area being a well-established part of the Hunter Valley coalfield which is the largest coal-producing region in NSW.

The Wambo mine and United mine (prior to entering a period of care and maintenance) have provided substantial economic benefits to the local, State and national economies. The approved operations at Wambo Open Cut will continue to provide substantial economic benefits until the existing open cut approved resource is extracted (approximately 2020 subject to Wambo's planned modification).

Existing land uses and land use planning forms a major constraint to coal mine development in the Hunter Valley. The development of a coal mine and associated infrastructure is limited, by its nature, to the location of the coal resource. The Project seeks to maximise resource recovery from an existing operational mining area, limiting the potential for conflicts with other land uses. The Project is adjacent to other major mining operations, with much of the surrounding land owned by mining companies, resulting in substantial separation distances to private land being in place. The Project is located within one of the most active mining areas in the Upper Hunter Valley.

Key Project objectives include maximising the use of previously disturbed areas and existing mining infrastructure and further development of existing environmental mitigation and management strategies to mitigate and manage the predicted impacts associated with the Project, thereby limiting potential for conflicts with other land uses.

United, on behalf of the Joint Venture, has actively engaged with stakeholders including the local community, to seek to understand the key concerns and issues associated with the Project and to assist with managing these issues through appropriate Project design.

The existing land uses of the Project Area are described in **Section 6.2**. Extensive management, mitigation and offset measures have been incorporated into the Project to minimise impacts, including land use impacts and conflicts. As described in **Sections 6.9** and **6.13**, the approach to site rehabilitation and the extensive revegetation program proposed is consistent with the strategic land use objectives for the area. The final landform integrates rehabilitation at United and Wambo mines which provides for a greatly improved final landform outcome than would have otherwise been achieved with standalone operations.

As discussed in **Section 6.2**, the land within the additional disturbance area is predominantly comprised of land classes that provide limited opportunity for agricultural uses. It is considered that the use of this land for coal mining purposes provides by far the highest economic returns from the land relative to any other identified permissible uses of the land.

9.3 Ecologically Sustainable Development

An objective of the EP&A Act is to encourage Ecologically Sustainable Development (ESD) within NSW. As outlined in **Section 4.2**, the Project requires approval from the Minister for Planning under Division 4.1 of Part 4 of the EP&A Act. This section provides an assessment of the Project in relation to the principles of ESD.

To justify the Project with regard to the principles of ESD, the benefits of the Project in an environmental and socio-economic context should outweigh any negative impacts. The principles of ESD encompass the following:

- the precautionary principle
- inter-generational equity
- conservation of biological diversity
- valuation and pricing of resources.

Essentially, ESD requires that current and future generations should live in an environment that is of the same or improved quality than the one that is inherited.

9.3.1 The Precautionary Principle

The EP&A Regulation defines the precautionary principle as:

> *if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:*
>
> *(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and*
>
> *(ii) an assessment of the risk-weighted consequences of various options.*

In order to achieve a level of scientific certainty in relation to potential impacts associated with the Project, the EIS includes an extensive evaluation of all the key components of the Project. Detailed assessment of all key issues and necessary management procedures has been conducted and is comprehensively documented in this EIS.

The assessment process has involved a detailed study of the existing environment (refer to **Section 6.0**), and the use of engineering and scientific modelling to assess and determine potential impacts as a result of the Project. To this end, there has been careful evaluation to avoid, where possible, irreversible damage to the environment.

The decision making process for the design, impact assessment and development of management processes has been transparent in the following respects:

1. Government authorities, landholders potentially affected by the Project, the local community, the Aboriginal community and other stakeholders were consulted during EIS preparation (refer to **Section 5.0**). This enabled comment and discussion regarding potential environmental impacts and proposed environmental management procedures.

2. The community has been engaged throughout the development and assessment of the Project through a range of mechanisms including one-on-one meetings, community information sessions, a community workshop to inform Project design and management of key issues, and community newsletters amongst other mechanisms (refer to **Section 5.0**) which provided landholders and stakeholders with both information and the opportunity to influence Project outcomes.

3. United will design and implement a comprehensive EMS which builds on the existing systems at the United mine and, where relevant, Wambo mine. Through implementation of the EMS and related environmental management programs, United will seek to implement best practice management. The Project will incorporate the practices previously implemented and demonstrated to be effective at United mine and at other Glencore open cut mines in the Hunter Valley. The EMS will incorporate the additional controls outlined in the EIS.

