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GLENCORE

ENVIRONMENTAL IMPACT STATEMENT

Mount Owen Continued Operations Project

FINAL

January 2015

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FINAL

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Prepared by
Umwelt (Australia) Pty Limited

on behalf of
Mount Owen Pty Limited

Project Director:	**Barbara Crossley**
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Report No.	**3109/R02/FINAL**
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Acknowledgment

Mount Owen 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.

Executive Summary

Mount Owen Pty Limited (Mount Owen), a subsidiary of Glencore Coal Pty Limited (Glencore), is seeking development consent under the *Environmental Planning and Assessment Act 1979* (EP&A Act) for the Mount Owen Continued Operations Project (the Project).

The Mount Owen Complex is located within the Hunter Coalfields in the Upper Hunter Valley of New South Wales (NSW), approximately 20 kilometres north-west of Singleton, 24 kilometres south-east of Muswellbrook and to the north of Camberwell village. The Mount Owen Complex consists of three open cut operations, Mount Owen (North Pit), Ravensworth East (West Pit) and Glendell (Barrett Pit). Mount Owen anticipates that mining will commence in the northern portion of the approved Ravensworth East Mine in an area known as the Bayswater North Pit (BNP) in 2015. The mining operations at the Mount Owen Complex include the integrated use of the Mount Owen coal handling and preparation plant (CHPP), coal stockpiles and the rail load-out facility.

There is an extensive history of mining operations within the Project Area, dating back to the early 1960's in the Ravensworth East Mine, and from 1993 at Mount Owen.

Mount Owen Continued Operations Project

Mount Owen has an approved production rate of up to 10 million tonnes per annum (Mtpa) of run of mine (ROM) coal. This ROM coal along with Ravensworth East (approved 4 Mtpa) and Glendell (approved 4.5 Mtpa) ROM coal, feed the Mount Owen CHPP and associated infrastructure which has an approved processing capacity of 17 Mtpa of ROM coal. Processed coal, both semi soft and thermal, are primarily transported via the Main Northern Rail Line to the Port of Newcastle for export, or by rail or conveyor for domestic consumption as required.

Mount Owen expects, subject to market conditions, that mining will be completed within the currently approved area of the North Pit and the Ravensworth East Mine by 2018 and 2021 respectively. Mount Owen has undertaken extensive exploration of its mining tenements and identified substantial additional mineable coal tonnes to the south of the currently approved North Pit and the BNP. The proposed Ravensworth East Resource Recovery (RERR) Mining Area, is located immediately east of the West Pit and is proposed to be mined sequentially after mining has been completed in the BNP.

The Project seeks to extract approximately 74 million tonnes (Mt) of ROM coal from the North Pit Continuation through open cut methods. The extraction of these additional mineable coal tonnes would continue the North Pit life to approximately 2030 (an additional 12 years from the existing approved mine life). Additionally, the Project seeks to maintain the current approved Ravensworth East extraction rate of 4 Mtpa of ROM coal, and to extract approximately 12 Mt of ROM coal from the BNP sequentially followed by extraction of approximately 6 Mt of ROM coal from the RERR Mining Area.

The Project offers the opportunity to consolidate the existing development consents for Mount Owen and Ravensworth East Mines and provide for further compliance efficiency by providing a single development consent for continued operations. The Project does not include any aspect of the ongoing operations at Glendell Mine.

The Project also seeks approval to undertake infrastructure works, which include:

- upgrades to Hebden Road, the primary employee and services access to the Project Area. The Project seeks approval to construct a road overpass over the Main Northern Rail Line that crosses Hebden Road and a new dual lane bridge over Bowmans Creek. These upgrades will improve road safety for all road users and minimise traffic delays on Hebden Road that are a result of the existing rail level crossing and single lane Bowmans Creek Bridge;

- provision for augmentation of the existing Mount Owen rail line through the construction of an additional rail line and northern turn-out west of the existing rail line. The existing Mount Owen Rail Line will be used as a siding for parking of Glencore trains when not in service and the northern turn out will allow Glencore trains the ability to turn around and return to Glencore owned mines to the west, thereby reducing unnecessary traffic flow on the Main Northern Rail Line;

- on-site infrastructure upgrades including the extension and improvements of the existing CHPP and coal stockpile facilities; and

- upgrades to the Mine Infrastructure Area (MIA) including increased capacity at the existing heavy vehicle workshop and fuel farm and upgrades to ancillary services.

The Project avoids disturbance of Ravensworth State Forest and existing Biodiversity Offset Areas, maximises use of existing approved disturbance areas and infrastructure, and commits to ongoing noise and air quality controls.

Consultation

The Project design has taken into account issues raised during extensive stakeholder consultation and studies, to minimise environmental and social impacts.

Consultation with the community and government agencies is a key component of the Environmental Impact Statement (EIS) process. A comprehensive stakeholder engagement program was implemented to support Mount Owen's aim of developing a Project that will coexist with the local community.

Stakeholder engagement and preparation of the EIS for the Project commenced in 2012, with the EIS initially submitted to the former Department of Planning and Infrastructure (DP&I) (now Department of Planning and Environment (DP&E)) and the Commonwealth Department of the Environment (DoE) for review in December 2013. In early 2014 Mount Owen consulted with DP&E regarding the Project changes to incorporate additional mineable coal reserves, and requested DP&E to hold further review whilst the EIS was updated. The updated EIS was reviewed in October 2014, and confirmed as adequate by the DP&E prior to public exhibition.

Community engagement for the Project involved a four phase program. Phases 1 and 2 (2012-2013) sought stakeholder feedback on key issues and aspects of the Project design. Phase 3 (2013) presented results and outcomes of the assessment and engagement process, and sought feedback on predicted impacts and proposed mitigation measures. Phase four (2014) provided further information to stakeholders regarding changes to the Project and also presented results and outcomes of the updated assessment.

A range of mechanisms were used to engage the community and other stakeholders. Community consultation mechanisms included individual meetings with surrounding landholders, Community Information Sheets, presentations to stakeholder and community groups, community information sessions and a number of briefings to the Mount Owen

Community Consultative Committee. Other stakeholders consulted included the Aboriginal community, various State and Commonwealth government agencies, Singleton Council, infrastructure providers, neighbouring mining operations, Mount Owen workforce and local service providers.

Agency consultation included Project briefings with all key government agencies at various stages of the Project to discuss key issues and outcomes of key studies, and proposed management measures.

Community Issues

Issues identified by the local community as most important were air quality, noise and economic impacts. Conversations regarding noise and air quality focused mainly on cumulative impacts, with landholders identifying these issues as the most challenging associated with living in an area with a number of active mining operations present. To a lesser extent, blasting, water, traffic, visual amenity, community sustainability, and final land use were also raised as issues of concern.

Economic discussions were overwhelmingly positive, with continued local employment, business generation and investment in community activities and infrastructure identified as key benefits of the Project.

The outcomes of the assessment relating to the key issues identified by the EIS requirements and during the consultation process, are briefly discussed in the following sections.

Key Environmental and Social Issues

This EIS includes a detailed assessment of the potential environmental and social impacts of the Project. A range of reasonable and feasible management and mitigation measures are proposed to minimise the environmental and social impacts of the Project. An overview of the outcomes of the detailed assessments for the key issues is provided below.

Air Quality

The detailed air quality assessment considers direct and predicted cumulative air quality impacts associated with the Project and other land uses, including approved mining operations. Air quality modelling has taken into account local meteorology, topographic details and air quality monitoring data collected from the existing Mount Owen Air Quality Monitoring Network.

The extensive iterative mine planning process conducted during EIS preparation, and incorporation of reasonable and feasible air quality controls, will assist in minimising impacts.

Air quality model predictions for dust PM_{10} (particulate matter less than 10 micrometres (µm) in diameter) and fine particles $PM_{2.5}$ (particulate matter less than 2.5 µm in diameter), were compared to DP&E and Environment Protection Authority (EPA) criteria to provide an assessment of the predicted air quality impacts.

The modelling process considered the implementation of reasonable and feasible management measures. The modelling demonstrates that in the later years of the Project (approximately Year 10), worst case weather conditions could lead to one private residence exceeding the 24 hour average PM_{10} air quality criterion (50 µg/m^3). Furthermore, there is one privately owned residence, without current acquisition rights, predicted to exceed the cumulative annual average PM_{10} criteria of 30 µg/m^3 in Year 1. The air quality impacts predicted at this residence resulting from the Project are very low, less than 1 µg/m^3. Air quality modelling has further identified that

PM10 levels at this residence are likely to be above the appropriate PM10 annual average criteria primarily as a result of other sources.

Mount Owen is committed to the development and implementation of all reasonable and feasible management measures to minimise air quality impacts including dust, diesel and blast fume emissions. A range of management and mitigation measures will be implemented for the Project including real-time air quality monitoring, haul road dust control, and temporary treatments (for example, early temporary revegetation) to overburden, to reduce wind erosion prior to final rehabilitation. At exposed locations, and in specific weather conditions, Mount Owen also commits to modify operations to further reduce dust emissions, as necessary to meet relevant air quality criteria.

Noise

A detailed Noise Impact Assessment was undertaken for the Project in accordance with the NSW Industrial Noise Policy (EPA, 2000). The assessment considered recorded local climatic conditions and extensive noise monitoring data from the Mount Owen Complex noise monitoring network. The predictive noise modelling investigated the potential noise impacts at the surrounding noise sensitive receivers under a full range of weather conditions. Direct and cumulative noise impacts associated with the Project and other approved mining operations, were assessed.

The Project design process included extensive iterative mine planning and noise modelling to minimise noise impacts, and the Project incorporates reasonable and feasible noise control measures.

Noise impacts to Falbrook and Middle Falbrook associated with the Project are predicted to increase in later years as mining within the North Pit Continuation progresses southeast and south of the Project Area, with the worst case being Year 10 of the Project. Worst case noise propagation conditions have been assessed to be winter nights, under inversion conditions. Under these worst case conditions, noise modelling indicates:

- three private residences are predicted to be affected by Project related noise levels more than 5 dB above the relevant Project Specific Noise Level (PSNL) in Year 10 of the Project. The PSNL is the noise criteria determined in accordance with the INP, and an exceedance of more than 5 dB is considered an appreciable increase in noise level, likely to be noticeable by most people.

- eight private residences are predicted to experience Project related noise levels above 2 dB and up to and including 5 dB above the relevant PSNL. This is considered a moderate noise level, which may not be noticeable to all residents. These land owners will be offered the opportunity for residence specific mitigation measures such as double glazing of windows, acoustic insulation, etc; and

- ten privately owned residences are predicted to experience Project related noise levels up to and including 2 dB above the relevant PSNL. These are considered minor noise level increases, not noticeable by most people. Ongoing and targeted noise monitoring (at the request of the landowner) will be conducted at these properties.

Mount Owen are committed to the ongoing development and implementation of mitigation measures to minimise the impact of all noise sources associated with the Project including mining operations, construction, traffic and rail. Some examples of proposed noise management and mitigation measures include:

- certain haul roads within the North Pit Continuation are designed to be below natural surface in addition to the use of strategically located noise bunds on selected haul roads;
- modification of certain operations during adverse meteorological conditions identified as having potential to elevate noise levels beyond those predicted;
- utilisation of continuous and attended noise monitoring; and
- continued implementation of adaptive management, considering noise monitoring results and emerging technologies.

Blasting

The ground vibration and air blast predictive model used for the Blast Impact Assessment for the Project is based on vibration and air blast monitoring data collected from the blast monitoring stations at the Mount Owen Complex.

The assessment confirms that blasting activities can be managed effectively to achieve no exceedance of the relevant blast criteria. Management will include detailed blast design and monitoring to meet the relevant blast criteria and will not be exceeded at any private residences or other blast sensitive locations.

Water Resources

Comprehensive groundwater and surface water assessments were undertaken for the Project. Mount Owen proposes to integrate water management for the Project within the well established, Water Management System (WMS) that exists across the Mount Owen Complex. A series of erosion and sedimentation control measures will be utilised during the construction, operation and rehabilitation phases of the Project to limit the potential impacts of the Project on downstream water quality.

The surface water assessment identified that although the Project will result in changes to catchment areas within and surrounding the Project Area, there will be negligible impacts on flows, water quality and water users downstream of the Project Area. The Project will not reduce the annual flow volumes in Main Creek, Glennies Creek and Bowmans Creek; therefore there will be negligible impact on the volume of water available to downstream water users.

Modelling indicates that the Project will have a positive site water balance with management of water surplus and deficits via the Greater Ravensworth Water Sharing Scheme (GRWSS), Hunter River Salinity Trading Scheme (HRSTS) and licensed water use from Glennies Creek. The modelling also indicates that the Project will have a high level of water supply reliability.

The potential groundwater impacts from the Project and the associated modelling predictions are considered to be negligible in relation to:

- leakage of groundwater from shallow alluvial aquifers of Bowmans and Glennies Creeks and associated tributaries;

- changes to base flows in surface drainage systems;
- impacts on water supply bores and wells;
- change in water quality; and
- groundwater dependent ecosystems.

Mount Owen currently hold a number of water licences for the Mount Owen and Ravensworth East Mines and further licences are not required. Mount Owen will continue to manage water resources within the Project Area in accordance with the Mount Owen Complex Water Management Plan, the Environmental Protection Licences and the requirements of the HRSTS.

Ecology

An extensive ecological survey and assessment has been undertaken to assess the impact of the Project on threatened flora and fauna species, endangered populations, threatened ecological communities (TEC) and their habitats.

The Project will result in clearing of approximately 451.5 hectares of native vegetation which includes approximately 223.7 hectares of native woodland, forest and riparian vegetation; approximately 223.1 hectares of derived native grassland and approximately 4.7 hectares of shrubland. Approximately 86.9 hectares of grassland rehabilitation will also be disturbed. Three Endangered Ecological Communities (EECs) listed at a State level, will be impacted by the Project. No Commonwealth listed EECs have been recorded within the Proposed Disturbance Area.

The Project is considered likely to result in a significant impact on the spotted-tailed quoll and squirrel glider and potentially 12 additional threatened species at a State level. The impact of the Project on the spotted-tailed quoll has been assessed as not being significant at the Commonwealth level.

Mount Owen has an excellent record for implementation of comprehensive flora and fauna management strategies as part of existing operations. This approach will continue for the Project, including a range of management strategies to limit impacts on native flora and fauna within the Project Area, including feral animal and weed control, use of native species in revegetation, management of erosion and sedimentation and ongoing monitoring and maintenance of revegetation works.

Mount Owen has committed to the implementation of a comprehensive Biodiversity Offset Strategy to mitigate the residual impacts of the Project. The Biodiversity Offset Strategy includes the protection and enhancement of native vegetation and threatened species habitat, to develop a positive long-term outcome for the threatened species and key ecological features impacted by the Project.

Agriculture

A detailed Agricultural Impact Statement was prepared in accordance with the requirements of the *Guidelines for Preparing Agricultural Impact Statements* (DP&I 2012a), *Agricultural Impact Statement Technical Notes* (DPI 2013), *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land* (OEH 2013)

The land within the Project Area includes part of the existing mining operations in addition to lands owned by Glencore, some of which are currently managed by Glencore's grazing enterprise. Existing agriculture uses in the locality are dominated by cattle grazing, but also includes fodder crops on the irrigated floodplain and some terrace landforms along Glennies Creek.

The Agricultural Impact Statement confirms that the Project will have no impact on Biophysical Strategic Agricultural Land (BSAL) or any Critical Industry Clusters and will also have negligible impact on agricultural resources.

Aboriginal Archaeology and Cultural Heritage

A comprehensive Aboriginal Cultural Heritage Assessment has been prepared in collaboration with the Registered Aboriginal Parties (RAPs) and Knowledge Holder groups to assess the Aboriginal cultural heritage values of the Project Area. Three key Knowledge Holder groups were invited to prepare their own Cultural Heritage Assessment Reports as contributions to the Project Cultural Heritage Assessment process. The RAPs also participated in an Aboriginal Archaeological Values Assessment to assess the scientific (archaeological) value of sites and landscapes identified within the Proposed Disturbance Area and provide management recommendations for identified and potential Aboriginal sites.

The Cultural Heritage Assessment has shown that the wider regional cultural landscape surrounding the Project Area does hold high cultural and historical significance to Wonnarua people. The landscape within the Project Area is highly disturbed and fragmented, resulting in much of the past archaeological record already having been lost due to previous agriculture and coal mining. The archaeological sites investigated within the Proposed Disturbance Area were found to be of low and low-moderate archaeological significance.

The management measures that have been developed in consultation with the RAPs and Knowledge Holder groups include onsite measures to further investigate and manage identified sites, in addition to offsite cultural heritage initiatives to enhance cultural heritage values and knowledge. Mount Owen will seek to establish an Aboriginal Working Group that will assist in implementing the proposed cultural heritage management measures.

Historic Heritage

A Historic Heritage Assessment was undertaken for the Project. No sites / items with any form of statutory heritage listing were identified within the Project Area. None of the identified listed heritage items located within the vicinity of the Project Area will be directly impacted as a result of the Project.

The area of the former Ravensworth Village has the potential for a locally significant archaeological resource, within the area proposed to be disturbed by the Hebden Road upgrade works. As such, an on-site archaeological investigation of that area will be undertaken prior to the commencement of construction of the Hebden Road upgrade works.

Greenhouse Gas and Energy

A detailed Greenhouse Gas and Energy Assessment was undertaken to consider emissions from the Project. Scope 1 emissions from the Project are primarily from the combustion of diesel and release of fugitive emissions as part of the construction and operation phase and Scope 2 emissions are associated with electricity used by the Project. Scope 3 emissions are indirect emissions that will occur downstream of the Project and be generated by third parties during product transport and consumption activities, and represent approximately 96 per cent of the Project's GHG emissions.

The Project is unlikely to impact National Greenhouse Gas Policy objectives due to the relatively small contribution the Project will make to National emissions on an annual basis.

Mount Owen will mitigate greenhouse gas emissions through ongoing energy efficiency initiatives, utilising alternative fuel sources and optimising productivity. This includes limiting the length of haulage routes (where feasible) to minimise transport distances and associated fuel consumption, select equipment and vehicles that have high energy efficiency and scheduling activities so that equipment and vehicle operation is optimised.

Traffic and Transport

A detailed traffic impact assessment was undertaken to assess the road and rail traffic impacts from the Project. Traffic levels associated with the continued operations are anticipated to be similar to current traffic levels. The Project is not expected to result in unacceptable traffic conditions or road service levels. The proposed construction of a new dual lane bridge over Bowmans Creek and rail overpass over the Main Northern Rail Line will improve road service levels and safety.

The traffic impact assessment indicates that during the construction phase of the Project, both the New England Highway / Hebden Road and New England Highway / Glennies Creek Road intersections will operate during peak traffic demands at good traffic service levels with minimal delays and queue lengths.

Whilst the Project will result in an additional 12 years of coal production in the North Pit and transportation along the Main Northern Rail Line, there will be no increase to the currently approved train movements.

Visual

A visual assessment was undertaken for the Project to determine potential impacts on visual amenity. Only two public viewing locations and two residences within the vicinity of the Project Area have views of the existing and proposed mining and associated operations.

Ongoing management of mobile lighting will be undertaken to reduce the potential impacts of lighting at night. Visual impacts of the Project will be mitigated through the screening effect of rehabilitation and development of a final landform that seeks as far as practicable to conform to the surrounding natural environment.

Social

The Project's Social Impact and Opportunities Assessment (SIOA) involved a number of phases of consultation to develop an understanding of the positive and negative social impacts of the Project. The SIOA has also considered cumulative issues relating to mining within the Singleton area.

An assessment of the potential impact on the key service areas of health, accommodation and education has identified that the health sector was the over-riding area of concern for residents and community groups in terms of community need.

As there are no proposed changes to operational staffing levels for the Project, impacts to community infrastructure, such as health, education, childcare, aged care, youth services, recreational facilities or other community services and facilities, due to permanent population increase, are considered negligible. Taking the assessments of community sensitivity at the local government area and township level into consideration, there is not anticipated to be any significant negative consequences regarding community sustainability.

Positive impacts include significant direct economic and community contributions associated with the ongoing retention of the existing workforce who share strong socio-economic linkages to Singleton and the wider Hunter Region, as well as opportunities related to local social investment, proactive approaches regarding cumulative impacts and collaborative involvement of community members in local land management.

The existing Mount Owen Social Involvement Plan will be revised to incorporate management strategies to include a framework to monitor the effectiveness of the proposed strategies in mitigating negative social impacts and / or enhancing positive social impacts over time.

Mine Closure and Rehabilitation

The Mine Closure and Rehabilitation Strategy developed for the Project has been designed to build on the success of the existing rehabilitation techniques implemented at the Mount Owen Complex. This strategy is based on the experience from extensive monitoring and research and will be adaptive to provide for continual improvement.

The aim of the Mine Closure and Rehabilitation Strategy for the Project is to ensure sustainable post mining land use options including the development of native woodland areas that are contiguous with adjacent and existing native vegetation and offset areas supplementing local and regional revegetation linkages. In addition, some areas suitable for sustaining potential future agricultural activities such as grazing will be established in the post mining landform.

The Mine Closure and Rehabilitation Strategy has also considered key strategic regional land use options and opportunities for integration with other Glencore operations in the Greater Ravensworth Area. This includes opportunities for integration of rehabilitation strategies within mining areas and existing offset areas to provide strategic and long term habitat linkages. The Mine Closure and Rehabilitation Strategy has also considered opportunities for ongoing and future water sharing and tailings emplacement options across the Greater Ravensworth Area which will be further reviewed within five years of closure.

The existing rehabilitation strategy has benefited from extensive research with a recent assessment of ecological outcomes of mine rehabilitation, regeneration and revegetation demonstrating rehabilitation success at the Mount Owen Complex. Rehabilitation will continue to be undertaken progressively with disturbed areas being rehabilitated as soon as practicable throughout the life of the Project. Proposed rehabilitation activities have been designed to integrate with the currently approved rehabilitation and final land use of other Glencore mines within the greater Ravensworth area. Mount Owen will continue to undertake a rehabilitation monitoring program to assess rehabilitation performance against the closure criteria and to facilitate continued improvement to rehabilitation practices.

Justification for the Project

The Project has been assessed against the principles of ecologically sustainable development (ESD) as required by the relevant legislation and this assessment has indicated that the Project is consistent with those principles.