4. The EIS has been undertaken on the basis of the best available scientific information about the Project Area. Where uncertainty in the data used in the assessment has been identified, a conservative worst-case analysis has been undertaken and contingency measures have been identified to manage that uncertainty. A validation program has also been proposed to measure predicted against actual impacts of the Project (refer to **Section 8.0**), so that contingency measures, if required, can be implemented in a timely and pro-active manner.

5. An auditing and review process will be an integral component of the EMS, providing for verification of Project performance by independent auditors and relevant government agencies. The Project will implement an auditing and verification process consistent with that currently undertaken at other Glencore operations.

9.3.2 Intergenerational Equity

The EP&A Regulation defines the principal of intergenerational equity as:

> *...that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.*

Intergenerational equity refers to equality between generations. It requires that the needs and requirements of today's generations do not compromise the needs and requirements of future generations in terms of health, biodiversity and productivity.

The objectives of the Project are to:

- conduct mining in an environmentally responsible manner to minimise Project specific and cumulative environmental and social impacts

- develop the coal resources within existing and proposed new mining leases with a long term focus on

    - maximising efficiency and coal resource recovery

  - optimising the use of existing infrastructure
  - minimising additional mining disturbance footprint by maximising the use of existing disturbed areas and utilising the capacity of existing infrastructure
- maintaining and extending the employment opportunities for existing Wambo Open Cut employees and creating additional employment opportunities
- developing comprehensive mitigation and management strategies to mitigate and offset predicted impacts associated with the Project
- co-existing with the local community
- establishing a final landform that is safe, stable and sustainable.

Further to the Project objectives, a range of environmental management measures discussed in **Sections 6.0** and **8.0** have been developed and evaluated to minimise the impact on the environment to the greatest extent reasonably possible.

The design of the Project and commitment to the management of environmental issues as outlined in this EIS will maintain the health, diversity and productivity of the environment for future generations. The Project will also make a significant contribution to maintaining services in the community through the direct and flow on effects of employee and operational expenditure and through development contributions in accordance with the EP&A Act.

9.3.3 Conservation and Biological Diversity

The EP&A Regulation identifies that the principal of conservation of biological diversity and ecological integrity should be a fundamental consideration in the decision making process. The conservation of biological diversity refers to the maintenance of species richness, ecosystem diversity and health and the links and processes between them. All environmental components, ecosystems and habitat values potentially affected by the Project are described in the EIS (refer in particular to **Section 6.9** and **Appendix 13**). Potential impacts are also outlined in the EIS (refer to **Section 6.9**) and measures to ameliorate any negative impact are outlined in **Section 8.0**.

A key objective of the Project is to develop the open cut coal resources within the Project Area, maximising production from within an existing mining area and with a long term focus on optimising the use of existing Wambo mine infrastructure.

Despite the design measures to reduce the extent of impacts to significant ecological features of the Project Area, the Project results in potentially significant ecological impacts. United has committed to a package of measures that aim to further mitigate the identified ecological impacts, including a biodiversity offset strategy for the Project. The assessment, mitigation and offsetting of impacts on biodiversity have been undertaken within the framework of the UHSA, a strategic assessment process designed by the NSW and Commonwealth governments.

The range of potential offsetting options available to proponents in accordance with the UHSA (OEH 2015b) includes:

- payment into the Upper Hunter Offsets Scheme
- retirement of biodiversity credits

- establishment of proponent-managed offset sites
- funding of supplementary measures
- mine site ecological rehabilitation.

United is committed to delivering a biodiversity offset strategy that appropriately compensates for the unavoidable loss of ecological values as a result of the Project. It is proposed that the biodiversity offset strategy will consist of the following:

- establishment of proponent-managed offset sites, including the following sites
    - Highfields Offset Site
    - Mangrove Offset Site
    - Wambo Offset Site
- mine site ecological rehabilitation contributing 25 per cent of the overall biodiversity offset requirement, currently estimated at approximately 878 hectares of ecological rehabilitation (refer to **Appendix 13**).

The proposed offset sites will be established as BioBank sites under BioBanking Agreements, ensuring in-perpetuity conservation and reporting consistent with the NSW BioBanking scheme.

9.3.4 Valuation of Pricing Resources

The goal of improved valuation of natural capital has been included in Agenda 21 of Australia's Intergovernmental Agreement on the Environment. The principle has been defined in the EP&A Regulation as:

> *that environmental factors should be included in the valuation of assets and services, such as:*
>
> *(i) polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement;*
>
> *(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste; and*
>
> *(iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems*

The polluter pays principle applies to the Project through the discharge of salt in surface water discharges to the Hunter River catchment through the Hunter River Salinity Trading Scheme (refer to **Section 6.8**). Pricing of resources is also captured in the regulatory regime applying to surface and groundwater extractions.

Project considerations have included the costs of management measures to minimise potential environmental and social impacts. There will also be additional costs associated with establishing and managing ecological offsets to reduce the magnitude of ecological impacts. In many cases, operational

efficiencies are also associated with improved environmental outcomes. For example, efficient haul routes reduce total noise and dust emissions and diesel use (with associated greenhouse gas and particulate emission reductions).

The Project also optimises the valuation and pricing of the coal resources with minimal impact by:

- optimising available use of the existing Wambo CHPP and train loading facilities to wash coal and to transport product coal to existing markets
- maximising the efficient extraction of the coal resource and avoiding the isolation and sterilisation of coal through effective mine planning and location of site infrastructure.

9.4 Conclusion

As outlined in **Section 9.3**, the Project has been assessed against the principles of ecologically sustainable development as required by the EP&A Act and EP&A Regulation. This assessment has indicated that the Project is consistent with the principles of ecologically sustainable development.

The Economic Assessment (refer to **Appendix 19**) describes a range of positive benefits from the Project that will result at a local, regional and State level. These benefits include:

- continued employment of up to approximately 250 full-time equivalent employees
- creation of up to approximately 250 full-time equivalent employees (peak)
- creation of up to approximately 120 additional construction jobs (peak) over the three year construction phase of the Project
- royalty revenue stream flowing to the NSW government estimated to be $369 million over the life of the Project
- net producer surplus attributable to NSW of $2.1 million.

The revenue, expenditure and employment associated with the construction and operation of the Project will stimulate economic activity in the regional economy, as well as for the broader NSW economy. Over the life of the Project, the Hunter Region's Gross Regional Product is projected to increase by just below $2.1 billion in NPV terms. NSW's Gross State Product (including the Hunter) increases by around $3.0 billion (NPV terms).

A cost benefit analysis was undertaken for the Project which assessed the net benefit of the Project when all external and internal costs were considered, including environmental and social externality costs. The cost benefit analysis determined that the Project had a net benefit of $414 million in NPV terms over the life of the Project (refer to **Section 6.21**). The Project will also provide considerable additional benefits in the form of royalties, taxation and other government revenue which will be recycled through the economy.

With the implementation of the management, mitigation and offset measures proposed by United, the assessment has concluded that the Project would result in a net benefit to the NSW community.

Section 10.0

References

10.0 References

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Section 11.0

Abbreviations and Glossary

11.0 Abbreviations and Glossary

11.1 Abbreviations

ABLs	Assessment Background Levels
ACHA	Aboriginal Cultural Heritage Assessment
ACHM	Australian Cultural Heritage Management
ACHMP	Aboriginal Cultural Heritage Management Plan
ADWG	Australian Drinking Water Guidelines
AIS	Agricultural Impact Statement
AIP	Aquifer Interference Policy
AEP	Annual Exceedance Probability
AGE	Australasian Groundwater and Environmental Consultants
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
ANC	Acid Neutralising Capacity
ANE	Ammonium Nitrate Emulsion
ANFO	Ammonium nitrate/fuel oil
ANZECC	Australian and New Zealand Environment and Conservation Council
APZ	Asset Protection Zone
ARD	Acid Rock Drainage
ARI	Average Recurrence Interval
ARTC	Australian Rail Track Corporation Ltd
AWDs	Available Water Determinations
BCA	Building Code of Australia
BCAM	Biodiversity Certification Assessment Methodology
BMP	Blast Management Plan
BSAL	Biophysical strategic agricultural land
CBA	Cost Benefit Analysis