The detailed cost benefit analysis (CBA) undertaken for the Project has also identified that the benefits of the Project will outweigh the costs, including consideration of environmental and social externality costs. The Project will provide significant economic benefits to a range of stakeholders, with the key benefits of the Project outlined below:

- economic returns from the extended mine life will benefit the company, workforce, suppliers and other stakeholders;

- creation of approximately 330 additional construction jobs during the construction phase of the Project;
- upfront Project capital investment of approximately $153 million;
- net benefits of around $758million (in NPV terms) over the Project life and a Benefit Cost Ratio of 1.30;
- royalties of an estimated $258 million in NPV terms to the NSW Government;
- generation of a net benefit to the Singleton community of around $306 million (in NPV terms) over the life of the Project;
- increase the Hunter economy by just under $1.3 billion in NPV terms, over the life of the Project;
- increase the NSW economy by approximately $1.9 billion (NPV terms); and
- directly and indirectly employing a peak of almost 1,200 full-time equivalents (FTEs) workers. Of this, about 1,000 are estimated to be employed in the Hunter region.

On this basis, it is considered that with the implementation of the management, mitigation and offset measures proposed by Mount Owen, the Project will result in a substantial net benefit to both the local and NSW communities.

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APPENDICES

1.0 Introduction

The Mount Owen Complex is located within the Hunter Coalfields in the Upper Hunter Valley of New South Wales (NSW), approximately 20 kilometres north-west of Singleton, 24 kilometres south-east of Muswellbrook and to the north of Camberwell village (refer to **Figures 1.1** and **1.2**). The Mount Owen Complex open cut operations are located in the north-eastern part of the Upper Hunter Valley which has been heavily dominated by coal mining and power station operations for many decades, with rural and rural residential land located to the north-east, east, south-east and south of the Mount Owen Complex (refer to **Figure 1.2**).

Mount Owen Pty Limited (Mount Owen), a subsidiary of Glencore Coal Pty Limited (formerly Xstrata Coal Pty Limited (Xstrata)), currently owns and operates the three existing open cut operations in the Mount Owen Complex; Mount Owen (North Pit), Ravensworth East (West Pit) and Glendell (Barrett Pit). Mount Owen anticipate that mining will commence in the northern portion of the approved Ravensworth East Mine in an area known as the Bayswater North Pit (BNP) in 2015. The mining operations at the Mount Owen Complex include the integrated use of the Mount Owen coal handling and preparation plant (CHPP), coal stockpiles and the rail load out facility (refer to **Figure 1.3**).

Mount Owen (North Pit) has an approved production rate of 10 million tonnes per annum (Mtpa) of run of mine (ROM) coal, and blended with Ravensworth East (approved 4 Mtpa) and Glendell (approved 4.5 Mtpa) ROM coal, feed the Mount Owen CHPP and associated infrastructure, which has a total approved processing capacity of 17 Mtpa of ROM coal. Processed coal, both semi soft and thermal, are primarily transported via the Main Northern Rail Line to the Port of Newcastle for export, or by conveyor or rail for domestic use as required.

Mount Owen expects, subject to market conditions, that mining will be completed within the currently approved area of the North Pit and the Ravensworth East Mine by 2018 and 2021 respectively. Mount Owen has undertaken extensive exploration of its mining tenements and identified substantial additional mineable coal tonnes to the south of the currently approved North Pit. Further exploration verified economically viable reserves within the BNP. The proposed Ravensworth East Resource Recovery (RERR) Mining Area, is located immediately east of the West Pit and is proposed to be mined sequentially after mining has been completed in the BNP.

Mount Owen is seeking development consent for the Mount Owen Continued Operations Project (the Project) to extract these additional mineable coal tonnes through continued open cut mining methods. The Project proposes to continue the existing mining operations within the North Pit to the south beyond the current approved North Pit mining limit (the North Pit Continuation) in addition to undertaking mining operations within the BNP, sequentially followed by the RERR Mining Area (refer to **Figure 1.4**).

The Project design has taken account of issues raised during extensive stakeholder consultation and was the subject of rigorous iterative studies to refine the Project to minimise environment and community impacts. The Project avoids disturbance of Ravensworth State Forest and existing Offset Areas, whilst maximising the use of previously disturbed areas and infrastructure.

FIGURE 1.1

Locality Plan

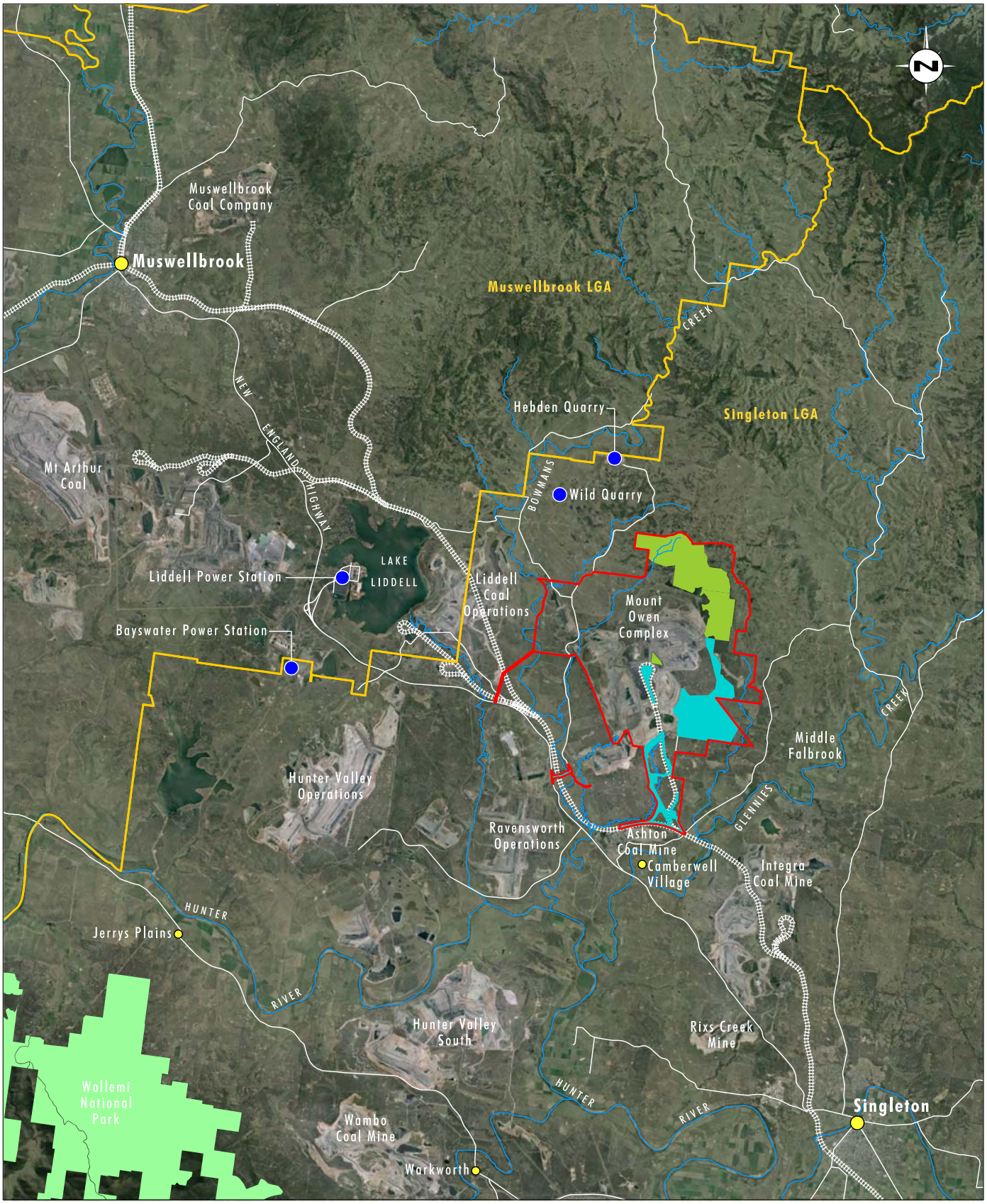

Image Source: Google Earth (2013)
Data Source: Mount Owen (2014), OEH (2013), Forest Corporation of NSW (2013)

0 2.5 5.0 10km
1:200 000

Legend

- Project Area
- Local Government Area Boundary
- Proposed Disturbance Area
- National Park
- State Forest
- Towns/Villages
- Road
- Railway

FIGURE 1.2

Upper Hunter Valley Context

File Name (A4): R02/3109_823.dgn
20141008 10.50

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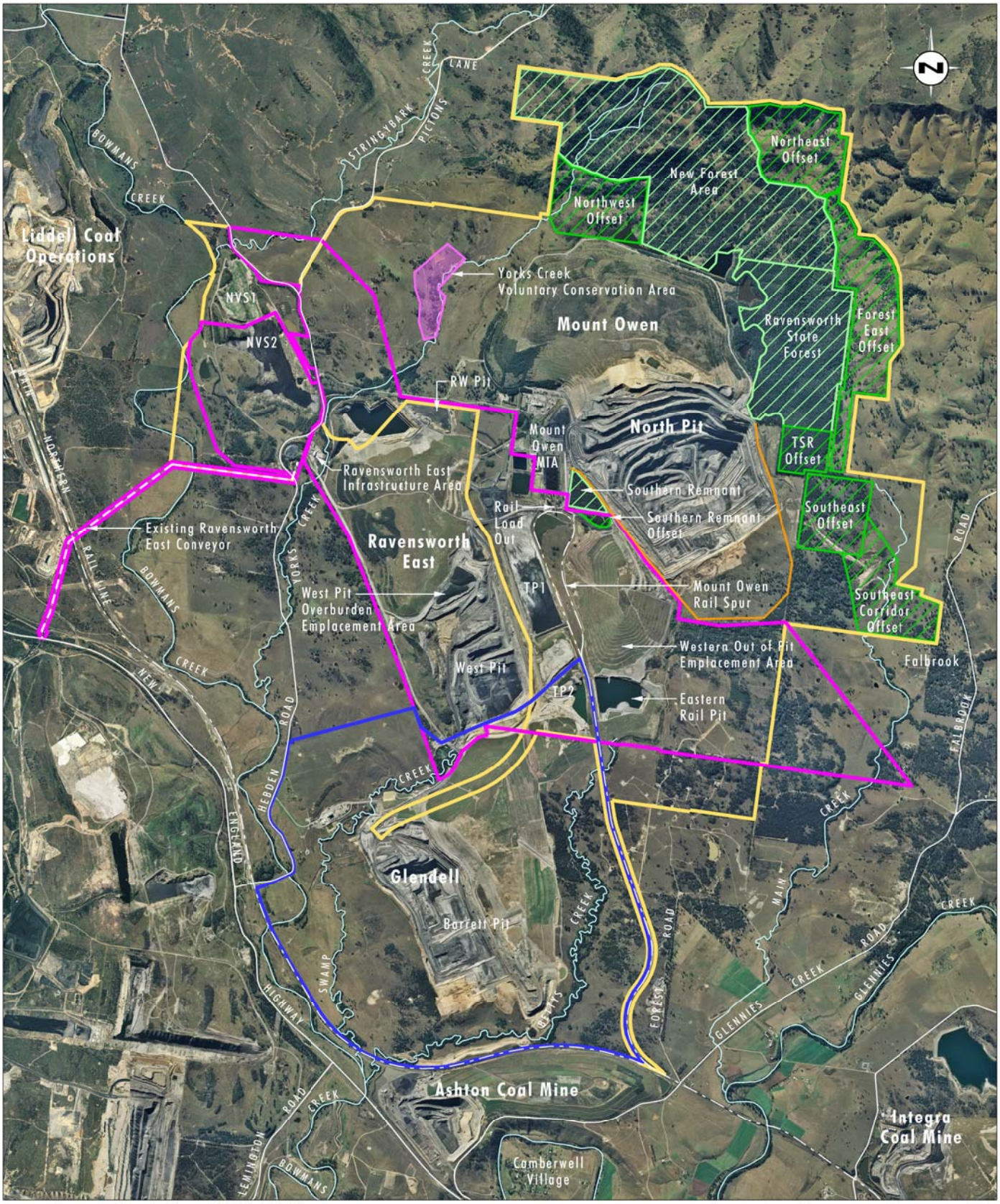

Image Source: Mount Owen (2012-2013)
Data Source: Mount Owen (2013), Department of Lands (2006)

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1:60 000

Legend

- Ravensworth East Mine DA Boundary (DA 52-03-99)
- Glendell Mine DA Boundary (DA 80/952)
- Mount Owen Mine DA Boundary (DA 14-1-2004)
- Existing Biodiversity Offset Area
- Ravensworth State Forest
- Yorks Creek Voluntary Conservation Area
- Approved North Pit Mining Extent

FIGURE 1.3

Mount Owen Complex Current Operations

File Name (A4): R02/3109_825.dgn
20141024 15.03

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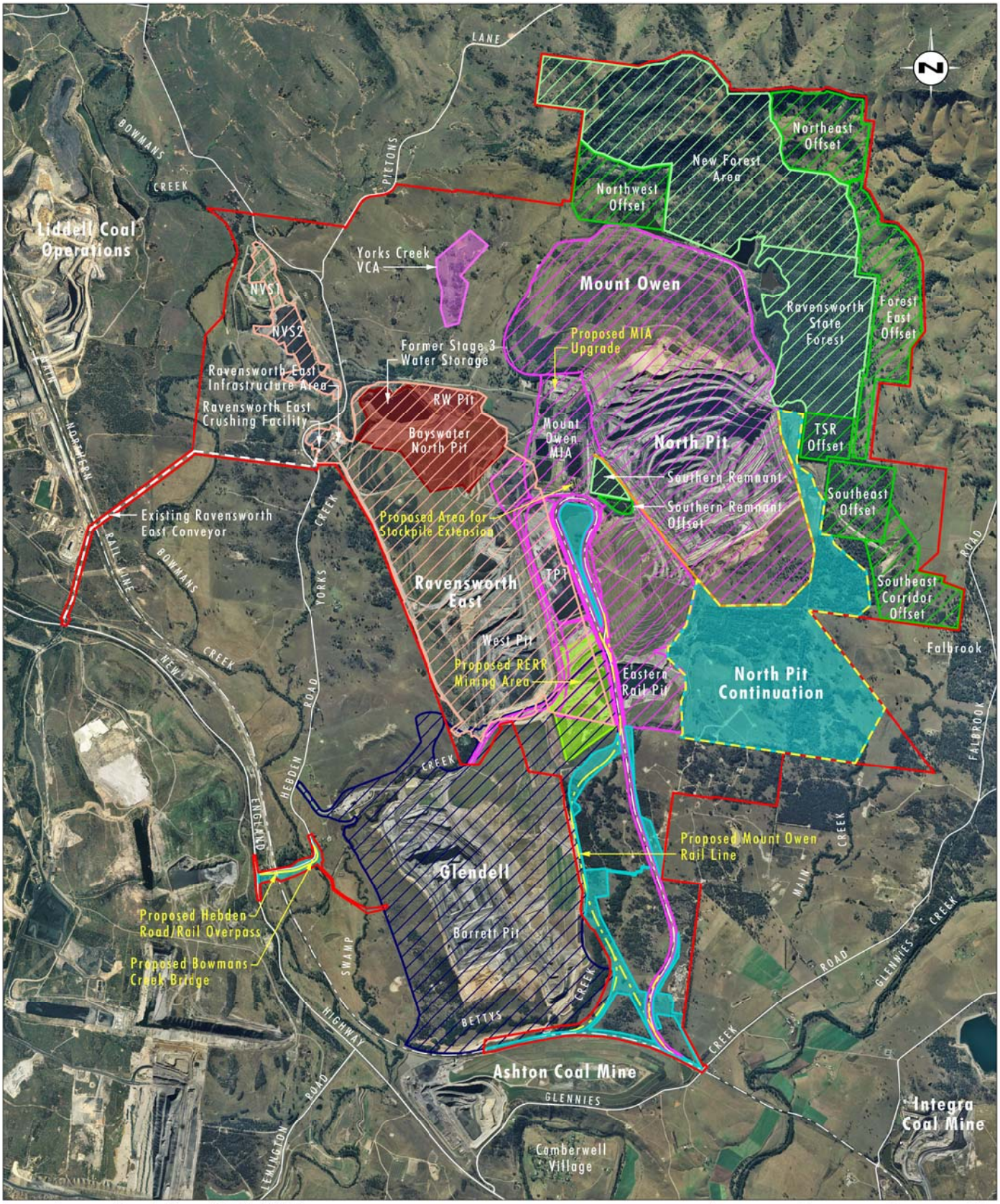

Image Source: Mount Owen (2012-2013)
Data Source: Mount Owen (2014)

0 1 2 3km
1:60 000

Legend

- Project Area
- Approved North Pit Mining Extent
- Proposed North Pit Continuation
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Proposed Disturbance Area
- Proposed RERR Mining Area
- Yorks Creek VCA
- Bayswater North Pit
- Mount Owen Operational Area
- Glendell Operational Area
- Ravensworth East Operational Area
- Existing Biodiversity Offset Area
- Ravensworth State Forest

FIGURE 1.4

Proposed Mount Owen Continued Operations Project

File Name (A4): R02/3109_824.dgn
20141008 9.53

The Project seeks to maintain the current approved North Pit extraction rate of 10 Mtpa of ROM coal, extracting approximately 74 million tonnes (Mt) of ROM coal from the North Pit Continuation. The extraction of these additional mineable coal tonnes would continue the North Pit life to approximately 2030 (an additional 12 years). Additionally, the Project seeks to maintain the current approved Ravensworth East extraction rate of 4 Mtpa of ROM coal, and to extract approximately 12 Mt of ROM coal from the BNP. Subject to market conditions, mining within the BNP will be undertaken from approximately 2015 to 2022, with the mining in the RERR Mining Area to follow sequentially from approximately 2022 to 2027 and extract approximately 6 Mt of ROM coal.

The extension to the mine life within the North Pit and Ravensworth East Mines would extend the substantial employment and economic benefits provided to the existing workforce and suppliers. The current remaining coal tonnes from the existing approved Mount Owen Mine and Ravensworth East Mine are estimated to be approximately 24 Mt ROM coal and if approved, the Project will increase this recovery to approximately 116 Mt ROM coal.

The Project will enable the consolidation of the Mount Owen and Ravensworth East Operations to provide for further operational efficiency by providing a single development consent for continued operations. The Project does not include any aspect of the ongoing operations at Glendell Mine and it will continue to operate in accordance with its current development consent.

Key objectives of the Project include:

- the continued operation of the Mount Owen and Ravensworth East Mines with a focus on:
  - maximising resource recovery from within the existing Glencore mining tenements;
  - optimising the use of existing infrastructure;
- maintaining the economic life of the Mount Owen Mine and providing ongoing employment for the existing workforce;
- further development of the existing environmental mitigation and management strategies, expanding the existing commitments to mitigate and manage the predicted impacts associated with the Project;
- maximising the use of previously disturbed areas and existing mining infrastructure, thereby minimising the overall Proposed Disturbance Area as far as practicable;
- avoiding disturbance of existing Biodiversity Offset Areas and the Ravensworth State Forest;
- continuing to actively engage and consult with the surrounding community; and
- establishing a final landform that is safe and stable which provides sustainable post mining land use options.

1.1 Brief History of Mining Operations at the Mount Owen Complex

Mining operations at the Mount Owen Complex commenced at the Ravensworth East Mine (previously known as Swamp Creek Mine) and dates back to the early 1960s. Ravensworth East Mine has been subject to various modifications including integration with the Mount Owen and Glendell Mines to allow efficient processing and haulage of coal to the Mount Owen CHPP and the emplacement of tailings within the Ravensworth East voids from the Mount Owen CHPP. Glendell mine was originally approved in 1983. Following earlier site preparation, mining commenced in 2009 and is expected to continue operating under the existing development consent until 2022.

Mining operations within the Mount Owen Mine commenced in 1993 under the management of Hunter Valley Coal Corporation Pty Limited (HVCC). Glencore (formerly Xstrata) has managed Mount Owen Mine, Ravensworth East and Glendell Mines as the Mount Owen Complex since 2004.

Thiess Pty Ltd currently operates the Mount Owen Mine (excluding the CHPP and associated infrastructure) under a contractual agreement with Mount Owen. Mount Owen operates the Mount Owen CHPP and associated infrastructure and the Ravensworth East and the Glendell mines.

Key operational aspects at the Mount Owen and Ravensworth East Mines are provided in **Table 1.1** below.

Table 1.1: Key Operational Aspects of Mount Owen and Ravensworth East Mines

Operational Aspect	Mount Owen	Ravensworth East
Mining Area	North Pit	West Pit (including Bayswater North Pit)
Previously mined areas	Eastern Rail Pit (ERP)	Tailings Pit 1 (TP1), Tailings Pit 2 (TP2), Stage 3 water storage, RW Pit, North Void Stage 1 (NVS1), North Void Stage 2 (NVS2)
Tailings Emplacement	ERP	TP1, RW Pit, NVS1, NVS2
Coal Processing	Mount Owen Coal Handling and Preparation Plant	Mount Owen Coal Handling and Preparation Plant
Coal Transportation	Mount Rail Loop	Mount Owen Rail Loop and M series conveyor
Mine Infrastructure Area (MIA)	Mount Owen MIA	Ravensworth East MIA

1.2 Overview of the Project

Preparation of the Environmental Impact Statement (EIS) for the Project commenced in 2012, with detailed assessment studies having been prepared over the past two years to meet government requirements and community expectations. The EIS was submitted to the former Department of Planning and Infrastructure (DP&I) (now Department of Planning and Environment (DP&E)) and the Commonwealth Department of the Environment (DoE) for review in December 2013. In late 2013, a drilling exploration program was completed in the northern portion of the Ravensworth East Mine to verify the extent of known coal reserves in an area previously approved for mining. Further evaluation in early 2014, confirmed this area, referred to as the BNP, as being economically feasible to mine with approximately 12 Mt of ROM coal to be extracted. In early 2014 Mount Owen consulted with DP&E regarding

the Project changes and requested DP&E to hold further review whilst the EIS was updated. It is proposed that mining within the BNP will commence under the existing Ravensworth East development consent in 2015, subject to approval of revised mining operations plan (MOP). As outlined in **Section 1.0**, it is proposed that, should the Project be approved, the existing Mount Owen and Ravensworth East development consents would be surrendered to provide a single development consent. In addition to seeking approval for the additional mining of the North Pit Continuation area, this application seeks approval for continued operations of the existing approved Mount Owen and Ravensworth East mines. Therefore, the potential impacts associated with the existing operations at these mines including the BNP have been assessed within this EIS.