CCC	Community Consultative Committee
CCL	Consolidated Coal Lease
CEEC	Critically Endangered Ecological Community
CFMEU	Construction, Forestry, Mining and Energy Union
CGE	Computable General Equilibrium
CHPP	Coal Handling and Preparation Plant
CIC	Critical Industry Cluster
CL	Coal Lease
CO	Carbon Monoxide
dB	Decibels
DEC	Former Department of Environment and Conservation (now OEH)
DECCW	Former Department of Climate Change and Water (now OEH)
DoE	Commonwealth Department of the Environment
DPE	Department of Planning and Environment
DPI	Department of Primary Industries
DPI Water	Department of Primary Industries – Water
DP&I	Former Department of Planning and Infrastructure
DRE	Division of Resources and Energy (a division of DPI)
EA	Environmental Assessment
EC	Electrical Conductivity
EEC	Endangered Ecological Community
EHC Act	*Environmentally Hazardous Chemicals Act 1985*
EIS	Environmental Impact Statement
EPA	Environment Protection Authority of NSW
EP&A Act	*Environmental Planning and Assessment Act 1979 (NSW)*
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000 (NSW)*
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)

EL	Exploration Lease
EPL	Environment Protection Licence
EMF	Electromagnetic Field
EMS	Environmental Management System
ENM	Environmental Noise Model
ESC	Enviro Strata Consulting
ESD	Ecologically Sustainable Development
FBA	Framework for Biodiversity Assessment
FTE	Full Time Equivalents
GDEs	Groundwater-dependent Ecosystems
Geoterra	Geoterra Pty Ltd
GHG	Greenhouse gas
GHGEA	Greenhouse Gas and Energy Assessment
GJ	Gigajoules
Glencore	Glencore Coal Pty Limited
GRP	Gross Regional Product
GSP	Gross State Product
ha	Hectare
HEC	Hydro Engineering and Consulting Pty Limited
HRSTS	Hunter River Salinity Trading Scheme
HVCCC	Hunter Valley Coal Chain Coordinator
HVO	Hunter Valley Operations
ICNG	Interim Construction Noise Guideline
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEEE	Institute of Electrical and Electronics Engineers
IESC	Independent Expert Scientific Committee
IPCC	Intergovernmental Panel on Climate Change

Infrastructure SEPP	State Environmental Planning Policy (Infrastructure) 2007
ING	Industrial Noise Guideline
INP	Industrial Noise Policy
km	kilometres
kV	Kilovolt (1000 volts)
LEA	Local Effects Analysis
LEP	Local Environmental Plan
LGA	Local Government Area
LSC	Land and Soil Capability
m	metres
m/s	metres per second
MGA	Map Grid of Australia
MIA	Mine Infrastructure Area
MJ	Megajoules
Mining SEPP	State Environmental Planning Policy (Mining, Petroleum and Extractive Industries 2007
MSB	Mine Subsidence Board
ML	Megalitres
ML	Mining Lease
MLA	Mining Lease Applications
MNES	Matters of National Environmental Significance
MOP	Mining Operations Plan
MSB	Mine Subsidence Board
Mt	Million tonnes
Mtpa	million tonnes per annum
MTW	Mount Thorley Warkworth mine
NAF	Non-acid Forming
NGA	National Greenhouse Accounts
NGIS	National Groundwater Information System

NGOs	Non-Government Organisations
NHMRC	National Health and Medical Research Council
NEPM	National Environment Protection Measures
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NO_x	Oxides of Nitrogen
NOW	NSW Office of Water
NPV	Net Present Value
NPW Act	*National Parks and Wildlife Act 1974*
NPW Regulation	*National Parks and Wildlife Regulation 2009*
NSW	New South Wales
OEH	Office of Environment and Heritage
OzArk	OzArk Environmental and Heritage Management
PAC	Planning Assessment Commission
PAD	Potential Archaeological Deposits
PAF	Potential Acid Forming
PBP	Planning for Bushfire Protection
PCT	Plant Community Type
PCWP	Plains Clans of the Wonnarua People
PEA	Preliminary Environmental Assessment
pH	Potential Hydrogen
PHA	Preliminary Hazard Analysis
Peabody	Peabody Energy Australia Pty Limited
PM	Particulate matter
PM10	Particulate matter less than 10 micro metres in diameter
PM2.5	Particulate matter less than 2.5 micro metres in diameter
POEO Act	*Protection of the Environment Operations Act 1997*

PSNL	Project Specific Noise Levels
RAAF	Royal Australian Air Force
RAPs	Registered Aboriginal Parties
RBLs	Rating Background Levels
REMP	Rehabilitation and Environmental Management Plan
RFS	Rural Fire Service
RING	EPA *Rail Infrastructure Noise Guideline*
RMS	Roads and Maritime Services
RNE	Register of the National Estate
RNP	*NSW Road Noise Policy*
ROM	Run-of-mine
SA3	Lower Hunter Statistical Area 3
SEARS	Secretary's Environmental Assessment Requirements
SEP	Stakeholder Engagement Plan
SEPP	State Environmental Planning Policy
SEPP 33	State Environmental Planning Policy 33 – Hazardous and Offensive Development
SEPP 44	State Environmental Planning Policy 44 – Koala Habitat Protection
SEPP 55	State Environmental Planning Policy 55 – Remediation of Land
SHR	State Heritage Register
SIOA	Social Impact and Opportunities Assessment
SRDD SEPP	State Environmental Planning Policy (State and Regional Development) 2011
SRLUP	Strategic Regional Land Use Plan
SWLs	Sound Power Levels
tCO2-e	Tonnes of CO2 equivalent
TDS	Total Dissolved Solids
TEC	Threatened Ecological Community
TGAN	Technical Grade Ammonium Nitrate

The Project	United and Wambo Open Cut Coal Mine Project
TNM	US Federal Highway Administration Traffic Noise Model
TSC Act	*Threatened Species Conservation Act 1997*
TRC - Analysis	Town Resource Cluster Analysis
TSP	Total suspended particulate matter, usually in the size range of zero to 50 micrometres
TSS	Total Suspended Solids
UHSA	Upper Hunter Strategic Assessment
Umwelt	Umwelt (Australia) Pty Limited
United	United Collieries Pty Limited
VOCs	Volatile Organic Compounds
VPA	Voluntary Planning Agreement
VWPs	Vibrating Wire Piezometers
WALs	Water Access Licences
Wambo	Wambo Coal Pty Limited
Water Act	*Water Act 1912*
WLALC	Wanaruah Local Aboriginal Land Council
WM Act	*Water Management Act 2000*
WMP	Water Management Plan
WMS	Water Management System
WNAC	Wonnarua Nation Aboriginal Corporation
WSP	Water Sharing Plan
WTC	Wonnarua Traditional Custodians
µg	micrograms
µm	micrometres
%	per cent

11.2 Glossary

Additional disturbance area	The conceptual additional disturbance area for the Project as shown on **Figure 3.25** and described in **Section 3.11**.
Acid Rock Drainage	Drainage of acidic water from rock material.
Alluvium	Sediment deposited by a flowing stream, e.g., clay, silt, sand, etc.
Amenity	An agreeable feature, facility or service which makes for a comfortable and pleasant life.
Aquifer	A water-bearing rock/sediment formation.
Archaeological	Pertaining to the study of culture and description of its remains.
Attenuation	The reduction in magnitude of some variable in a transmission system, for example, the reduction of noise with distance as it travels through air.
Catchment Area	The area from which a river or stream receives its water.
Coal Reserves	Those parts of the Coal Resources for which sufficient information is available to enable detailed or conceptual mine planning and for which such planning has been undertaken.
Coal Resources	All of the potentially useable coal in a defined area, based on geological data at certain points and extrapolations from these points.
Coarse Reject	Lumps of carbonaceous shale up to 200 mm in size separated in the coal preparation process.
Conservation	The management of natural resources in a way that will preserve them for the benefit of both present and future generations.
Dip	The direction in which rock strata is inclined.
Ecology	The science dealing with the relationships between organisms and their environment.
Ecosystem	Organisms of a community together with its non-living components through which energy and matter flow.
Electrical Conductivity	The measure of electrical conduction through water or a soil-water suspension generally measured in millisiemens per centimetre or microsiemens per centimetre. An approximate measure of soil or water salinity.
Environmental Planning and Assessment Act 1979	NSW Government Act to provide for the orderly development of land in NSW.
Environment Protection and Biodiversity Conservation Act 1999	Commonwealth legislation that regulates development proposals that have an actual or potential impact on matters of national environmental significance.
Fault	A fracture or fracture zone along which there has been displacement of the sides relative to one another. Displacement can be vertical and/or horizontal.