The Project aims to maintain the utilisation of the existing Mount Owen and Ravensworth East infrastructure and to maximise the recovery of mineable coal tonnes from within the existing Glencore mining tenements.

The key features of the Project are illustrated on **Figure 1.4** and include:

- continuing North Pit life to approximately 2030 (an additional estimated 12 years beyond the current approved mining limit, expected to be completed in 2018), with the final year of mining subject to market and other drivers which influence the production schedule;
- continued overburden removal and coal mining within the BNP from approximately 2016 to 2022 and overburden removal and coal mining in the RERR Mining Area from approximately 2022 to 2027;
- the continued extraction of coal at a maximum ROM production rate of 10 Mtpa from within the North Pit and 4 Mtpa from Ravensworth East mining operations (same as existing);
- approximately 381 hectare continuation of the existing North Pit to the south (North Pit Continuation) to continue mining beyond the current approved North Pit limit (refer to **Figure 1.4**) to provide for the extraction of approximately an additional 74 Mt ROM coal;
- continued use of the Mount Owen CHPP and rail loading facility at the approved capacity of 17 Mtpa ROM coal;
- on-site infrastructure upgrades including the extension of the existing product stockpile and improvement to the coal handling functionality of the stockpile;
- upgrades to the Mine Infrastructure Area (MIA) including increased capacity at the existing heavy vehicle workshop and fuel farm and the replacement of associated site services, such as the raw water system, to meet current standards;
- upgrades to the CHPP coal processing to improve yields and reduce water consumption;
- upgrades to the CHPP area including covered storage areas;
- provision for augmentation of the existing Mount Owen rail line through the construction of an additional rail line and northern turn-out west of the existing rail line (refer to **Figure 1.4**). The existing Mount Owen rail line will be used as a siding for parking of Glencore trains and allow them the ability to turn around within the Mount Owen rail line and return to Glencore owned mines to the west, thereby reducing unnecessary traffic flow on the Main Northern Rail Line;

- upgrades to Hebden Road, which is the primary employee and services access to the Mount Owen Complex. The Project seeks approval to construct an overpass over the Main Northern Rail Line that crosses Hebden Road and a new bridge over Bowmans Creek in order to improve road safety for all road users and to minimise traffic delays on Hebden Road that are a result of the existing rail level crossing and single lane Bowmans Creek Bridge (refer to **Figure 1.4**);

- continuation of the existing approved mining operations at Ravensworth East including the integration of the environmental management of the Mount Owen and Ravensworth East Mines into a single development consent;

- continued use of Ravensworth East voids for tailings and coarse reject emplacement and provision for the use of in-pit tailings cells in the North Pit Continuation, as well as the co-disposal of coarse reject with overburden in-pit within the North Pit, West Pit, BNP and RERR Mining Area;

- continued ability to transfer ROM coal to the Liddell and Bayswater power stations via the Ravensworth East and M-series conveyors, in addition, transport of up to 2 Mtpa of ROM coal and crushed gravel on an as needed basis via the existing overland conveyor to Liddell Coal Operations and the Ravensworth Coal Terminal (RCT);

- approval for the receipt of tailings from other mining operations; and

- development consent for 21 years (from the date of approval) to allow for mining and final closure and rehabilitation of the Project Area.

In order to cover all aspects of the existing approved Mount Owen and Ravensworth East Mines and the Project, the Project Area (refer to **Figures 1.4** and **1.5**) encompasses the current approved development consent areas for the Mount Owen Mine and Ravensworth East Mine in addition to all areas associated with the proposed operations and associated works described above.

The Proposed Disturbance Area for the Project represents the total area that would be disturbed, outside of the areas that were previously approved for disturbance. The total area of the Proposed Disturbance Area is approximately 485 hectares, of which approximately 381 hectares is associated with the North Pit Continuation and 104 hectares is associated with the infrastructure upgrades (Hebden Road upgrades and Rail Line).

A detailed description of the Project is provided in **Section 2.3**.

1.3 Overview of the Existing Environment

1.3.1 Land Ownership and Land Use

Glencore or its subsidiaries own all the land within the Proposed Disturbance Area and large areas of land within the surrounding area (refer to **Figure 1.6**). The Project Area and its surrounds is comprised of mine owned land, privately owned land, Crown Land, State Forest and government authority or corporation owned land as detailed on **Figure 1.6**. The location of existing residences, and those private properties and residences with current acquisition rights under existing development consents, are shown on **Figure 1.6**.

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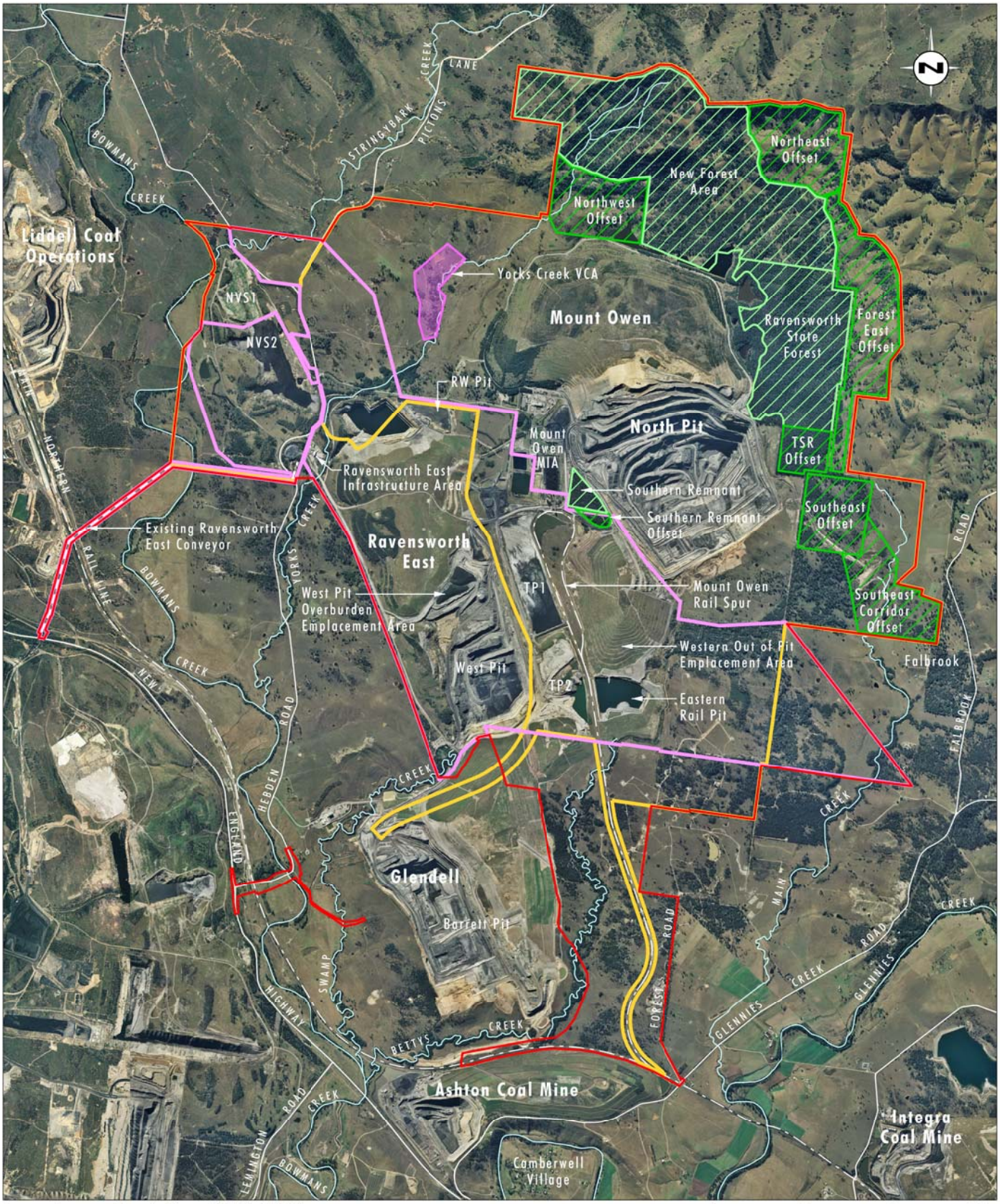

Image Source: Mount Owen (2012-2013)
Data Source: Mount Owen (2014), Department of Lands (2006)

0 1 2 3km
1:60 000

Legend

- Project Area
- Ravensworth East Mine DA Boundary (DA 52-03-99)
- Mount Owen Mine DA Boundary (DA 14-1-2004)
- Existing Biodiversity Offset Area
- Ravensworth State Forest
- Yorks Creek VCA

FIGURE 1.5

Existing Development Consent Boundaries and Proposed Project Area

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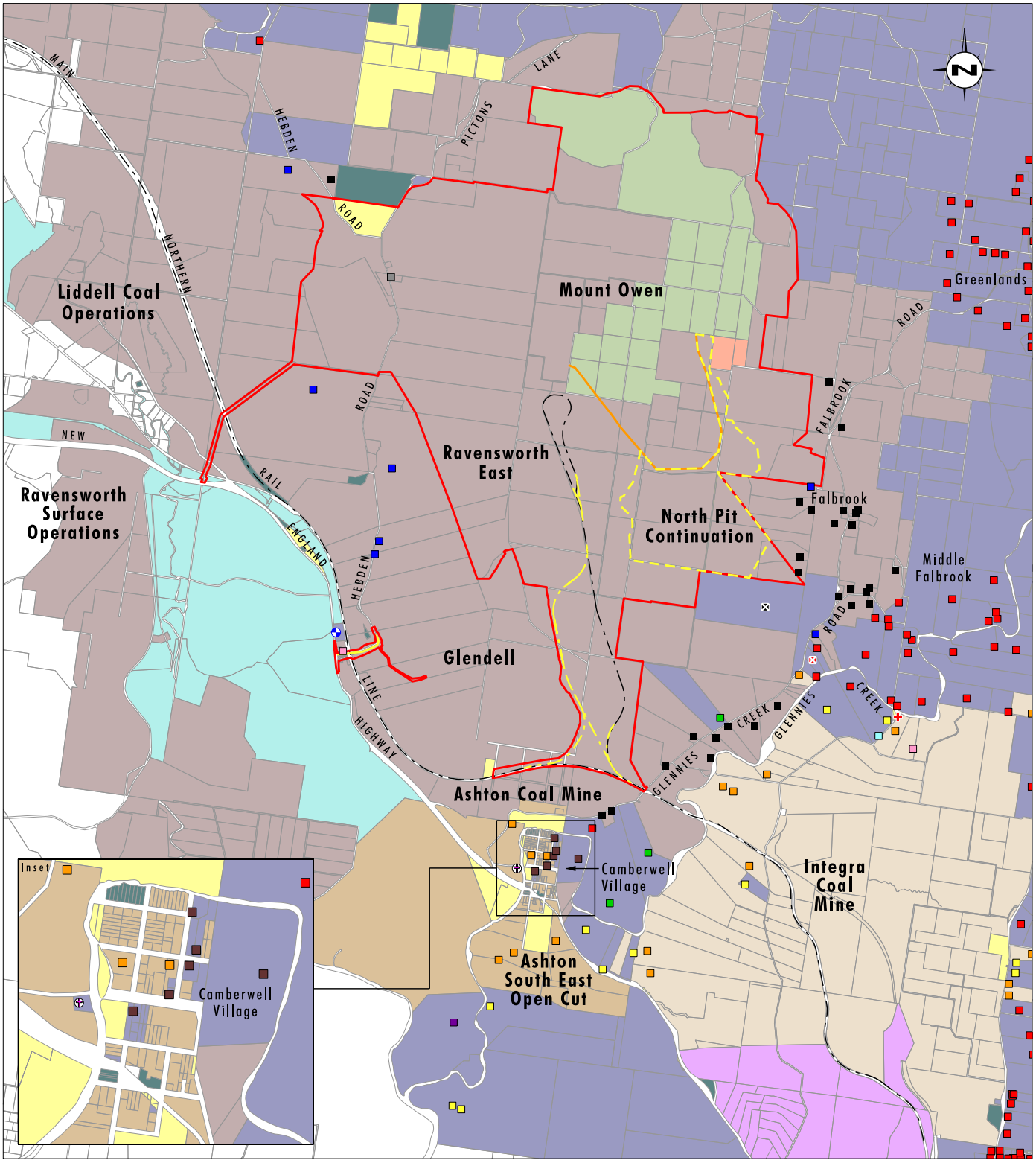

Data Source: Mount Owen (2014), Department of Lands (2009)

0 0.5 1.0 1.5km
Inset Scale 1:30 000

0 1 2 4km
Main Scale 1:90 000

Legend

- Project Area
- Approved North Pit Mining Extent
- Proposed North Pit Continuation
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Ashton Coal
- Crown Land
- Crown Land TSR
- Government Authority
- Integra Coal
- Macquarie Generation
- Glencore
- Private
- Rixs Creek Mine
- State Forest
- Church
- Daracon Site Office
- Glennies Creek Fire Brigade
- Private No Dwelling
- Subject to Acquisition Rights - Glencore No Dwelling
- Currently Subject to Acquisition Rights - Dairy
- SEOC Acquisition
- Private Residence
- Private Residence - Currently Subject to Acquisition Rights - Glencore
- Private Residence - Currently Subject to Acquisition Rights - Other Mines
- Mine Owned Residence - Glencore
- Mine Owned Residence - Other Mine
- Mine Owned Residence - Derelict
- Mine Owned Residence - Vacant
- Community Hall
- Former Hebden Public School

FIGURE 1.6

Land Ownership

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20141024 9.28

Glencore owns an extensive area of land surrounding the majority of the Project Area. The majority of the mine-owned residences within the vicinity of the Project Area are currently tenanted. The nearest private residences to the proposed mining operations are located to the south-east and east of the Project Area in the Middle Falbrook area approximately 1 kilometre from the boundary of the Project Area (refer to **Figure 1.6**). The nearest private landholder is located immediately to the south of the south-eastern boundary of the Project Area. The property is vacant land and currently has acquisition rights under the existing Mount Owen development consent (DA 14-1-2004). Further privately owned land is located to the north, north-east and north-west of the Project Area (over 2 kilometres from BNP and over 6 kilometres from the North Pit); however as mining progresses the North Pit Continuation will move further away from the existing residences in these localities.

Camberwell Village is located approximately 4.5 kilometres from the southern boundary of the North Pit Continuation. The majority of the existing residences within Camberwell Village are mine owned or have acquisition rights under approved mining development consents. The properties with acquisition rights under the Ashton South East Open Cut development consent are labelled separately on **Figure 1.6**.

The surrounding area is dominated by established mining operations within 10 kilometres of the Project Area including:

- Glendell Mine to the south-west;
- Liddell Coal Operations to the north-west;
- Ravensworth Surface Operations to the south-west;
- Integra Mine to the south-east (currently on care and maintenance); and
- Ashton Mine to the south.

A large portion of the land to the south and south-east of the Project Area is owned by Ashton Coal Mines Pty Limited (Ashton Coal Project) and Integra Coal (Integra open cut and underground mines). RHA Pastoral Company Pty Ltd is affiliated with Integra Coal and currently utilises large areas of land owned by Integra Coal surrounding the Integra Mining operations for agricultural purposes. Land to the west and south-west of the Project Area is predominantly owned by Glencore and Macquarie Generation (refer to **Figure 1.6**).

Road access to the Mount Owen and Glendell Mines is via Hebden Road and the New England Highway. The Main Northern Rail Line adjoins the southern and south-western boundary of the Project Area.

There is no proposed disturbance to the Ravensworth State Forest or existing Biodiversity Offset Areas. The Ravensworth State Forest and New Forest area are located within the north-eastern corner of the Project Area. The Southern Remnant is located between the existing North Pit and the MIA (refer to **Figure 1.4**). The New Forest area was created to compensate for the removal of vegetation within the Ravensworth State Forest as a result of previously approved mining. It was subsequently transferred into the ownership of the Forestry Corporation NSW in 2004.

Surrounding these State Forest areas are existing Mount Owen Biodiversity Offset Areas (refer to **Figure 1.4**). Adjoining the State Forest to the south is a Travelling Stock Reserve (TSR89694) managed by NSW Local Land Services. As part of the biodiversity offset commitments for the previous Mount Owen development consent in 2004, HVCC (now Mount Owen) lodged an application with the then Department of Infrastructure, Planning and

Natural Resources (DIPNR), for the transfer of this TSR to freehold lots (Lot 21 DP 6842, Lot 96 DP 752470, Lots 3 and 4 DP774683). This application is currently being assessed. This land forms part of the existing Mount Owen offset areas and is not proposed to be disturbed.

Land surrounding the Project Area currently owned by Mount Owen is utilised for cattle grazing and breeding, currently managed and operated by Colinta Holdings Pty Limited, a Glencore subsidiary. Other land uses within the surrounding area include mining operations, grazing and rural residential holdings, the Hebden and Wild Quarries and the Bayswater and Liddell Power Stations.

Further details regarding land use and resources within and surrounding the Project Area are provided in **Sections 5.1** and **5.8**.

1.3.2 Environmental Setting

The Proposed Disturbance Area has been heavily cleared for agriculture in the past, and the majority remains as cleared grazing land. Approximately 223 hectares of native woodland that currently exists within the Proposed Disturbance Area has predominantly regrown since the period of heavy vegetation clearing prior to 1958.

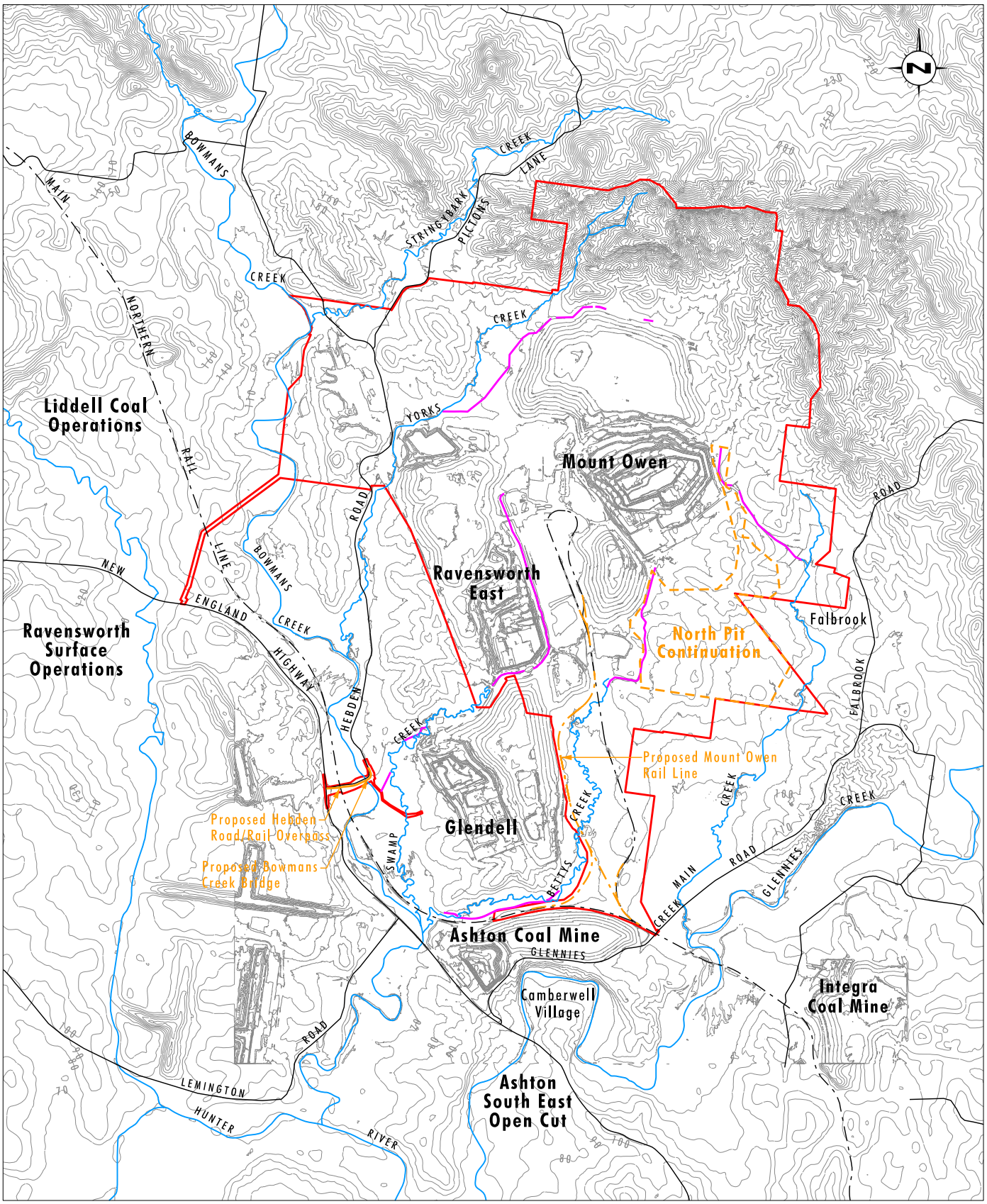
The area surrounding the Project Area is characterised by gently sloping alluvial plains and undulating hills. A ridgeline runs in an east to west direction to the south of the Project Area, with an elevation of approximately 100 to 115 m AHD (refer to **Figure 1.7**). Camberwell Village is situated immediately south of the ridgeline with an elevation of approximately 60 m AHD to a peak of 95 m AHD (refer to **Figure 1.7**). In addition, the Ashton Mine and associated overburden emplacement area is located to the south of the Project Area between the Project Area and Camberwell Village. Extending further north-east and east of the Project Area the terrain becomes more undulating and hilly.

The topography of the Project Area is characterised by an undulating and hilly landscape extending down to lower areas associated with the waterways that traverse the Project Area. A notable topographical feature is a ridgeline extending north to south through the north-eastern and eastern extent of the Project Area which extends to a height of approximately 385m AHD (refer to **Figure 1.7**). The majority of the residences located within the Falbrook and Middle Falbrook area are located on the eastern side of this ridge line.

The Project Area is located within both the Bowmans Creek catchment and its sub catchments and the Main Creek catchment (a sub catchment of Glennies Creek catchment). Bowmans Creek is a tributary of the Hunter River. The Project Area is primarily within three sub-catchments of Bowmans Creek, namely Yorks Creek, Swamp Creek and Bettys Creek.

Yorks Creek and the southern section of Bettys Creek flow through the Project Area before flowing into Bowmans Creek. Sections of Bettys Creek have been subject to previous diversion works associated with the current approved operations and its upper catchment now flows into Main Creek.

Main Creek flows through the east of the Project Area for a short distance and then into Glennies Creek south-east of the Project Area (refer to **Figure 1.7**). The North Pit Continuation mining limit has been designed to be located a minimum of 200 metres from the high bank of Main Creek. Bowmans Creek intersects the western extent of the Project Area (in the vicinity of the proposed Bowmans Creek Bridge upgrade) and continues south and joins the Hunter River approximately 3.5 kilometres downstream of the Project Area. Further details on existing surface water characteristics are provided in **Section 5.5**.



Data Source: Mount Owen (2014), Department of Lands (2006)
Note: Contour Interval 10m

0 1.0 2.0 4.0km
1:80 000

Legend

- Project Area
- Proposed North Pit Continuation
- Rail Upgrade Works
- Hebden Road Upgrade Works
- Drainage Line
- Diversion Drainage Line

FIGURE 1.7

Topography of Mount Owen Complex and Surrounds

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20141008 10.55

1.4 Overview of the Planning and Approval Process

The Project is State significant development as defined by the provisions of the *State Environmental Planning Policy (State and Regional Development) 2011* and requires development consent under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The Minister for Planning is the consent authority for the Project.

If development consent is granted under Part 4 of the EP&A Act, various other approvals, licences and permits under other relevant NSW legislation will also be required. Further details on the planning and approval process are provided in **Section 3.0**.

The Project seeks to provide for a single approval that incorporates all of the existing and future mining activities within the Mount Owen and Ravensworth East Mines. The existing Mount Owen and Ravensworth East Mine development consents are proposed to be surrendered within two years of Project Approval, subject to an appropriate development consent being granted to provide for the Project.

1.5 Environmental Assessment of the Project

This EIS has been prepared by Umwelt (Australia) Pty Limited (Umwelt) on behalf of Mount Owen in accordance with the EP&A Act and particularly the Director-General's requirements (DGRs) for the Project issued by the DP&E on 13 March 2013.

The DGRs outline the specific requirements to be addressed by this EIS. A copy of the DGRs is provided in **Appendix 1**. A checklist of the DGRs and where they have been addressed in the EIS is provided in **Section 3.2.1.2**.

The Project was also declared a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 24 October 2013. The decision notice from the DoE indicated that the assessment approach would be via Accredited Assessment. On 8 November 2013, supplementary DGRs were provided specifically relating to Matters of National Environmental Significance (MNES), refer to **Appendix 1**.

1.6 The Applicant

The Mount Owen and Ravensworth East Mines and all associated infrastructure are owned and managed by Mount Owen Pty Ltd (Mount Owen) a subsidiary of Glencore Coal Pty Limited. The applicant for this Project is Mount Owen Pty Limited (Mount Owen). Since issuing of the DGRs, Xstrata plc (Xstrata), the major shareholder in Mount Owen, has merged with Glencore plc creating Glencore Xstrata plc (Glencore). The applicant for the development application remains unchanged however, and references to Xstrata in the DGRs and sections of the EIS should be read as references to Glencore.

The Project Area is shown on **Figure 1.4** and a schedule of lands within the Project Area is included as **Appendix 2**.

1.7 Working with the Community and Stakeholders

Mount Owen 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 the existing operations. Mount Owen has an established communication program which includes 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. The Mount Owen Complex also has a Community Consultative Committee (CCC) which operates as a more formal mechanism for feedback between Mount Owen and the community.

Mount Owen has regularly met with Singleton Council, through the Coal Advisory Committee, to discuss the Project in detail and provide an update on the outcome of the environmental studies as results became available, and to receive feedback on potential impacts and proposed management and mitigation measures.

As discussed in **Section 4.0**, extensive Project specific consultation and engagement has also been undertaken with the community. This engagement included face to face meetings, community open days (the first held on 19 May 2013, the second held on 4 December 2013 and the third held over two days on 31st October and 1st November 2014). In addition updates have been provided via project specific newsletters and community information sheets (copies of the project specific newsletters and community information sheets are included in **Appendix 3**). Detailed stakeholder engagement was also undertaken as part of the social impact and opportunities assessment process for the Project (refer to **Section 4.0**).

The Project Area is located within the traditional lands of the Wonnarua people. Extensive consultation has been undertaken with 60 Registered Aboriginal Parties (RAPs), including three knowledge holder groups, being Wonnarua Traditional Custodians (WTC), Wonnarua Nation Aboriginal Corporation (WNAC) and the Plains Clans of the Wonnarua People (PCWP) as part of the Aboriginal Cultural Heritage and Aboriginal Archaeology Assessment process for the Project (refer to **Sections 4.0** and **5.9**).

The feedback and input obtained during these engagement processes has informed the development of the detailed design for the Project.

1.8 Project Team

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

- Air Quality Impact Assessment (Pacific Environment 2014) – Pacific Environment Limited;
- Noise Impact Assessment (Umwelt 2014a) – Umwelt;
- Blast Impact Assessment (ESC 2014a) – Enviro Strata Consulting (ESC);
- Ecological Impact Assessment (Umwelt 2014b) – Umwelt;
- Surface Water Resources Assessment (Umwelt 2014c) – Umwelt;

- Site Water Balance (Umwelt 2014c) – Umwelt;
- Groundwater Impact Assessment (Jacobs 2014) – Jacobs (formerly Sinclair Knight Merz (SKM));
- Agricultural Impact Statement (Umwelt 2014d) – Umwelt;
- Aboriginal Cultural Heritage Assessment:
  - Australian Cultural Heritage Management (ACHM 2014) (Cultural Heritage);
  - OzArk Environmental and Heritage Management Pty Limited (Archaeology) (OzArk 2014);
- Social Impact and Opportunities Assessment (Umwelt 2014e) – Coakes Consulting and Umwelt;
- Historical Heritage Assessment (Umwelt 2014f) – Umwelt;
- Greenhouse Gas and Energy Assessment (Umwelt 2014g) – Umwelt;
- Traffic Impact Assessment (TAUP 2014) – Transport and Urban Planning (TAUP);
- Visual Impact Assessment – Umwelt;
- Economic Impact Assessment (DAE 2014) – Deloitte Access Economics (DAE); and
- Mine Closure and Rehabilitation Strategy (Umwelt 2014h) – Umwelt.

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

1.9 Environmental Impact Statement Structure

The 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 key outcomes of the EIS.

Section 1.0 introduces the Project, outlines the key objectives of the Project, provides a summary of the Project details and outlines the EIS Project team and the structure of this document.

Section 2.0 contains a detailed description of the Project, including existing and approved operations.

Section 3.0 outlines the planning context for the Project, including the applicability of State and Commonwealth legislation.

Section 4.0 describes the stakeholder consultation program and details the environmental and community issues identified for consideration in the EIS.

Section 5.0 contains a description of the existing environment and a comprehensive analysis and assessment of the EIS issues relevant to the Project, including the Project specific and cumulative impacts.

Section 6.0 includes a summary of the measures proposed to be adopted through the life of the Project in order to mitigate the impacts.

Section 7.0 summarises the key conclusions arising from the detailed environmental assessment. This section also provides the Project justification and demonstrates the Project outcomes with reference to the principles of Ecologically Sustainable Development (ESD).

Section 8.0 lists references cited in the EIS.

2.0 Description of Continued Operations

The Project provides for continued operations at Mount Owen and Ravensworth East Mines. The Project will allow for extraction of approximately an additional 92 Mt of ROM coal from proposed continued operations in a manner that optimises the use of existing infrastructure and provides for effective integration of Glencore's existing approved mining operations in this locality. This section describes the Project and in accordance with the DGRs includes:

- details of the existing and approved mining operations and infrastructure at the Mount Owen and Ravensworth East Mines (**Section 2.1**);
- details of the need for the Project (**Section 2.2**);
- a detailed description of the Project including the anticipated staging of construction and operational stages and rehabilitation (**Section 2.3**);
- proposed management of interactions with other mines, including Integra Underground Mine (currently on care and maintenance) (**Section 2.3.3**);
- alternatives considered, efficiency of resource recovery, mine safety, environmental protection and maintaining biodiversity offset obligations (**Section 2.5**); and
- consideration of opportunities for improved integration between the Mount Owen Complex and Glencore's existing approved mining operations in the region (**Section 2.3**).

2.1 Description of Existing and Approved Operations

The Mount Owen Complex includes the Mount Owen, Ravensworth East and Glendell Mines. The proposed Project includes continuation of the currently approved haulage of coal mined from the Glendell Mine through the Mount Owen Complex for processing at the Mount Owen Coal Handling and Preparation Plant (CHPP) and transportation from the site. No change is proposed to the existing approved Glendell Mine and it does not form part of the Project. This section provides an overview of the current approved mining operations at the Mount Owen and Ravensworth East Mines.

2.1.1 Development Consent History

2.1.1.1 Mount Owen Mine

Operations at the Mount Owen Mine commenced in 1993 pursuant to development consent (DA 63/91) granted in 1991, with an extraction limit of 1.4 Mtpa ROM coal. Subsequent development consents and modifications were granted to provide for extensions to the North Pit and / or allow an increase in the extraction limit. The approved extraction limit increased to 5.3 Mtpa (ROM coal) in 1994 and to 8 Mtpa (ROM coal) in 1999.

Mount Owen Mine currently operates pursuant to development consent DA 14-1-2004, which was granted in December 2004 and allowed for the continuation of open cut operations over a 17 to 21 year mine life with an increase in ROM coal production to 10 Mtpa. Following the approval of DA 14-1-2004 all previous consents for the Mount Owen Mine were surrendered.

DA 14-1-2004 included:

- continuation of open cut mining operations within an extended North Pit, increasing the approved extraction rate from 8 Mtpa to 10 Mtpa ROM coal;
- mining to depths of approximately 270 metres;
- construction and operation of a ROM coal receivable facility and haul road to enable the Mount Owen CHPP to continue to receive and process ROM coal from the Ravensworth East and Glendell mining operations;
- increase to the approved processing rate of the Mount Owen CHPP to 15 Mtpa ROM coal;
- increase to the approved capacity of the Mount Owen rail loading facility and rail line to 15 Mtpa ROM coal;
- development of the Eastern Rail Pit (ERP);
- development of an out of pit overburden emplacement area known as the Western Out of Pit emplacement area (WOOP);
- upgrade works to the coal stockpile, infrastructure area and the water management system;
- continued disposal of tailings from the Mount Owen CHPP in voids within Ravensworth East Mine; and
- modifications to the water management system, office buildings and other ancillary infrastructure.

DA 14-1-2004 has been the subject of two modifications, the first modification in 2010 allowed for the establishment of a rail provisioning facility installed on the existing Mount Owen Rail Line to service the Glencore Rail (previously X-Rail) trains. The rail provisioning facility included the construction of hydrocarbon and water storage tanks, sanding facility, maintenance gantry, an access road and ancillary mechanical and electrical equipment. The second modification submitted to DP&E in 2014 to seek an increase in throughput at the Mount Owen CHPP and rail load out facility from 15 to 17 Mtpa of ROM coal. This modification is required to realise the benefits of implementation of operational efficiencies (such as improved operating hours and input rate with the existing infrastructure) at the CHPP.

2.1.1.2 Ravensworth East

The Ravensworth East Mine, formerly known as the Swamp Creek Mine, has been operating since the 1960s. Ravensworth East Mine currently operates under DA 52-03-99 which originally allowed for the supply of coal to the domestic market through the transportation of ROM coal via conveyor to both the Bayswater and Liddell power stations. Subsequent modifications to DA 52-03-99 from 2000 to 2005 allowed for an increase of the approved extraction rate to 4 Mtpa ROM coal, the production of coal for the export market following processing at the Mount Owen CHPP and the emplacement of tailings from the Mount Owen CHPP within voids at Ravensworth East Mine. Ravensworth East Mine consists of the West Pit (currently operational), the formerly mined Stage 3 Pit, the RW Pit and two shallow pits

known as TP1 and TP2. TP1 has been used for tailings emplacement, whilst TP2 has been partially backfilled with overburden from the Glendell Mine.

Mount Owen anticipates that mining will commence within the BNP in approximately 2015 in accordance with the existing Ravensworth East DA (DA 52-03-99).

The current Ravensworth East (DA 52-03-99) and Mount Owen (DA 14-1-2004) approvals allow for the emplacement of tailings and rejects from the Mount Owen CHPP within the Eastern Rail Pit (ERP) and Raw Water (RW) Pit at Mount Owen Mine, and within the Ravensworth East voids (including the North Void Stage 1 and 2 (NVS1 and NVS2), Tailings Pit 1 (TP1) and West Pit).

2.1.1.3 Current Development Consents

There are two existing development consents for the Mount Owen and Ravensworth East Mines which are listed in **Table 2.1**. The existing approved development consent boundaries for the Mount Owen and Ravensworth East Mines are presented on **Figure 1.5**.

Table 2.1 – Existing Development Consents for Mount Owen and Ravensworth East Mines

Development Consent	Date Approved	Description	Approval Lapse Date	Modifications	Brief Description of Modification
DA 14-1-2004	8/12/2004	Mount Owen Open Cut Coal Mine	2025	1 – 2010	Construction and operation of the rail provisioning facility
				2 – 2014	Increased throughput at the Mount Owen CHPP and rail load out facility from 15 to 17 Mtpa of ROM coal.
DA 52-03-99	2/03/2000	Ravensworth East Open Cut Coal Mine	2021	1 – 2000	Diversion works to Hebden Road
				2 – 2003	Emplacement of tailings within the Stage 3 void
				3 – 2004	Transfer and processing of ROM coal from Ravensworth East to the Mount Owen CHPP for export and emplacement of tailings from Mount Owen CHPP within Ravensworth East voids
				4 – 2005	Integrated management and implementation of combined management processes across the Mount Owen Complex

2.1.2 Existing Mining Titles

Details of the existing mining titles, including coal leases (CLs), mining leases (MLs) and exploration authorisation (A), relevant to Mount Owen Complex are presented in **Table 2.2**. **Table 2.2** also presents both the approved areas and depths of each mining title. The existing mining titles are shown on **Figure 2.1**.

Table 2.2 – Mining Titles Relevant to the Mount Owen Complex

Lease No	Expiry Date	Area (ha)	Depth (m)
CL 383	12/11/2033	874	Surface to unlimited
ML 1355	27/07/2015 (renewal sought)	439.8	Surface to unlimited
ML 1419	12/11/2012 (renewal sought)	82.65	Surface to unlimited
CL 715	12/09/2019	82	Surface to unlimited
ML 1453	4/07/2020	140.3	Surface to unlimited
ML 1561	17/02/2026	160	Surface to 15.24
ML 1415	4/07/2020	1,557.6	Various*
ML 1475	24/11/2021	240.7	Surface to 15.24 m
ML 1476	24/11/2021	153.9	Surface to 15 m below floor of Bayswater Seam
ML 1694	22/10/2034	501.6	Varying
CL358	27/03/2032	747	Varying
CL382 (Sublease)	Transfer pending – awaiting renewal of head lease	65.2	Varying
ML1410	14/07/2020	52.99	Surface to 106.68
ML1608	19/12/2028	30.17	Surface to unlimited
MPL343	04/01/2026	442.1	Surface to 5
ML1629	09/03/2030	128.2	Surface to 15.24
AL08	10/07/2013 (renewal sought)	287.2	Surface to 15.24
A423	21/12/2015	555	Varying
A429	Renewed awaiting reissue	1,094	Surface to 900
A268	25/08/2016	252	Varying

Note: *Encompasses the Stratum between the surface or 15.24 and 152.4- 243.84 metres from the surface.

No additional mining leases are required for the Project. AL08 will be transferred to a Mining Lease once the DA has been approved.

2.1.3 Existing Approved Mining Operations

2.1.3.1 Mount Owen Mine Existing Operations

The North Pit (refer to **Figure 1.3**) is currently operating as a multi-seam truck and excavator operation, with an approved ROM extraction rate of 10 Mtpa, mining to depths of approximately 270 metres down to the Lower Hebden coal seam. The sequence of mining involves the clearing of vegetation and topsoil followed by drilling and blasting of overburden and then the excavation and haulage of overburden to emplacement areas and ROM coal to the Mount Owen CHPP for processing. Product coal is then loaded onto trains using the rail loading facility.

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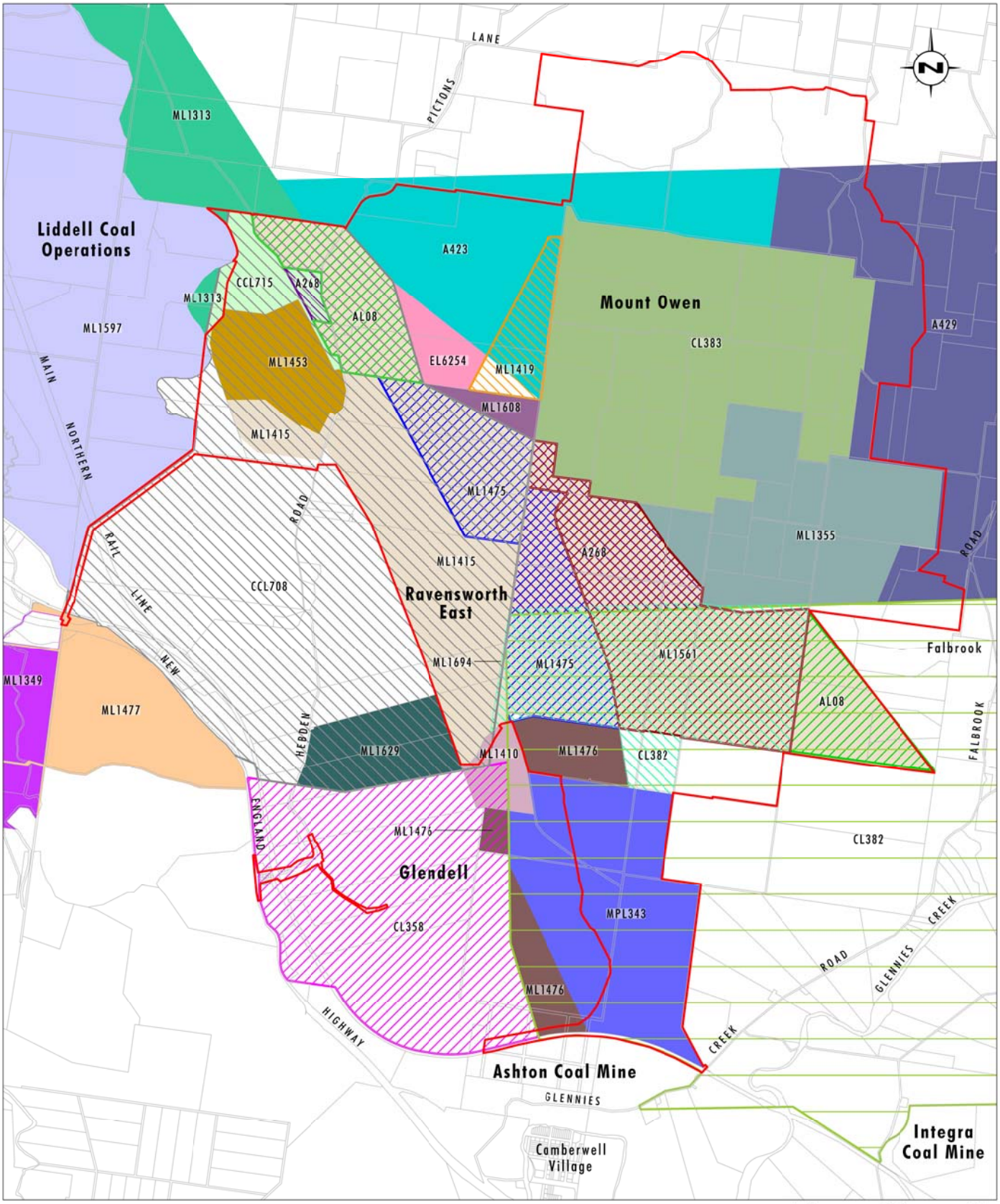

Data Source: Mount Owen (2014), Department of Lands (2009)

0 1.0 2.0 3km
1:60 000

Legend

Project Area	CL715	ML1349	ML1475	ML1629
AL08	CL358	ML1355	ML1476	ML1694
A423	CL382	ML1410	ML1477	MPL343
A268	CL383	ML1415	ML1561	
A429	EL6254	ML1419	ML1597	
CCL708	ML1313	ML1453	ML1608	

FIGURE 2.1

Mount Owen Complex
Mining Titles

File Name (A4): R02/3109_829.dgn
20140901 16.09

The existing Mount Owen CHPP (**Figure 2.2**) consists of the following key components:

- South ROM stockpile and coal dump hopper and haul road to enable Mount Owen CHPP to receive and process ROM coal from Ravensworth East and Glendell mines;
- North ROM stockpile and coal dump hopper and haul road to enable Mount Owen CHPP to receive and process ROM coal from the Mount Owen North Pit;
- two temporary ROM stockpile areas (one located within the North Pit, one within the West Pit);
- three 750 tonne per hour CHPP modules;
- coarse reject handling system comprising a conveyor and an 800 tonne rejects bin;
- travelling luffer stacker serviced by the product coal stockpiling conveyor and designed to stack coal out on the product stockpile;
- the product stockpile (approximate capacity of 600,000 tonnes) and associated reclaim tunnel;
- train load out system;
- rail provisioning facility; and
- other CHPP components, ancillary infrastructure and staff, visitor and contractor buildings.

Where possible, to minimise re-handle, coal is directly fed to the Mount Owen CHPP without stockpiling. Coarse reject is trucked back into the active overburden emplacement areas and tailings (fine reject) material from the Mount Owen CHPP is pumped to the ERP, RW Pit and West Pit tailings emplacement areas.

Export product coal is currently loaded onto trains using the Mount Owen Complex Load out Facility and rail line (refer to **Figures 2.2** and **2.3**), and is transported to the Port of Newcastle via the Main Northern Rail Line. Mount Owen also occasionally transports domestic coal on the Main Northern Rail Line (within the currently approved train movements) and via M series conveyor.