Fauna	All vertebrate animal life of a given time and place.
Floodplain	Large flat area of land adjacent to a stream which has been deposited during previous stream flow events and is inundated during times of high flow.
Flora	All vascular plant life of a given time and place.
Geology	Science relating to the earth, the rocks of which it is composed and the changes it undergoes.
Groundwater	Sub-surface water which is within the saturated zone and can supply wells and springs. The upper surface of this saturated zone is called the water table.
Habitat	The environment in which a plant or animal lives; often described in terms of geography and climate.
Indigenous	Native to, or originating in, a particular region or country.
In situ	In its original place.
kL (Kilo litre)	One thousand litres.
kV (Kilo Volt)	One thousand volts.
LA1 Noise Level	The noise level exceeded for one per cent of the time. It is used in assessment of sleep disturbance.
LA90 Noise Level	The noise level, measured in dB(A), exceeded for 90 per cent of the time, which is approximately the average of the minimum noise levels. The L90 level is often referred to as the 'background' noise level and is commonly used to determine noise criteria for assessment purposes.
LAeq Noise Level	The equivalent continuous noise level, measured in dB(A), during a measurement period.
LAMax Noise Level	The maximum noise energy, measured in dB(A), during a measurement period.
Land Capability	The ability of a parcel of land to be used in a sustainable manner (that is without permanent damage) for a given land use.
Landform	Sections of the earth's surface which have a definable appearance (e.g. cliff, valley, mountain range, plain, etc).
Longwall Mining	A form of underground mining. A panel of coal is removed by shearing machinery, which travels back and forth across the coal face. The area immediately in front of the coal face is supported by a series of hydraulic roof supports providing working space.
Mean	The average value of a particular set of numbers.
Megalitre (ML)	One million litres.
Meteorology	Science dealing with atmospheric phenomena and weather.

Mitigate	To lessen in force, intensity or harshness. To moderate in severity.
Native	Belonging to the natural flora or fauna in a region.
Outcrop	Bedrock exposed at the ground surface.
Overburden Emplacement	An area for placing overburden or waste rock, removed from above and between the coal seams.
Particulates	Fine solid particles which remain individually dispersed in gases.
pH	Scale used to express acidity and alkalinity. Values range from 0-14 with seven representing neutrality. Numbers from seven to zero represent increasing acidity whilst seven to fourteen represent increasing alkalinity.
Piezometer	A small diameter bore lined with a slotted tube used for determining the standing water level of groundwater.
Protection of the Environment Operations Act 1997	NSW legislation administered by the EPA that regulates discharges to land, air and water.
Radial Analysis	Radial analyses are developed using 3D topographic information and electronic data files relating to the proposed Project to identify what can theoretically be seen from particular vantage points. The radial analysis illustrates what is visible from a height of 1.7 metres at that location (i.e. from average eye height).
Rehabilitation	The process of restoring to a condition of usefulness. In regard to mining, relates to restoration of land from a degraded or mined condition to a stable and vegetated landform.
Revegetation	The process of re-establishing vegetation cover.
Run-of-mine (ROM)	Bulk material extracted from a mine, before it is processed in any way.
Salinity	A measure of the concentration of dissolved solids in water.
Seam	An identifiable discrete coal unit.
Sedimentation	Deposition or settling of materials by means of water, ice or wind action.
Sediment Dam	A dam built to retard dirty runoff to allow sediment to settle out before allowing clean water discharge.
Site Specific	Relating to conditions existing at a particular location.
Socio-economic	Combination of social and economic factors.
Sound Power Level	The total sound energy radiated per unit time measured as 10 times a logarithmic scale, the reference power being 12 picowatts.
Spontaneous Combustion	Spontaneous ignition of some or all of a combustible material.

Subsidence	The vertical movement of a point on the surface of the ground as it settles above a coal panel extracted by underground mining.
Surface Infrastructure	Any manmade object, facility or structure on the surface of the land.
Tailings	Fine residual waste material separated in the coal preparation process.
Thermal Coal	Includes medium to high ash, low sulphur coals used for domestic power generation and medium to low ash energy coals which are exported.
Topography	Description of all the physical features of an area of land and their relative positions, either in words or by way of a map.
Total Dissolved Solids (TDS)	A measure of salinity expressed in milligrams per litre (mg/L).
Total Suspended Particulates (TSP)	A measure of the total amount of un-dissolved matter in a volume of water or air usually expressed in milligrams per litre (mg/L) (for water) or micrograms per cubic metre (µg/m3) for air.
Woodland	Land covered by trees that do not form a closed canopy.



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