The current layout of the existing MIA is shown on **Figure 2.2** and includes:

- administration buildings;
- car parks;
- heavy and light vehicle workshops;
- fuel and hydrocarbon storage;
- tyre storage;
- heavy vehicle hardstand areas;
- bath houses;

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Image Source: Mount Owen (2013)
Data Source: Mount Owen (2014)

0 100 200 400m
1:7 500

Legend

- CHPP Boundary
- MIA Boundary

FIGURE 2.2

Mount Owen Existing Mine Infrastructure Area

File Name (A4): R02/3109_830.dgn
20140725 11.56

Image Source: Mount Owen (2012-2013)
Data Source: Mount Owen (2014), Department of Lands (2006)

0 0.5 1.0 1.5km
1:30 000

FIGURE 2.3

Mount Owen and Ravensworth East Mine
Current Approved Coal Handling Facilities
and Mine Infrastructure Areas

File Name (A4): R02/3109_831.dgn
20140725 12.01

- stores;
- raw water processing;
- sewage treatment plant;
- vehicle washdown facilities;
- water management structures;
- helipad; and
- associated ancillary infrastructure.

The existing operations utilise the MIA at the Mount Owen Mine for administration, stores, amenity and workshop facilities for Mount Owen's staff and mining equipment. The existing explosives magazine is located to the north west of the MIA.

Mount Owen also maintains a mobile crushing unit on an as required basis for the crushing of gravels and overburden for use and maintenance of its internal haul roads.

Further description of the existing mining, coal preparation, reject disposal and transport operations is provided in the context of the proposed continued operations in **Section 2.3**.

2.1.3.2 Existing Ravensworth East Mine Operations

Current approved operations at Ravensworth East include the West Pit (currently operational), the West Pit Overburden Emplacement Area, Stage 3 water storage, the RW Pit (currently part of the tailings management system), and two shallow pits known as TP1 and TP2 (refer to **Figure 1.3**).

TP1 was previously used intermittently for tailings emplacement, and is now planned to be capped using overburden from mining operations within the Mount Owen Complex from 2016 and rehabilitated by approximately 2017.

Approved mining operations are currently occurring within the West Pit, where coal is extracted from the Ravensworth seams and the Bayswater seam to a depth of approximately 200 metres at an approved extraction rate of 4 Mtpa. Mining operations are expected to continue in Ravensworth East Mine in the BNP in accordance with the existing Ravensworth East development consent (DA 52-03-99) on completion of mining within the currently operational area of West Pit.

Ravensworth East operates as a multi seam truck and excavator operation, with ROM coal hauled to the Mount Owen CHPP ROM stockpiles via internal haul roads for processing within the Mount Owen CHPP. Where possible, to minimise re-handle, coal is directly fed to the Mount Owen CHPP without stockpiling.

The existing Ravensworth East Infrastructure area is located on the north-west side of the Ravensworth East Mine (refer to **Figure 2.3**) and includes:

- administration buildings;
- conveyors;

- workshop;
- crushing facility; and
- ROM stockpile.

The Ravensworth East Infrastructure area is also used as a laydown area for mining equipment and for equipment and vehicle maintenance. The operational workforce use various facilities across the Mount Owen Complex, as required.

2.1.3.3 Mine Workforce and Hours of Operation

The workforce required to operate the North Pit and the Mount Owen CHPP fluctuates and peaks at about 660. The current Ravensworth East development consent allows for a workforce of up to 260.

Mining activities at Mount Owen and Ravensworth East Mine currently occur 24 hours per day, 7 days per week.

2.1.4 Progressive Mine Rehabilitation

The primary objective of mine site rehabilitation at the Mount Owen and Ravensworth East Mines is to create a stable final landform with acceptable post-mining land use capability. Rehabilitation of the overburden emplacement areas and backfilled pits is conducted progressively over the life of the mine as an integral component of mining operations, with all rehabilitation works scheduled to occur progressively as soon as practicable after mining disturbance.

Mount Owen is committed to the ongoing rehabilitation of disturbed areas, providing habitat for endangered fauna known to occur in the region. The current end land use objective for the rehabilitation of the overburden emplacement areas at Mount Owen Mine is to create a conservation area comprising dry sclerophyll forest and open woodland that will complement the remnants of Ravensworth State Forest (RSF) and the Biodiversity Offset Areas in surrounding lands.

The rehabilitation activities at Ravensworth East Mine have primarily involved the establishment of pasture with vegetated corridors comprised of native ecosystems to achieve a final land use with both rehabilitated pasture and native trees and shrubs consistent with pre-mining conditions.

The Mount Owen Complex is a showcase for setting rehabilitation standards which is now listed as a ‘Highly Commended’ site on the Global Restoration Network of the Society for Ecosystem Restoration, International. Further details regarding ongoing progressive rehabilitation are provided in **Section 5.19**.

2.1.5 Environmental Management and Monitoring Systems

All current approved operations are undertaken in accordance with the approved Environmental Management Plans (EMPs)[1] as detailed below:

- Water Management Plan (including Erosion and Sediment Control Plan, Surface Water and Groundwater Response Plan, Groundwater Monitoring Program, Surface Water Monitoring Program).
- Landscape Management Plan (including Rehabilitation and Offset Management Plan, Mine Closure Plan and Final Void Management Plan).
- Noise Monitoring Program.
- Air Quality and Greenhouse Gas Management Plan (AQGG Management Plan).
- Flora and Fauna Management Plan (including Biodiversity Offset Strategy).
- Bushfire Management Plan.
- Blast Management Plan.
- Pollution Reduction Program.
- Pollution Incident Response Management Plan.
- Blast Fume Management Plan.
- Haul Road and Overburden Material Monitoring Program.

The current environmental management plans and monitoring programs for the Mount Owen Complex are available on the Mount Owen website (http://www.mtowencomplex.com.au).

Mount Owen continually monitors environmental performance and legislative compliance of the existing operations within the Mount Owen and Ravensworth East Mines. Mining operations are managed through the existing Environmental Management System (EMS) to minimise impacts on the surrounding environment and community. The EMS has been developed to be in accordance with the principles of the environmental management standard ISO14001.

The EMS provides for the environmental monitoring of all key aspects of the current operations.

As outlined above, an integral aspect of the current EMS is the continued implementation of environmental performance monitoring. The existing environmental monitoring locations are listed below and are illustrated on **Figure 2.4**:

- Air quality monitoring network including 25 dust deposition gauges, five High Volume Air Samplers (HVAS) and five continuous dust monitors (Tapered Element Oscillating Microbalance instruments (TEOM)).
- Water quality monitoring network including 23 surface water monitoring locations and 41 groundwater monitoring locations.

[1] EMPs cover the entire Mount Owen Complex, i.e. Mount Owen Mine, Glendell Mine and Ravensworth East Mine.

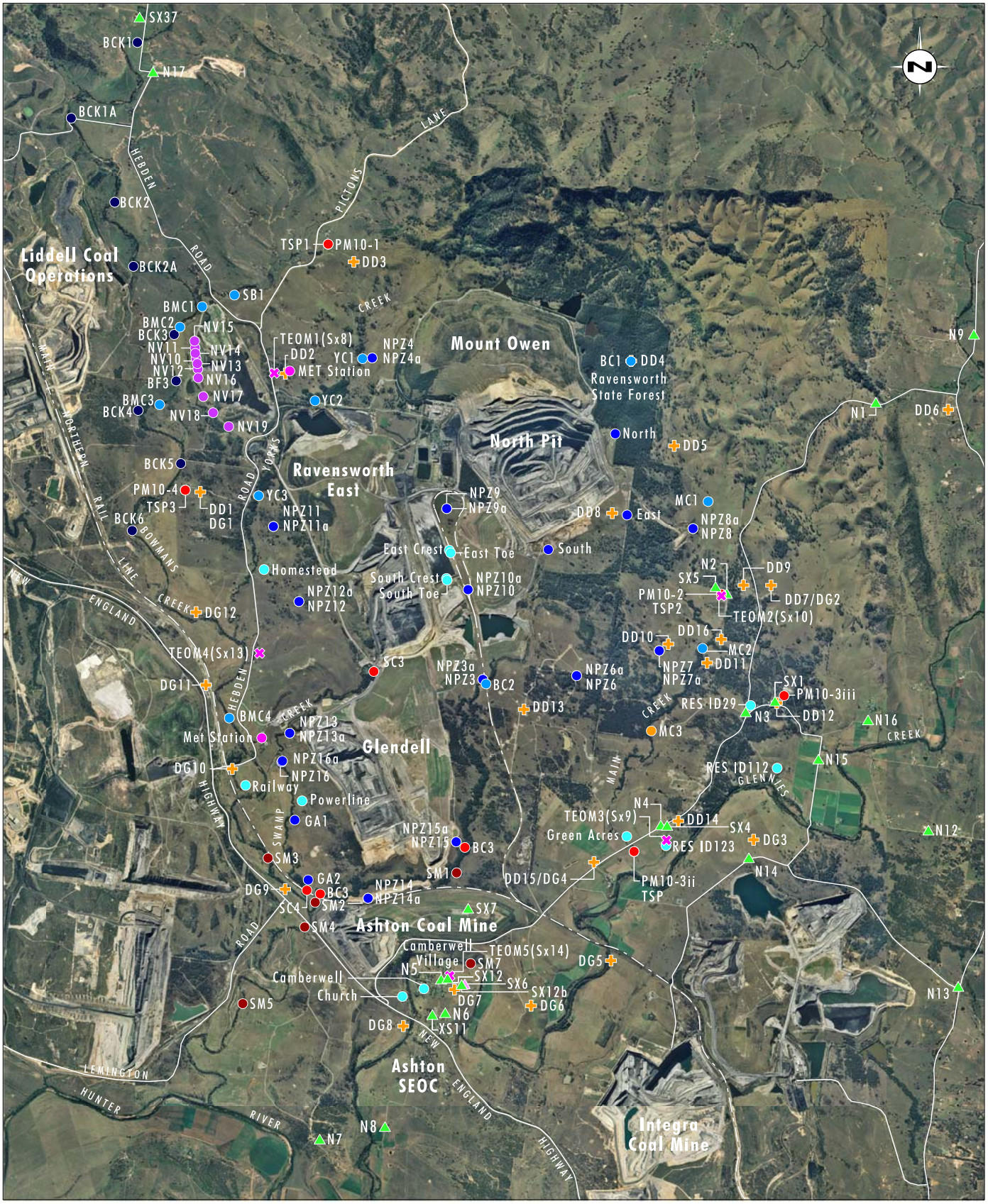

Image Source: Mount Owen (2012-2014)
Data Source: Mount Owen (2014)

0 1 2 4 km
1:80 000

Legend

- Depositional Dust Monitoring
- HVAS Location (dust)
- TEOM Monitoring Location
- Blast Monitoring Location
- Noise Monitoring Location
- MET Station Location
- Groundwater Monitoring Location
- Surface Water Monitoring Location
- Continuous Noise Monitoring Location
- Proposed Future Water Monitoring Location
- Piezometer Groundwater Monitoring Location

FIGURE 2.4

Mount Owen Complex Monitoring Locations

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20141024 9.37

- Blast monitoring network comprising 13 blast monitoring locations near potentially impacted heritage items, public services, residences and TP1 (a prescribed dam).
- Attended noise monitoring undertaken at nine receivers on a three-monthly basis over a 72 hour period.
- Unattended monitoring at continuous noise monitoring locations.
- Two meteorological monitoring stations.

The outcomes of monitoring programs are reported annually to the community and regulators through the Annual Review (AR) and monthly Monitoring Reports available on the Mount Owen website.

2.2 Need for the Project

The coal industry's share of the global energy mix is still rising, with global coal demand expected to continue to grow. According to the International Energy Agency (IEA), coal consumption is projected to increase by another 15% until 2018, or about 2.3% year on year (IEA 2013a). 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 Glencore mining tenements and utilising existing infrastructure whilst minimising the environmental impact associated with meeting this demand.

The current approval allows for mining operations in the North Pit until 2025; however Mount Owen expects that mining will be completed within the currently approved areas of the North Pit by the end of 2018 (based on the current geological information and production rates). The completion of mining in the North Pit in 2018 would result in a reduction in employment at the Mount Owen mine from approximately 2016 as mining operations start to wind down with the loss of approximately 96 jobs and ultimately resulting in the loss of employment for the current North Pit workforce by 2018. To allow for uninterrupted mining, the Project would progress past the currently approved mining limit for the North Pit in 2016. This continued mining would allow current workforce levels to be maintained.

The current approval for Ravensworth East allows for mining within the West Pit, including the BNP until 2021. Mount Owen expects that mining will move to the BNP in the northern extent of the West Pit by late 2014 which will be followed by mining of the proposed RERR Mining Area. Based on the current production schedule, Mount Owen expect that mining within BNP and the RERR Mining Area will continue until 2027, resulting in an additional six years of production and associated employment.

The Project will enable Mount Owen to continue open cut mining in the Mount Owen (North Pit) and Ravensworth East mines (the BNP and RERR Mining Area); enabling the extraction of approximately 92 Mt of ROM coal tonnes and provide for the continued employment of the existing workforce of up to 920 people (660 and 260 for Mount Owen Mine and Ravensworth East Mine, respectively). The Project will also result in capital expenditure of approximately $153 million and ongoing royalties to the NSW Government.

Strategically the location of the Project provides an opportunity to extract approximately 92 Mt of ROM coal within an area that has a long established history of mining. Moreover, the Project will maximise the utilisation of the existing Mount Owen CHPP and MIA, tailings and rejects emplacement areas and rail infrastructure. The Project has been designed to maximise the use of previously disturbed areas and existing mining infrastructure, thereby minimising the overall Proposed Disturbance Area as far as practicable. Environmental management and monitoring systems that cover the Project Area will be utilised and supplemented where required as part of the proposed environmental management system for the Project.

A single development consent is sought for the Mount Owen and Ravensworth East Mines to allow another 6 years mining at Ravensworth East and Mount Owen to undertake mining, coal transport and processing with greater efficiency across these two operations.

Mount Owen will also undertake an integrated approach to the rehabilitation of all disturbed areas across the Project Area to provide for an improved final landform, enhanced habitat corridors and ongoing sustainable land use.

2.3 The Project

2.3.1 Project Overview

The design of the Project has been developed to maximise resource recovery efficiency and minimise environmental impacts including avoiding disturbance to Ravensworth State Forest and existing Biodiversity Offset Areas. The mine and infrastructure design seeks to optimise the use of existing facilities and approved disturbance areas. The Project's mitigation measures have considered the issues raised by stakeholders during the comprehensive engagement program.

Based on the current production schedules, approved mining operations within the North Pit are expected to reach the extent of the current approved mining limit by 2016, with mining to be completed by 2018; while mining in the West Pit of Ravensworth East Mine is expected to be completed by the end of 2014. To allow for the uninterrupted continuation of mining for the Project, changes are required to the current approved mine plan to allow pre-strip activities beyond the currently approved mining limit in the North Pit during 2016. The Project would then allow for the extraction of approximately 92 Mt of ROM coal; with 74 Mt ROM, 12 Mt ROM and 6 Mt ROM extracted from the North Pit Continuation, BNP and RERR Mining Area respectively. This would continue the Mount Owen North Pit life for approximately an additional 12 years (from 2018 to 2030) and the Ravensworth East Mine life by 6 years beyond the current approved mine life.

Given that the Project will require additional disturbance in the North Pit outside the currently approved mining limit by 2016, the environmental studies for the Project consider there to be an operational life for the Project of approximately 15 years (2016 to 2030). The Project will also provide for the continuation of mining within the Ravensworth East Mine. As the BNP and RERR Mining Area are located in existing operational areas approved for mining, the Project does not require additional disturbance in the Ravensworth East Mine. Notwithstanding, this EIS includes an integrated assessment of all relevant potential impacts as a result of the ongoing operations at BNP and the RERR Mining Area. Subject to approval, this Project will continue integrated mining at Mount Owen and Ravensworth East Mines, in accordance with a single development consent.

Integral to the iterative mine planning process has been a strong focus on measures to further reduce noise and air quality impacts as the North Pit Continuation progresses closer to the Middle Falbrook and Falbrook residences to the south-east and south of the existing operations.

The key features of the Project are outlined in **Table 2.3**. **Figure 1.4** shows the general layout of the Project.

Table 2.3 – Key Proposed Features of the Project

Key Feature	Proposed Operations
Mine Life	• Consent will be sought for 21 years (from date of Project Approval) to provide for mining until approximately 2030 and contingency for other activities such as rehabilitation and capping of tailings emplacement areas.
Limits on Extraction	No change in approved extraction rates. • North Pit – up to 10 Mtpa ROM. • Ravensworth East – up to 4 Mtpa ROM.
Mine Extent	• Continuation of the North Pit footprint to the south of current approved North Pit mining limit. • Mining within the approved BNP, followed sequentially by mining within the RERR Mining Area within the Ravensworth East Mine. • Mining depths to approximately 300 m (North Pit). • Total additional mineable coal tonnes of approximately 92 Mt ROM (comprising 74 Mt ROM (North Pit Continuation), 12 Mt ROM (BNP) and 6 Mt ROM) (RERR Mining Area). • Changes to mine water management system.
Operating Hours	• No change proposed - 24 hours per day, 7 days per week.
Workforce Numbers	• No significant change to workforce numbers is required. Current workforce required to operate North Pit and CHPP fluctuates and peaks at about 660 and the Ravensworth East development consent allows for a workforce of up to 260 to operate Ravensworth East operations. • Addition of approximately 330 personnel for construction phase for proposed infrastructure works (approximately 18 months).
Mining Methods	• No change to mining methods proposed.
Mount Owen CHPP and MIA	• No change to existing approved CHPP capacity of 17 Mtpa ROM. • product stockpile extension; • CHPP improvements (including operational efficiencies) to increase processing capacity and tailings management; • MIA extensions and improvements;
Existing Mine Infrastructure	• Continued utilisation of all existing mining infrastructure, including the existing crushing plant for the crushing of overburden.
Infrastructure Construction Activities	• Infrastructure upgrades including: ▪ provision for a northern rail line turn-out and additional Mount Owen rail line; ▪ Hebden Road overpass over Main Northern Rail Line; and ▪ New Hebden Road bridge crossing over Bowmans Creek.

Table 2.3 – Key Proposed Features of the Project (cont.)

Key Feature	Proposed Operations
Tailings and Coarse Reject Emplacement	• Continued use of the Ravensworth East voids for tailings emplacement and co-disposal of coarse reject and overburden within the North Pit Continuation, the West Pit / BNP and the RERR Mining Area as mining progresses. • Tailings cells may be constructed and filled within the North Pit Continuation area as required to allow time for consolidation and drying of tailings in the West Pit and the RERR Mining Area. • Allowance for the receipt of tailings from other mines.
Coal Transportation	• No change to current export coal transportation with the exception of the use of the proposed additional rail line. • No change to capacity of 17 Mtpa ROM coal. • Use of existing rail line for Glencore train park up. • Transportation of up to 2 Mtpa ROM coal and crushed gravel on an as required basis via the existing overland conveyor to Liddell Coal Operations and the RCT in addition to maintaining the current approval to transport ROM coal to Bayswater and Liddell power stations.

2.3.2 Geological Features

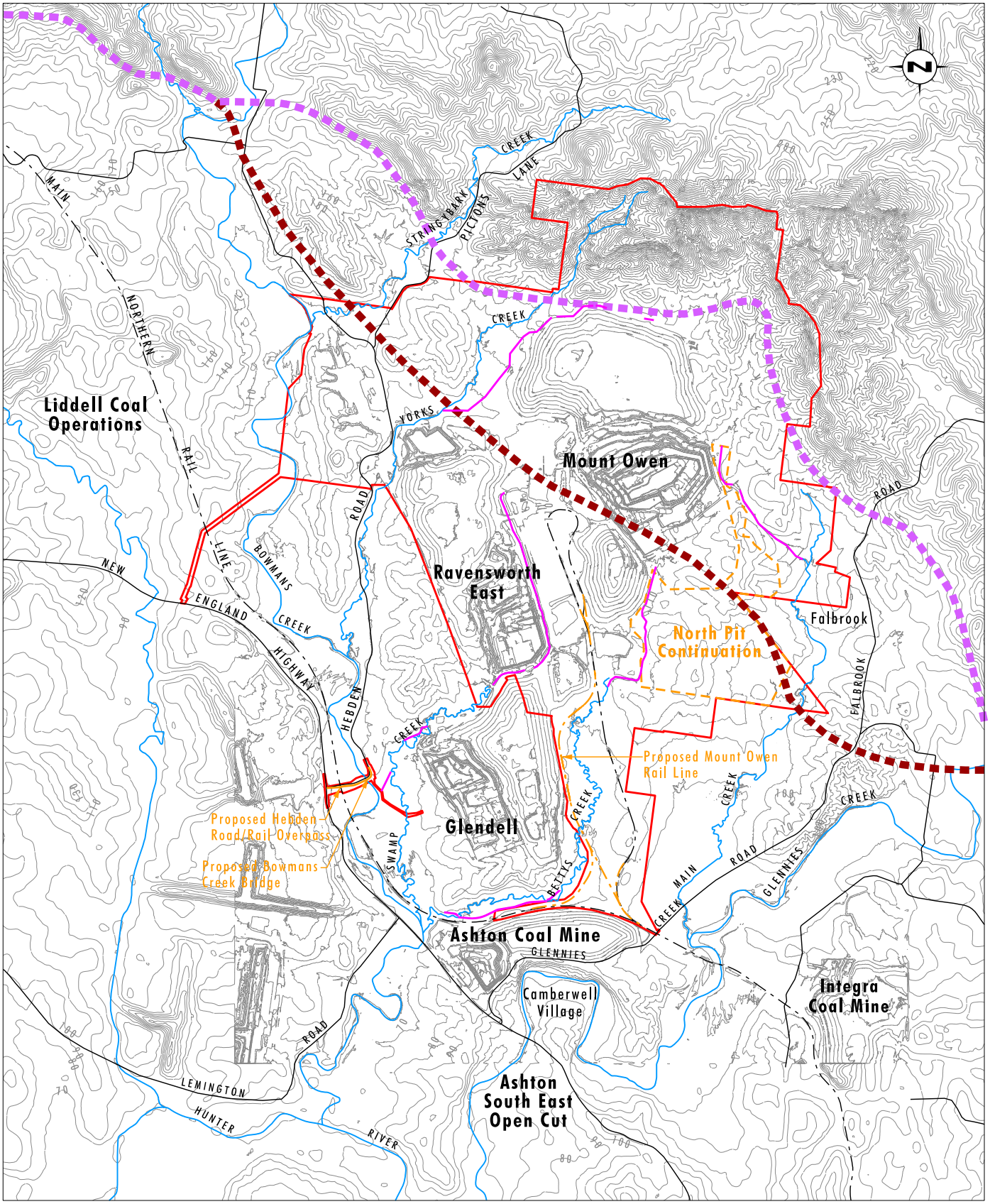
The Project Area is located in the central coal-producing region of the Hunter Coalfields. The seams of this coalfield were formed in the Permian period and are similar in age to the Illawarra Coal Measures south and west of Sydney, and the Newcastle and Tomago Coal Measures of the Newcastle / Maitland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

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

2.3.2.1 Coal Resources and Geological Structures

The currently mined area of the North Pit is situated between two regional thrust faults, the Hebden Thrust and the Hunter Thrust which limit the lateral extent of the coal seams to the east (refer to **Figure 2.5**). The Hebden Thrust has caused significant distortion of the coal seams resulting in different target sequences for the current mining operations within the Mount Owen North Pit, North Pit Continuation and Ravensworth East Mine. Seam dips vary throughout the deposit, with dips being steep (up to 45º) in the areas near the Hunter and Hebden Thrusts where parallel thrusts dislocate the seam by up to 40 metres. Recent exploration has further defined the Hebden Thrust as a deep seated structure, causing a roll structure within the coal seams close to the surface.

Within the existing North Pit, coal is currently extracted from the Lemington Seams to the Lower Hebden Seams within the Foybrook Formation to a depth of approximately 270 metres. The North Pit Continuation target seams include the existing North Pit target seams (Lemington to Lower Hebden) and the Jerrys Plains sub-group including the Ravensworth seams to the Bayswater seams (refer to **Figure 2.6**). The mining depth will reach approximately 300 metres and will vary in accordance with the Mining Lease limits.



Data Source: Mount Owen (2014), Department of Lands (2006), SKM (2013)
Note: Contour Interval 10m

0 1.0 2.0 4.0km
1:80 000

Legend

- Project Area
- Proposed North Pit Continuation
- Rail Upgrade Works
- Hebden Road Upgrade Works
- Drainage Line
- Diversion Drainage Line
- Hunter Thrust
- Hebden Thrust

FIGURE 2.5

Geological Structures

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20141008 10.57

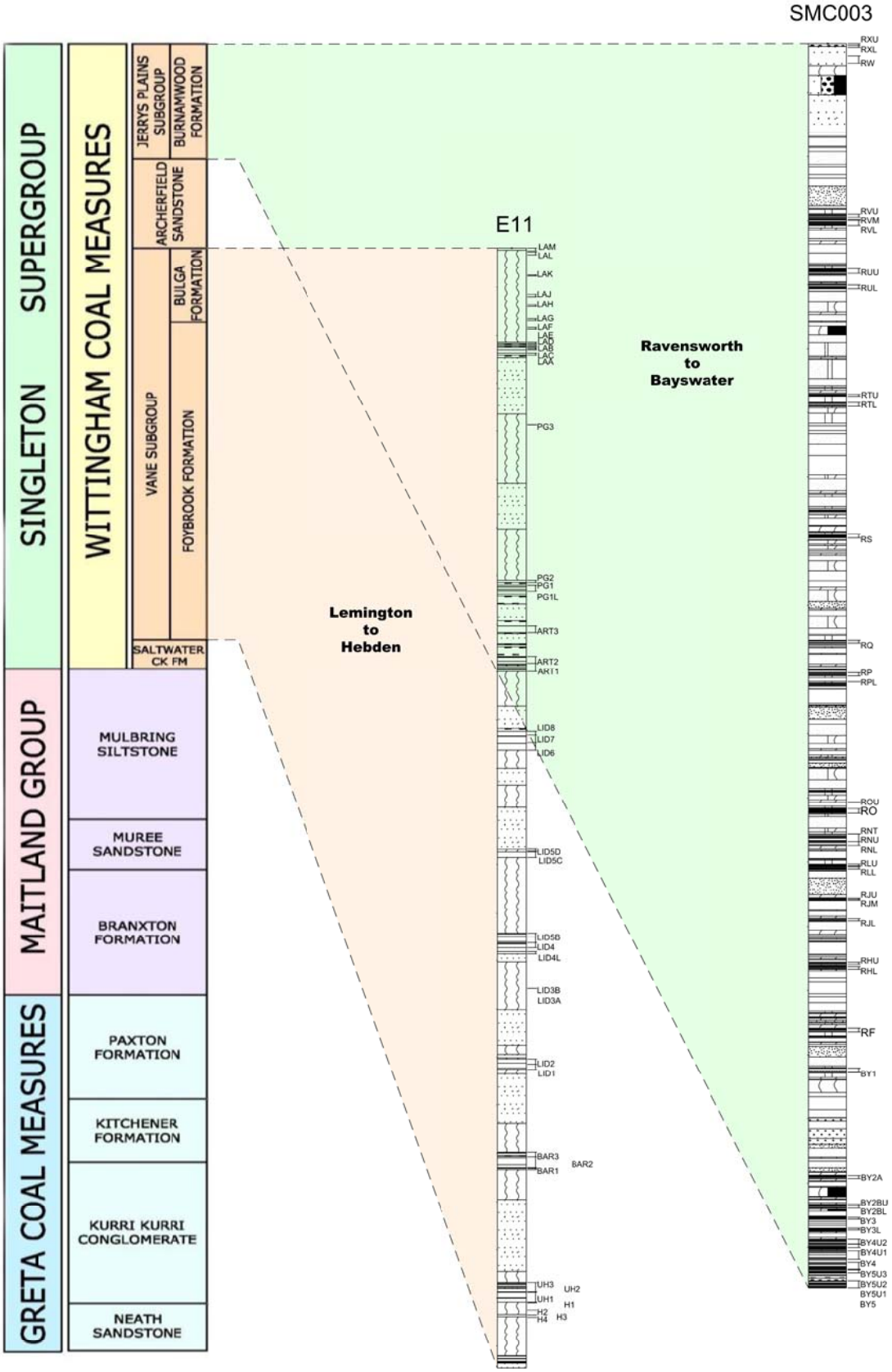

FIGURE 2.6

Stratigraphic Column

Image Source: Mount Owen Complex Prepared by McElroy Bryan Geological Services (December 2010)

File Name (A4): R02/3109_410.dgn
20130902 11.54

The dip of the coal seams varies up to 15 degrees, and generally dips to the south-east, similar to current operations at Ravensworth East Mine. Interseam sediments are predominantly siltstone and lithic sandstone with sporadic claystone units. Minor conglomeratic bands, thin siderite bands and coarse-grained sandstones are more common between lower seams in the sequence.

The mineable coal seams at BNP vary in thickness from 0.3 metres to 8.5 metres, and include the Ravensworth and Bayswater seams over a stratigraphic interval of approximately 130 metres. These seams form part of the Jerrys Plains sub-group of the Wittingham Coal Measures. Interseam sediments are predominantly siltstone and lithic sandstone with sporadic claystone units. Minor conglomeratic bands, thin siderite bands and coarse-grained sandstones are more common between lower seams in the sequence.

Raw coal characteristics are as follows:

- seam thickness varies, with the maximum seam thickness being approximately 8 metres and average seam thickness being 1 metre;
- *in situ* ash levels have an average of 22.5 per cent (ad); and
- calorific value levels are good for a coal-type at this ash level.

2.3.3 Mine Plan Development

Mount Owen has completed detailed iterative environmental studies to inform the proposed conceptual design for the Project. As part of these studies a range of different mine design options including mine areas, overburden emplacement schedules, fleet numbers and type and equipment location and scheduling were reviewed. Additionally, a number of design options for the proposed infrastructure were considered. Throughout these studies the various options were reviewed with consideration of the following key objectives:

- minimising potential environmental and social impacts including air quality, noise, water, biodiversity and Aboriginal cultural heritage;
- minimising the Proposed Disturbance Area by maximising the use of existing approved disturbed areas and existing infrastructure;
- maximising the recovery of economic coal resources within the Project Area;
- constructability of the proposed infrastructure; and
- maintaining the economic viability of the Project.

As part of the Project, specific consultation has been undertaken with the local community regarding both the current operations and the Project to understand what issues are important to the community. The primary issues raised by the community were cumulative air quality, noise and blast impacts, economic impacts and land management (including final landform design and final land use). This community feedback has provided valuable information to facilitate thorough consideration of these issues in determining the design options for the Project. Throughout the Project, ongoing consultation with state government agencies and Singleton Council has also provided valuable feedback to inform the conceptual Project design process.

The Proposed Disturbance Area for the North Pit Continuation has been identified through Mount Owen's commitment to maintaining the integrity of the existing Biodiversity Offset Areas committed to by Mount Owen as part of the current development consent and to avoid disturbance to the adjoining Ravensworth State Forest areas. The extent of the North Pit Continuation has also been designed with a minimum standoff of 200 metres from the high bank of Main Creek in accordance with the minimal harm criteria of the *NSW Aquifer Interference Policy* (2012) (refer to **Section 2.5**).

As part of the detailed feasibility studies and the mine plan design, Mount Owen also undertook detailed sensitivity analysis modelling to determine the potential air quality and noise impacts associated with different mine plan scenarios, equipment numbers and locations. The development of the conceptual mine plans has been guided by this process with a strong focus on reducing noise and air quality emissions from the proposed operations; particularly in the North Pit Continuation as it progresses to south-east and south.

The proposed depth of mining within the North Pit Continuation is restricted by lease holdings related to the Integra Underground Mining operations. Based on the current conceptual mine plans, the North Pit Continuation will result in mining over a portion of the current approved Integra underground workings (refer to **Figure 2.7**). The vertical separation between the North Pit Continuation pit floor and the Integra underground workings will be a minimum of approximately 250 metres (refer to **Figure 2.8**), which is considered adequate to enable the management of safety and operational issues. Mount Owen has commenced and will maintain consultation with Integra Underground management throughout the approvals and operational phases. It is proposed to manage any interaction through the development and implementation of a Blast Management Protocol which worked successfully during the mining of the Eastern Rail Pit in 2005 and 2006 where there was an earlier interaction between the mines. Further details of the proposed blast management are provided in **Section 5.4.**

There will be continued subsidence maintenance and management relating to Integra Operations interaction with the existing rail line, which will continue to be undertaken in accordance with the existing Memorandum of Understanding between Mount Owen and Integra. Maintenance of gas ventilation fans and gas drainage infrastructure will also continue, and associated management protocols updated, as consultation with Integra management progresses.

A detailed description of key alternatives considered during the Project design and development is provided in **Section 2.5**.

2.3.4 Proposed Disturbance Area

The Proposed Disturbance Area for the Project represents the total area that would be disturbed, outside of the areas that are currently approved for disturbance under existing development consents. The Proposed Disturbance Area is approximately 485 hectares, of which approximately 381 hectares is associated with the North Pit Continuation and approximately 104 hectares is associated with the infrastructure upgrades.

2.3.5 Conceptual Mine Plans

Mount Owen proposes to continue the existing mining operations within the North Pit to the south beyond the current approved North Pit mining limit. The current approved North Pit would be extended by an additional estimated surface disturbance footprint of approximately 381 hectares. Mining depths within the North Pit Continuation will vary from approximately

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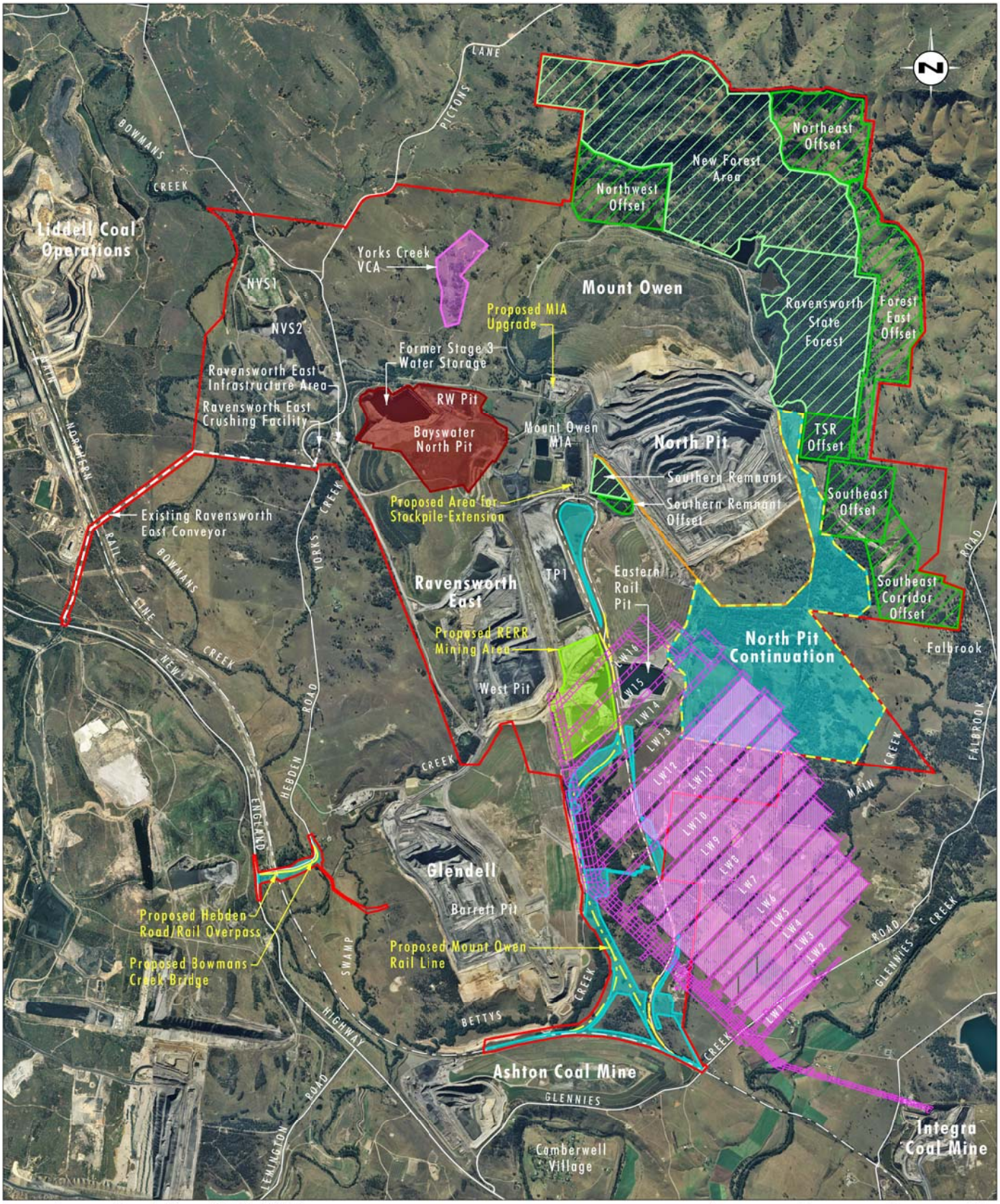


Image Source: Mount Owen (2012-2013)
Data Source: Mount Owen (2014)

0 1 2 3km
1:60 000

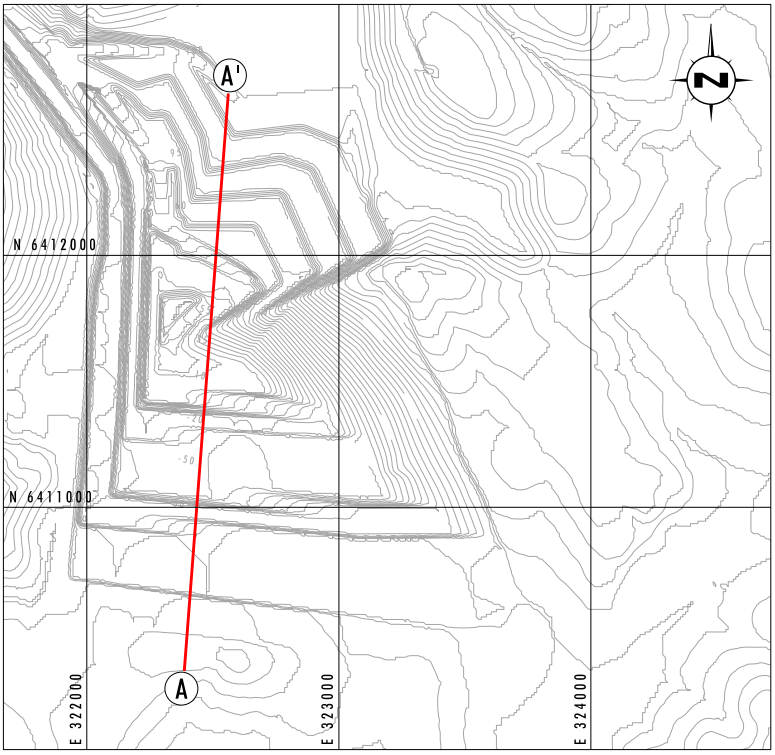
Legend

- Project Area
- Approved North Pit Mining Extent
- Proposed North Pit Continuation
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Proposed Disturbance Area
- Proposed RERR Mining Area
- Existing Biodiversity Offset Area
- Ravensworth State Forest
- Integra Coal Mine Plan
- Integra Underground Mined Area as at May 2014
- Bayswater North Pit
- Yorks Creek VCA

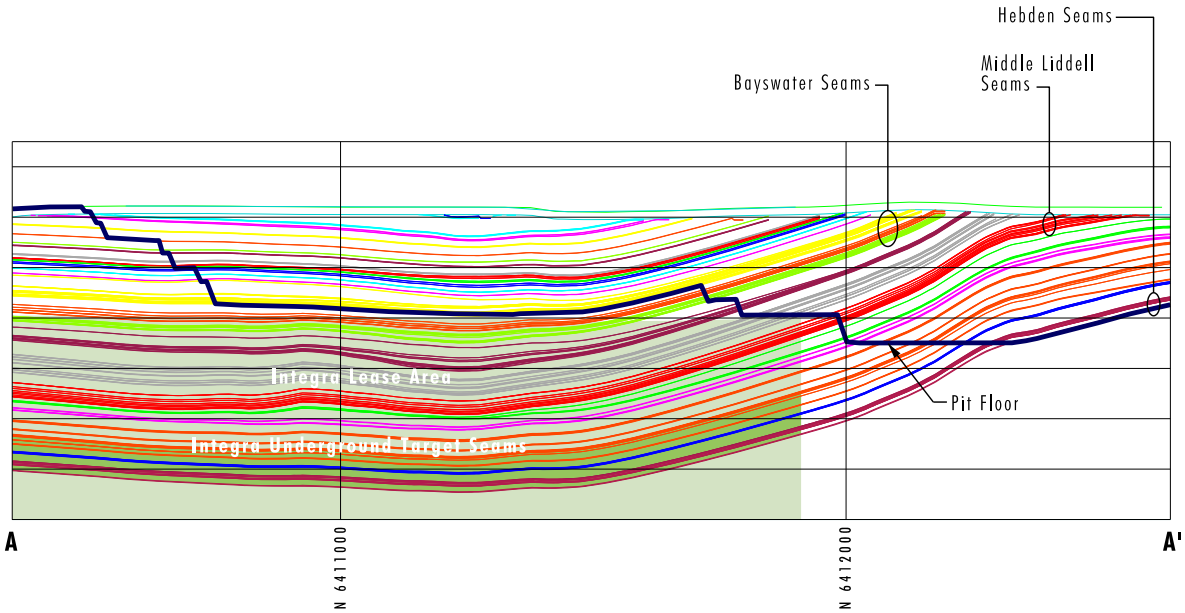
FIGURE 2.7

Proposed Project Area and Integra Underground

File Name (A4): R02/3109_834.dgn
20141008 10.58



Plan View
SCALE 1:30 000



Section View of Pit Floor
SCALE 1:15 000

0 250 500 750m
1:15 000

0 0.5 1.0 1.5km
1:30 000

Data Source: Mount Owen (2014)

File Name (A4): R02/3109_835.dgn
20140918 17.12

FIGURE 2.8

Vertical Separation North Pit and Integra Underground Mine

180 metres to 300 metres and target the Ravensworth, Bayswater and Lemington seams (refer to **Figure 2.6**). Mount Owen also proposes to continue mining within the BNP down to the Bayswater seam sequentially followed by mining within the RERR Mining Area.

The conceptual mine plans (Years 1, 5, 10 and final landform) for the Project are outlined in **Figures 2.9** to **2.12**.

The conceptual mine stage plans presented in **Figures 2.9** to **2.12** have been selected as they are considered to represent indicative key features of the proposed mining progression for the Project as outlined below:

- **Year 1**: to allow for an efficient continuation of mining, mining activities (including pre strip operations) would be undertaken south of the currently approved North Pit mining limit during Year 1. Mining activity within Ravensworth East will be primarily in the BNP.

- **Year 5**: In Year 5, mining in the North Pit Continuation has progressed in a southerly direction. Additionally, operational activities within the North Pit Continuation in Year 5 represent the maximum production rate (up to 10 Mtpa ROM), maximum equipment numbers and overburden emplacement high in the landform for the Project. Mining in the BNP has progressed in an easterly direction towards the North Pit.

- **Year 10**: Year 10 represents the southernmost extent of the North Pit Continuation mining limit. Additionally, Year 10 has longer haul distances to the ROM stockpiles and the Mount Owen CHPP. Mining in the BNP will have been completed, with activities in this area focussed on rehabilitation and overburden emplacement. Mining in the RERR Mining Area will be underway.

2.3.5.1 Progression of Conceptual Mine Stages

Year 1

Mining associated with the Project in Year 1 is anticipated to commence in 2016 and will include operations at both the North Pit and Ravensworth East. Based on the current production schedules, mining operations within the North Pit are expected to reach the extent of the current approved mining limit by 2016. To allow for the uninterrupted continuation of mining for the Project, pre-strip activities will be undertaken beyond the currently approved mining limit. Overburden will be hauled to the Mount Owen North Pit emplacement area to a maximum height of approximately 230 m AHD and to the southern end of the WOOP emplacement area capping the existing ERP tailings emplacement area (refer to **Figure 2.9**).

To reduce potential noise emissions, the main haul roads within the North Pit have been designed to be located as far as practicable below natural surface, extending to the surface at the higher active overburden emplacement areas and the ROM stockpile. Noise bunds will be constructed in strategic locations on some of the longer, more permanent haul roads. These haul road design aspects will be maintained for the life of mine (applicable to all years including Years 5 and 10). Haulage of coal from the Glendell Mine to the ROM stockpiles along the internal haul road will continue.

A haul road from the ROM stockpiles to the Ravensworth East ROM facility and M-series conveyor will be used on an as required basis to allow for the transport of ROM coal and crushed gravel to the conveyor.

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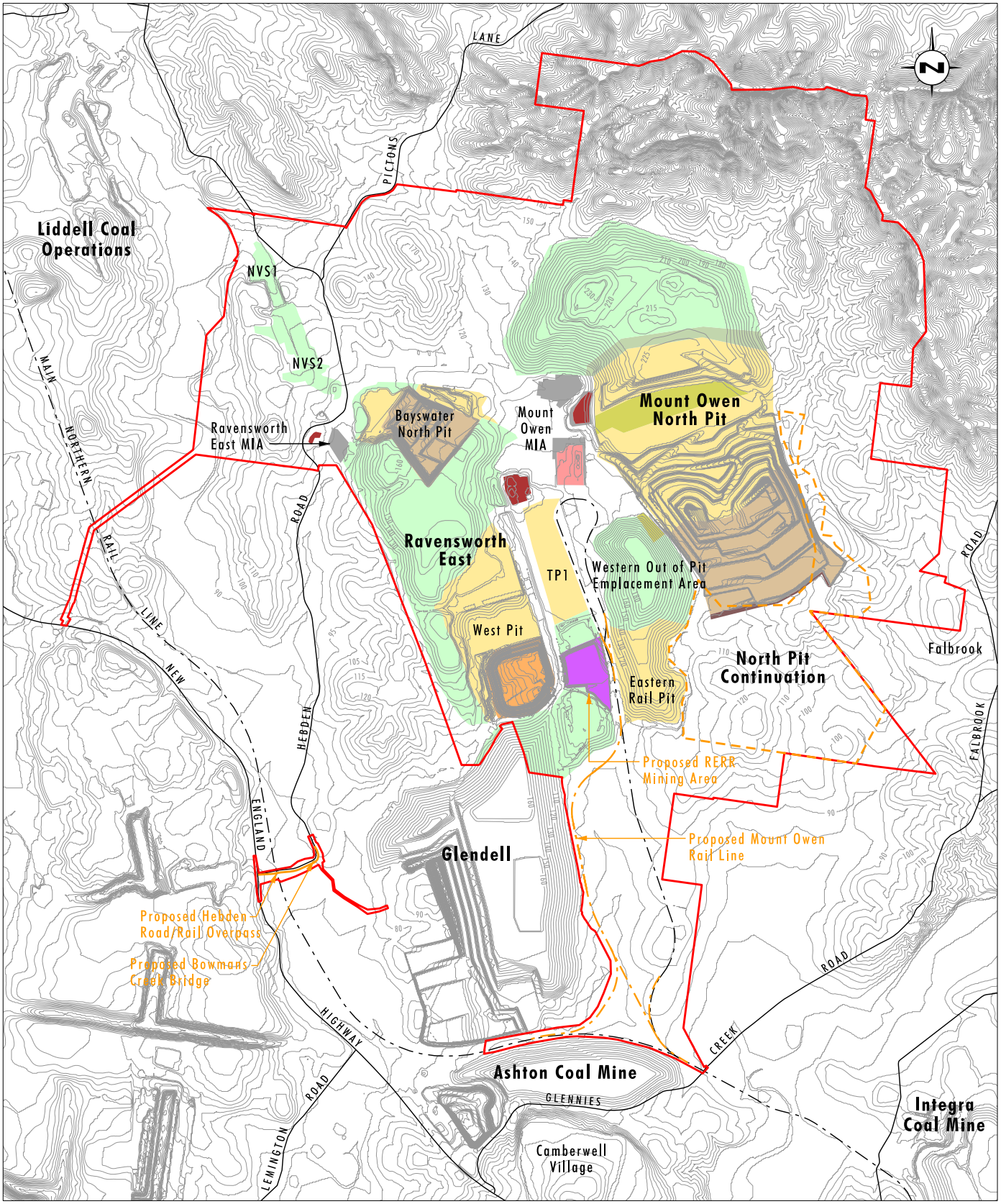

Data Source: Mount Owen (2014)
Note: Contour Interval 5m(AHD)

0 1 2 3km
1:60 000

Legend

- Project Area
- Proposed North Pit Continuation
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Contour
- Active Mining Area
- Active Overburden Emplacement Area
- Coal Stockpile - Product
- Coal Stockpile - ROM
- Infrastructure
- Rehabilitation - Complete
- Rehabilitation - Temporary
- Shaped Not Seeded
- Tailings Emplacement
- Topsoil Removal
- Proposed RERR Mining Area

FIGURE 2.9

Proposed Mount Owen Conceptual Mine Plan Year 1

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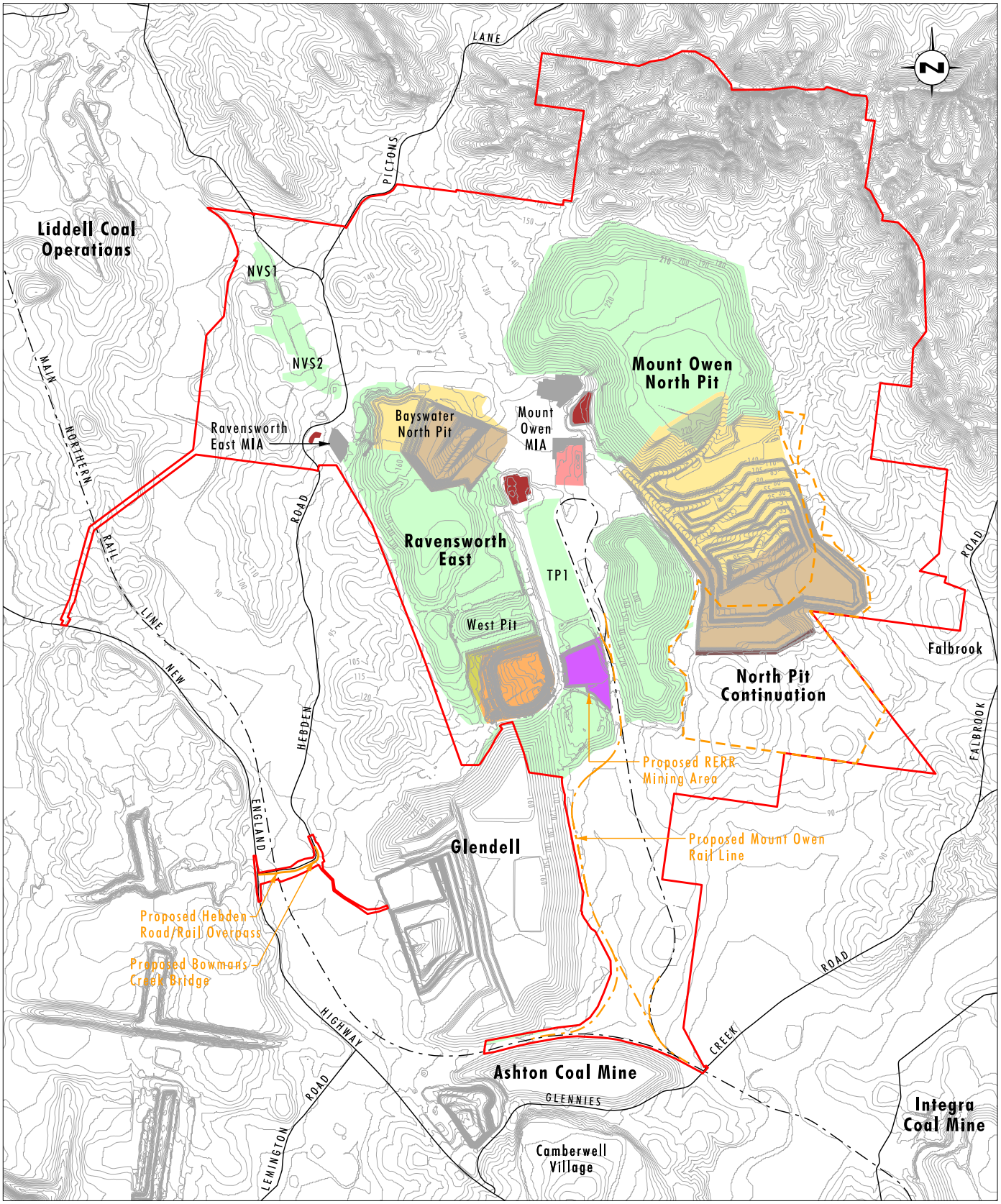

Data Source: Mount Owen (2014)
Note: Contour Interval 5m(AHD)

0 1 2 3 km
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Legend

- Project Area
- Proposed North Pit Continuation
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Contour
- Active Mining Area
- Active Overburden Emplacement Area
- Coal Stockpile - Product
- Coal Stockpile - ROM
- Infrastructure
- Rehabilitation - Complete
- Rehabilitation - Temporary
- Shaped Not Seeded
- Tailings Emplacement
- Topsoil Removal
- Proposed RERR Mining Area

FIGURE 2.10

Proposed Mount Owen Conceptual Mine Plan Year 5

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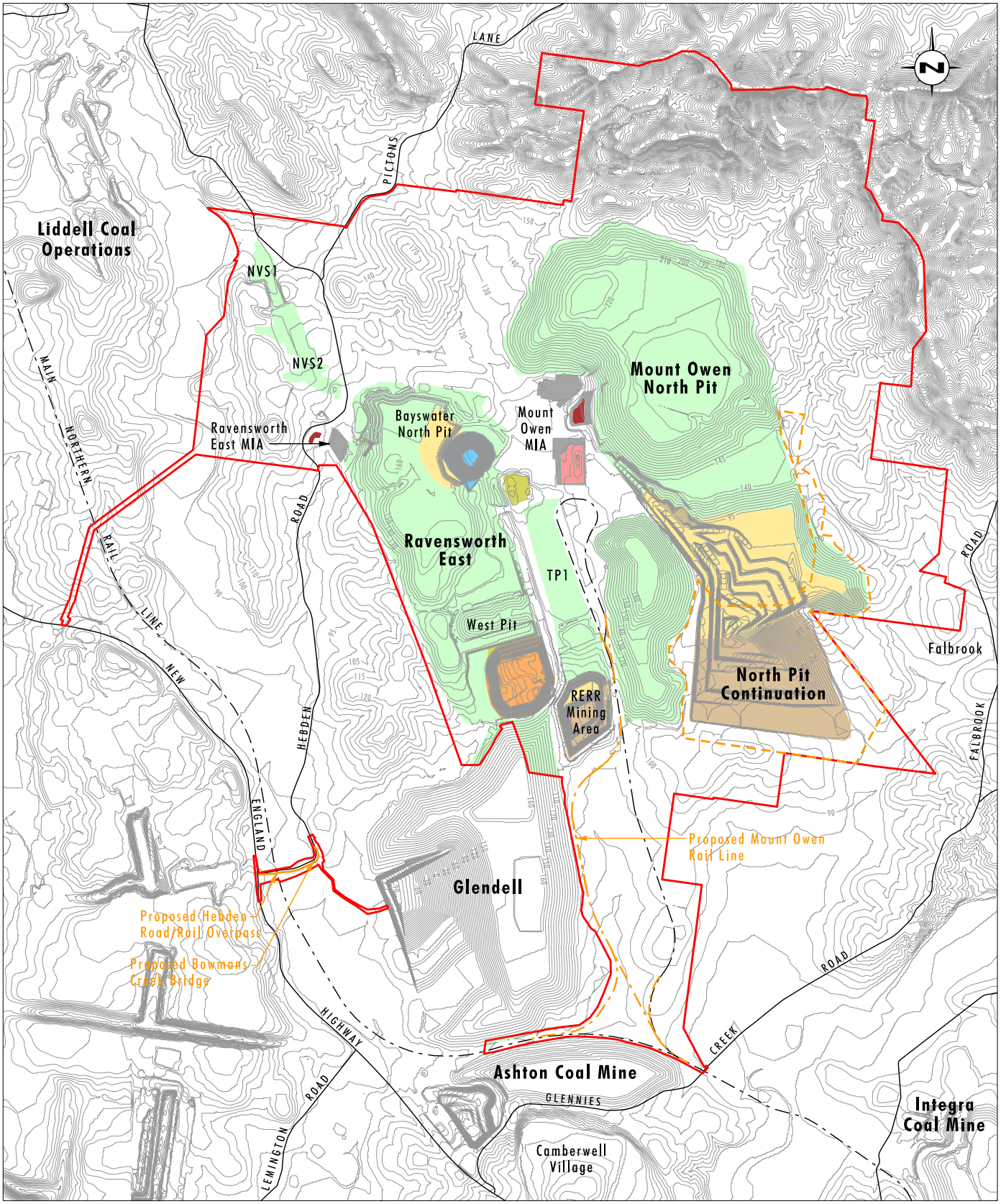

Data Source: Mount Owen (2014)
Note: Contour Interval 5m(AHD)

0 1 2 3km
1:60 000

Legend

- Project Area
- Proposed North Pit Continuation
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Contour
- Active Mining Area
- Active Overburden Emplacement Area
- Coal Stockpile - Product
- Coal Stockpile - ROM
- Infrastructure
- Rehabilitation - Complete
- Rehabilitation - Temporary
- Shaped Not Seeded
- Tailings Emplacement
- Water Storage Area

FIGURE 2.11

Proposed Mount Owen Conceptual Mine Plan Year 10

File Name (A4): R02/3109_773.dgn
20141008 11.10

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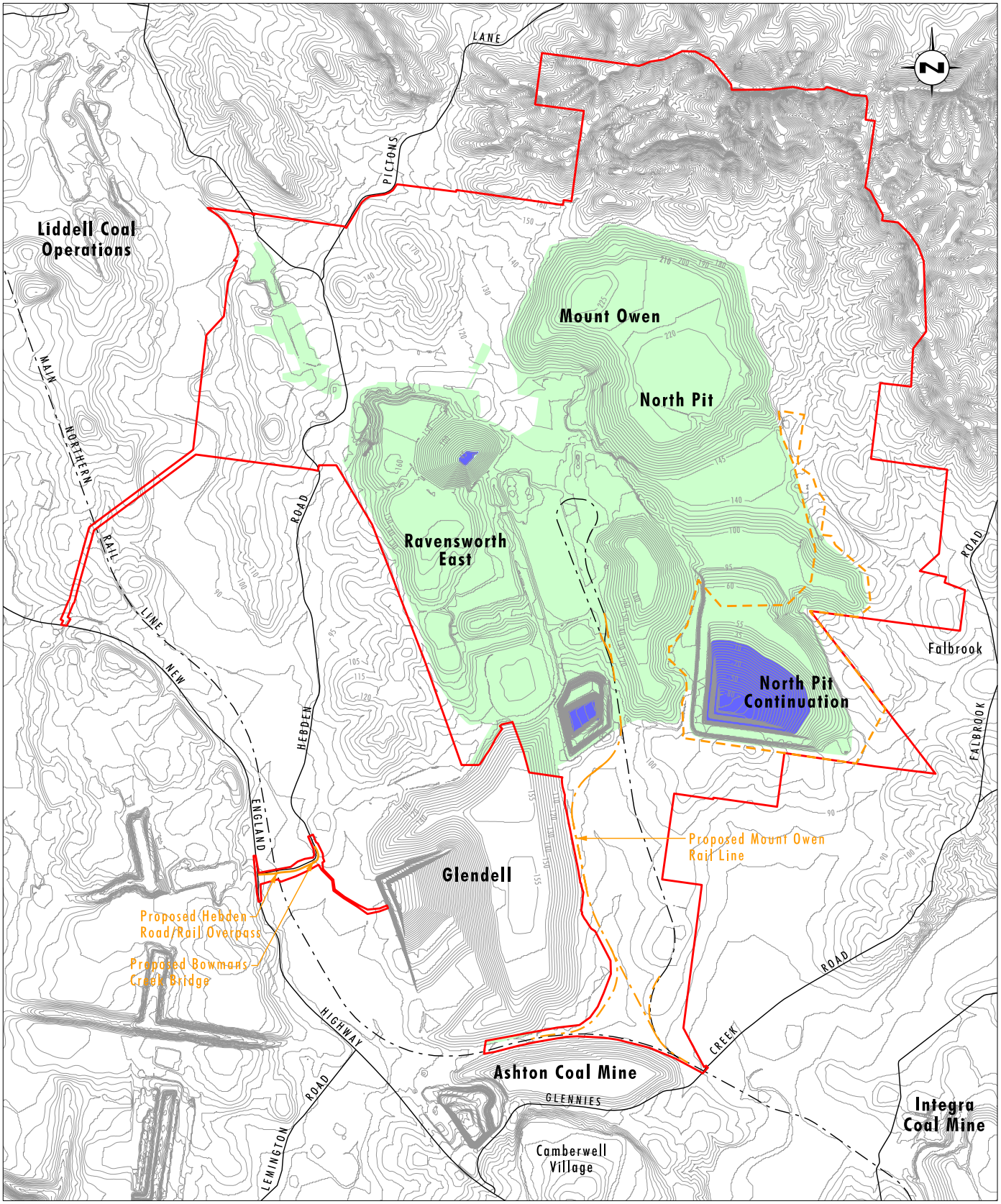

Data Source: Mount Owen (2014)
Note: Contour Interval 5m(AHD)

0 1 2 3km
1:60 000

Legend

- Project Area
- Proposed North Pit Continuation
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Contour
- Rehabilitation - Complete
- Final Void Water Level

FIGURE 2.12

Proposed Mount Owen Conceptual Mine Plan Final Landform

File Name (A4): R02/3109_774.dgn
20141008 11.11

Tailings from the Mount Owen CHPP will be emplaced within the West Pit void. Co-disposal of overburden and coarse reject will continue within the North Pit Continuation and West Pit emplacement area. Rehabilitation works associated with the Eastern Rail Pit and TP1 will be underway.

Mining activities in the Ravensworth East Mine are expected to be operating in Year 1 and include mining of coal within BNP. ROM coal from BNP will be transported via truck to the ROM coal stockpiles for processing within the Mount Owen CHPP. Overburden from BNP will be emplaced west and north of BNP within RW Pit. Additionally, co-disposal of coarse reject and overburden will occur within the West Pit overburden emplacement area to a maximum height of approximately 160 m AHD and the capping of TP1 tailings emplacement area would have commenced. Tailings from the Mount Owen CHPP will be emplaced into the southern portion of the West Pit (refer to **Figure 2.9**).

Year 5

During Years 5 to 10 of the Project, mining operations within the North Pit Continuation will advance in a southerly direction with overburden emplacement continuing within the North Pit Continuation. As mining progresses, rehabilitation of these areas will occur progressively (refer to **Figures 2.10** and **Figure 2.11**).

In this stage it is expected that mining activities will be undertaken up to the maximum production rate (10 Mtpa ROM) utilising the maximum anticipated number of operational machinery.

Haulage of coal from the Glendell Mine to the ROM stockpiles along the internal haul road will continue and the haul road from the ROM stockpiles to the Ravensworth East ROM facility would be maintained.

Mining activities within the BNP will be continuing, however overburden emplacement within the West Pit Overburden Emplacement area is anticipated to be complete, with rehabilitation activities in this area well progressed. Overburden from the BNP will be emplaced in the immediate vicinity of BNP and used as capping material for the RW Pit. Tailings from the Mount Owen CHPP will continue to be emplaced within the southern portion of the West Pit and in-pit within tailings cells in the North Pit Continuation, with co-disposal of overburden and coarse reject within the North Pit Continuation and BNP continuing. Rehabilitation works associated with the ERP and TP1 are expected to be complete.

Year 10

By Year 10, it is expected that the North Pit Continuation mining limit will have reached its southernmost limit. As outlined in **Section 2.3.3**, Mount Owen mining leases and the Integra Underground mining leases overlap within the south and south-western side of the North Pit Continuation mining limit. Within the North Pit Continuation, Mount Owen holds the extraction rights of the upper seams and Integra holds the extraction rights of the lower seams. As a result, the North Pit Continuation pit floor will ‘step up’ at this location reducing the total depth (refer to **Figure 2.8**).

The anticipated extraction will decrease from the anticipated peak around Year 5 and accordingly mining equipment required for operations will also decrease. Based on current approvals, it is envisaged that coal haulage from Glendell Mine has now ceased, however the haul road from the ROM stockpiles to the Ravensworth East ROM facility will still be operational.

Mining activities within the RERR Mining Area will be continuing in Year 10. Overburden from the RERR Mining Area will be emplaced back within pit at the RERR Mining Area in addition to being hauled via truck to the BNP. ROM coal will be trucked along the internal haul road previously used for Glendell Mine ROM coal to the ROM coal stockpiles for processing at the Mount Owen CHPP.

Tailings from the Mount Owen CHPP will continue to be emplaced within the southern portion of the West Pit with co-disposal of overburden and coarse reject within the available mining pits including the North Pit Continuation, RERR Mining Area and the West Pit continuing. Tailings will be emplaced in-pit within tailings cells in the North Pit Continuation and RERR Mining Area to assist in the drying of areas of tailings in the southern portion of the West Pit and RERR Mining Area that are being prepared for capping.

Final Landform

The proposed final landform will result in three final voids, one in the southern area of the North Pit Continuation, another in the former RERR Mining Area in the south-east of the Ravensworth East Mine, and one in the former BNP in the north of the Ravensworth East Mine. It is proposed that, on completion of mining within the BNP, the void would be investigated for potential use as an operational water storage and potentially allow for integration within the GRWSS. As the RERR Mining Area is scheduled later in the Project, the potential for continued use of this area for tailings emplacement and implications for mine closure, will be considered as part of detailed mine closure planning, initiated five years prior to cessation of mining as part of this Project.

The retention of the Mount Owen rail line will also be investigated as part of the closure process for continued use by Glencore trains or other alternate land uses post mine closure. Completed tailings emplacement areas will be capped and rehabilitated should no alternative beneficial re-use options be identified during closure planning five years prior to cessation of mining.

In addition, all other infrastructure associated with the Project will be decommissioned and rehabilitated. Final landform and rehabilitation activities associated with the Project, including details of closure criteria and objectives, are discussed further in **Section 2.3.15** and **Section 5.19**.

2.3.6 Mining Methods

2.3.6.1 North Pit Continuation

No change is proposed to the existing mining methods currently occurring within the North Pit.

As discussed in **Section 2.1.3.1**, the North Pit currently operates as a multi-seam truck and excavator operation with the typical sequence of mining involving the clearing of vegetation and topsoil, drilling and blasting of overburden followed by the excavation and haulage of overburden to the overburden emplacement areas and ROM coal to the Mount Owen CHPP. Product coal is loaded on trains via the existing product stockpile and rail load out facility for transportation to the Port of Newcastle or domestic facilities.

Pre-strip operations include the removal of vegetation and topsoil ahead of the active mining operation. The clearing of vegetation is minimised ahead of mining and is generally limited to one strip width. Following the removal of vegetation, topsoil is stripped and either placed in topsoil stockpiles or placed directly on reshaped overburden for rehabilitation purposes.

Prior to any disturbance of the surface and as mining progresses, clean water diversions and erosion and sediment control works are established as required to divert rainfall around the active mining area where possible.

Once the surface area is cleared of vegetation and topsoil, the overburden may require drilling and blasting to enable it to be effectively removed by excavators. Generally, the top layer of overburden is a weathered material that does not require blasting, however there are some instances where blasting of the weathered material is required. This layer is of variable thickness, typically between 8 and 15 metres. Once the weathered material is removed, the remaining overburden is drilled and blasted as required.

The geology of the area requires detailed design of each blast as the sequence and amount of explosives varies both between blasts and between holes within the same blast. The dedication to blast design means that not only is blast efficiency maximised but the potential impacts of dust, fume generation, vibration and overpressure are addressed on a per blast basis.

Hydraulic excavators are used to move the overburden which is then loaded into large rear dump trucks and hauled to the overburden emplacement areas or used within tailings areas for capping material.

This method of mining maximises recovery of the resource, and is an effective method considering the geological conditions experienced at the existing North Pit. Backfilling of the active mining areas is undertaken as mining progresses with active overburden emplacement immediately behind the mining area allowing for active and progressive rehabilitation. The overburden emplacement areas are then shaped to final design contours prior to rehabilitation works.

Exposed coal is then mined by either front-end loader or excavator and loaded into rear dump trucks for transportation, via internal haul roads to the ROM stockpiles (or temporary ROM stockpiles within the North Pit Continuation where required) where it is then crushed and conveyed to the Mount Owen CHPP.

Mount Owen also proposes to continue to utilise a mobile crushing unit which is currently transported to the North Pit to crush overburden on an as needed basis as road base on haul roads.

The North Pit and CHPP workforce will continue to access the site from the existing Mount Owen MIA.

2.3.6.2 Ravensworth East

Ravensworth East Mine includes the West Pit, BNP and the proposed RERR Mining Area, the West Pit Overburden Emplacement Area, the formerly mined Stage 3 water storage, the RW Pit (currently part of the existing tailings management system), and TP1 (refer to **Figure 2.3**). TP1 is currently being utilised intermittently for tailings emplacement, however is proposed that TP1 will be capped using overburden from mining operations within the Mount Owen Complex and rehabilitated by approximately 2017.

Approved mining operations are currently occurring within the West Pit, where coal is extracted from the Ravensworth seams and the Bayswater seam to a depth of approximately 200 metres at a maximum approved extraction rate of 4 Mtpa. The proposed RERR Mining Area is within an area previously referred to as TP2, which was formerly mined in accordance with the existing Mount Owen development consent (DA 14-1-2004).

Ravensworth East Mine operates as a multi-seam truck and excavator operation. Mining operations within the BNP and RERR Mining Areas will involve the excavation of overburden previously emplaced within the BNP and RERR Mining Area as part of the existing approved mining operations. Overburden will be transported and emplaced within the West Pit Overburden Emplacement Area and in the vicinity of BNP, including as capping for the RW Pit and TP1. Coal will be mined and trucked to the Mount Owen CHPP via internal haul roads for processing.

The current Ravensworth East development consent allows for ROM coal to be transported via conveyor to both the Bayswater and Liddell power stations. The ROM coal is loaded onto the Ravensworth East Conveyor located at the Ravensworth East infrastructure area, the Ravensworth East Conveyor then links with the 'M' Series conveyor which extends to the Bayswater and Liddell power stations and RCT.

Mount Owen also proposes to utilise the existing Ravensworth East conveyor for the transport of ROM coal and crushed gravel to Liddell Coal Operations and the RCT on an as required basis.

The workforce for BNP will continue to access the site from the existing Ravensworth East MIA.

2.3.7 Mining Fleet

There is no proposed change to the current mining fleet for the North Pit and the Ravensworth East operations as a result of the Project. However, some of the existing fleet will reach the end of its operational life during the life of the Project. Existing mining plant that reaches the end of its operating life will be replaced as required. As the North Pit Continuation progresses further to the south, the available mining area within the pit will reduce, resulting in a reduction in production and subsequent decrease in the required mining fleet.

Selection of equipment required during the life of the Project has been considered as part of this EIS and the Noise Impact Assessment with further detail included in **Section 5.3**.

The typical mining fleet that will be used at the Mount Owen Mine over the life of the Project is outlined in **Table 2.4**; however, this is subject 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 2.4 – Indicative Typical Mining and Key Ancillary Equipment within the North Pit Continuation

Equipment Type	Indicative No.	Key Ancillary Equipment	Indicative No.
600 t Excavator	4	Drill	3
400 t Excavator	2	Scraper	1
200 t Excavator	2	Grader	4
Dozers (both wheeled and tracked)	15	Water cart	4
Rear dump truck (Overburden)	31	Fuel and service truck	4
Rear dump truck (Coal)	10	Loaders	3

Note: The table outlines typical numbers of equipment for the maximum production scenario. There may be variation in numbers, size and types of equipment used to suit operational needs, provided that the relevant limits and environmental impact criteria are maintained.

The typical mining fleet currently utilised for the mining operations within the Ravensworth East Mine and proposed to be used in continued operations are outlined in **Table 2.5**.

Table 2.5 – Indicative Typical Mining Equipment at Ravensworth East Mine

Equipment Description	No.
500 tonne Excavator	1
250 tonne Excavator	1
Haul Truck 240 tonne	6
Haul Truck 180 tonne	6
Bulldozers	3
Rubber Tyre Dozer	1
Grader	2
Drill	1
Water Cart	1

Note: The table outlines typical numbers of equipment for the maximum production scenario. There may be variation in numbers, size and types of equipment used to suit operational needs, provided that the relevant limits and environmental impact criteria are maintained.

2.3.8 Coal Handling and Processing

The Project proposes to utilise the existing Mount Owen CHPP as described in **Section 2.1.3.1**. ROM coal from the North Pit Continuation and the Ravensworth East Mine will continue to be transported to the Mount Owen CHPP for processing. All ROM coal extracted from the Glendell Mine is currently transported to the Mount Owen CHPP for processing. No change is proposed to the current Glendell Mine as part of the Project.

No changes are proposed to the Mount Owen CHPP processing and load out capacity of 17 Mtpa ROM coal, with the CHPP and rail load-out operations to continue to process coal on a 24 hour, 7 days per week basis. It is proposed to upgrade the CHPP facilities during the Project to improve coal recovery and reduce water usage. Further discussion on tailings management is provided in **Section 2.3.10**.

Coarse rejects from the Mount Owen CHPP will continue to be incorporated into the overburden emplacement areas. Rehabilitation of the tailings emplacement areas will be undertaken once the tailings have sufficiently consolidated, which generally occurs approximately 3 to 5 years after the emplacement of tailings has ceased.

The existing product stockpile area associated with the North Pit Continuation is located to the west of the current approved North Pit, within the existing MIA (refer to **Figure 2.2**). The product coal handling and stockpile system has modern air quality and water management control systems. Product coal is transferred from the Mount Owen CHPP to the product stockpile via a rail mounted luffing stacker and reclaimed for train load-out. To assist with managing additional product types, the existing product stockpile is proposed to be extended to the west and south within an area currently approved for disturbance.

The existing Ravensworth East stockpile is located within the Ravensworth East MIA and will be used on an as required basis for the transportation of ROM coal and crushed gravel to either Liddell Coal Operations the RCT and / or Bayswater and Liddell power stations.

2.3.9 Product Transportation

Apart from utilising the proposed rail line as outlined in **Section 2.3.12**, the Project will not involve any change to the currently approved product transportation infrastructure as described in **Section 2.1.3.1**. Anticipated train movements will not increase from that currently approved.

Mount Owen, pursuant to the Ravensworth East consent (DA 52-03-99), has current approval to transfer ROM coal to the Liddell and Bayswater power stations via the Ravensworth East and M-series conveyors. As part of the Project, Mount Owen is seeking approval to transport up to 2 Mtpa ROM coal and crushed gravel on an as required basis via the existing overland conveyor to the Liddell Coal Operations and the RCT in addition to maintaining the current approval to transport ROM coal to Bayswater and Liddell power stations. Liddell Coal Operations is currently going through an approval process which includes seeking approval to receive ROM coal and crushed gravel from the Mount Owen Complex and also the construction of a conveyor which will link to the existing M Series Conveyor.

2.3.10 Tailings Management

Tailings emplacement within the Project Area is undertaken within disused mining areas in accordance with the *Mount Owen Tailings Management Strategy*. There is sufficient capacity for the emplacement of tailings in the current emplacement areas within the Mount Owen Complex (including the West Pit void) to support all currently approved and proposed mining operations at the Mount Owen Complex, including tailings associated with the Project.

Tailings from the Mount Owen CHPP are currently pumped to the ERP and the RW Pit. Tailings were also previously pumped intermittently to TP1 however TP1 is being prepared for capping and rehabilitation early in the Project. An interim tailings cell will be constructed within West Pit in late 2014 to provide additional tailings capacity prior to the completion of mining within West Pit.

Previously, tailings were pumped to NVS2; however this tailings emplacement area is at capacity and is currently being allowed to dry out for future capping. Tailings were also previously pumped to NVS1 and this tailings emplacement area has now been capped and rehabilitated.

NVS2 and the RW Pit will be capped and rehabilitated by Year 1 and Year 5 of the Project respectively provided adequate consolidation and drying has been achieved (refer to **Figure 2.9**). Capping of TP1 and the ERP will have commenced by Year 1 of the Project with rehabilitation of these areas expected to be completed by Year 5 of the Project (refer to **Figure 2.10**).

The Project will utilise the southern portion of the West Pit and RERR Mining Area (from 2014 and 2027, respectively) for tailings emplacement for the life of the Project (refer to **Figures 2.9** to **2.11**). Tailings from the Mount Owen CHPP will be pumped to the West Pit and the RERR Mining Area voids. Tailings cells may also be constructed in the North Pit Continuation (as required) to allow for interim in-pit tailings disposal to assist with consolidation and dewatering of tailings in the West Pit and RERR Mining Area. The estimated total coarse rejects for the Project is approximately 27 Mt. Coarse reject will be trucked back into the active overburden areas associated with the North Pit Continuation, West Pit and RERR Mining Area.

The estimated total dry tailings production for the Project is approximately 17 Mt. Following consolidation of tailings, these emplacement areas will be capped with overburden to achieve a stable final landform and allow the area to be rehabilitated in accordance with the proposed mine plans and the mine closure and rehabilitation strategy, as detailed in **Section 5.19**.

The Project is seeking approval to allow for the receipt of tailings from other mining operations. Based on the current tailings strategy, it is anticipated that the combined dry tailings capacity of the both the West Pit and RERR Mining Area will not be fully exhausted at the end of the Project. Given the proximity of other Glencore owned mining operations, there is the potential for integrated use of these tailings facilities (West Pit and RERR Mining Area) which would reduce the need for additional tailings facilities at other Glencore mines in the Greater Ravensworth Area.

2.3.11 Mine Infrastructure Area

The Project proposes the continued use of the existing infrastructure as described in **Sections 2.1.3.1** and **2.1.3.2**. Extensions and improvements are also proposed in areas approved for disturbance to the following infrastructure located within the MIA (refer to **Figure 2.2**):

- Potential processing upgrades to the CHPP, to improve recovery of coal, increase production yield and reduce the volume of tailings;
- Construction of covered CHPP storage area:
  - Construction of a covered storage area servicing the Mount Owen CHPP, including a reinforced concrete slab on ground with reinforced concrete footings, steel frame cladding and roller doors.
- Extension to the existing heavy vehicle workshop including:
  - Construction of additional workshop capacity adjacent to the existing heavy vehicle workshop with materials and cladding similar to the existing vehicle workshop and a similar height.
- Upgrades to the raw / fire water system.
- Upgrade of the existing fuel facility including:
  - expansion of the bulk fuel store to provide additional storage capacity; and
  - upgrade of concrete bunding in accordance with relevant Australian Standards (including AS 1940-2004 *The storage and handling of flammable and combustible liquids*) and Glencore standards.
- Additional works include:
  - upgrade of the existing lubrication facility;
  - construction of heavy vehicle park-up area;
  - visitor car park extension; and
  - extension of the existing stores lay down area.

Further detail regarding the proposed upgrade works to the fuel facility is included in **Section 5.15**.

2.3.12 Proposed Rail Line

Mount Owen will continue to utilise the existing Mount Owen Load Out Facility and rail line that currently services the Mount Owen Complex. In addition, Mount Owen is seeking approval for the provision of an additional rail line and northern turn-out west of the existing Mount Owen Complex Rail Line (refer to **Figure 2.13**). The proposed rail line will require the construction of a single span bridge over Bettys Creek (refer to **Figure 2.13**). The alignment of the proposed rail line has been designed to avoid disturbance to the existing Bettys Creek Habitat Management Area and align with the western extent of the adjoining Integra Underground mining area, outside of the subsidence zone. The rail bridge crossing Bettys Creek has been designed to minimise disruption to the Bettys Creek low flow channel (refer to **Figure 2.14**). The remainder of the proposed rail line will run parallel to the existing rail line and then join the existing rail line to the south of the existing rail loop.

Additional works required on the Main Northern Rail Line as part of the new northern turn-out include:

- installation of a crossover between the two existing lines;
- localised slewing of the existing lines and associated formation works; and
- installation of new signals and signal adjustments.

It is also proposed to reconfigure the existing rail loop turnout such that loaded trains are exiting the rail loop via the straight leg of the turnout. This will reduce ongoing maintenance costs and extend the life of the turnout.

The construction of the additional rail line and northern turn-out will allow Glencore Rail trains the ability to turn around within the Mount Owen Complex Rail Line and return to Glencore owned mines to the west. At present, empty Glencore Rail trains travel to the Port of Newcastle to turn around before heading back to the west. This northern turn-out will allow for an increased capacity along the Main Northern Rail Line by providing additional train paths between the Mount Owen Complex and the Port of Newcastle, which would otherwise have been taken by Glencore Rail empty trains.

Moreover, the construction of the new rail line will reduce Glencore's ongoing maintenance liability associated with the existing rail line, which is subject to subsidence due to the existing Integra Underground Mine. The new rail line will become the main connection between the Main Northern Rail Line and the Mount Owen Complex. The existing rail line will also be used as a park-up area for Glencore Rail trains that are not in service. The proposed park-up area (existing rail line) will be used for inspection of wagons and minor maintenance works that include brake block change out. There will be no major servicing of trains (e.g. oil change) as this will take place at the existing provisioning facility. To allow for this activity, an access track will be established on both sides of the existing rail line at ballast level in addition to widening the ballast along the existing spur by approximately 1 metre on each side. This work will be undertaken within the previously approved disturbance area.

The proposed rail construction works will require access for construction workers via Forest Road located in the south-eastern portion of the Project Area. Construction laydown areas are located to the north of Forest Road and access to the proposed rail line from the east will

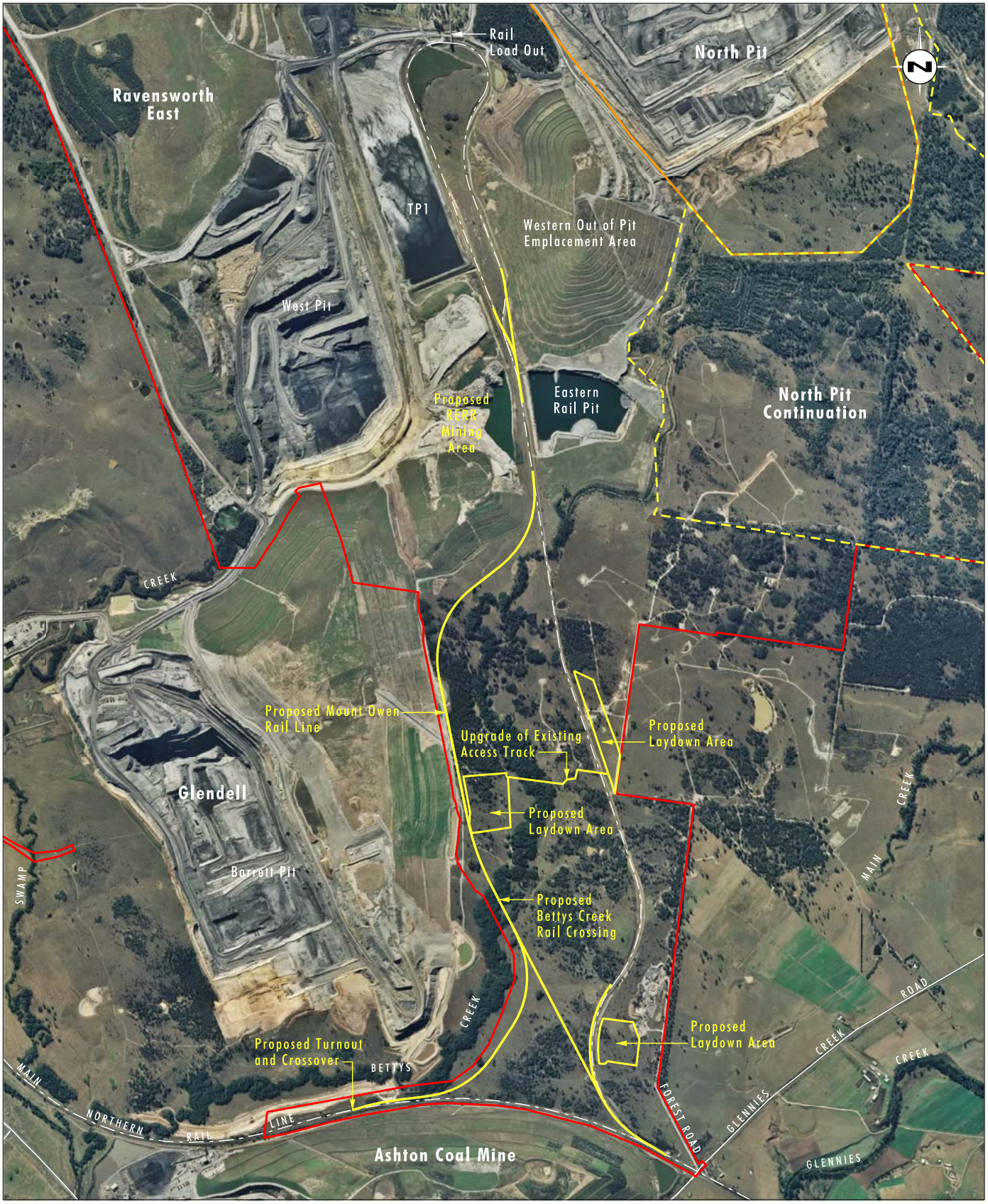

Image Source: Mount Owen (2013)
Data Source: Mount Owen (2014)

0 0.5 1.0 1.5km
1:30 000

Legend

- Project Area
- Approved North Pit Mining Extent
- Proposed North Pit Continuation
- Proposed Rail Upgrade Works

FIGURE 2.13

Proposed Rail Line Conceptual Design

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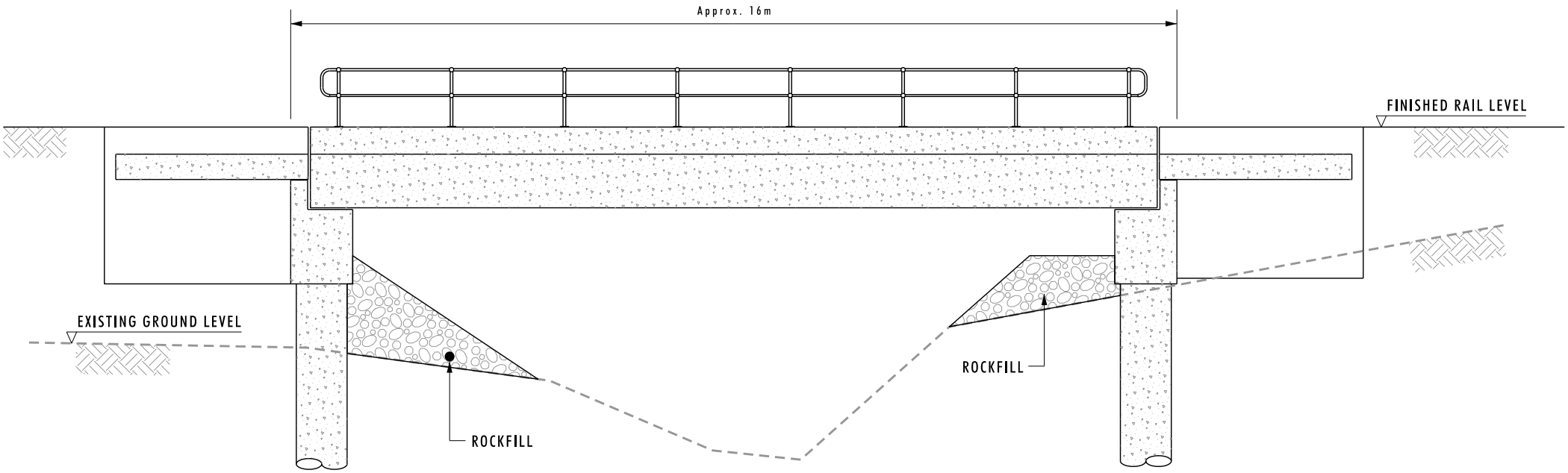

TYPICAL CROSS SECTION

0 1.0 2.0 4.0m
1:100

FIGURE 2.14

Proposed Bettys Creek Rail Bridge
Conceptual Design

Data Source: Parsons Brinckerhoff (2013)
Note: All dimensions are in metres

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utilise existing tracks, that will be upgraded as required (refer to **Figure 2.13**). To manage the use of Forest Road during construction, Mount Owen will prepare a Construction Traffic Management Plan in consultation with Singleton Council.

Further detail regarding the assessment of the traffic and transport impacts associated with the Project and the proposed rail works is provided in **Section 5.12**.

2.3.13 Proposed Hebden Road Upgrade Works

Hebden Road provides employee and service access to the Mount Owen, Ravensworth East and Glendell Mines in addition to use by the public accessing properties and other industrial operations including the nearby Hebden and Wild Quarries. It is also an access road for the northern side of Lake Liddell and the Lake Liddell recreation area. It is anticipated that there may be minor increases in road traffic in this area for light vehicles and trucks accessing the mine during the construction phase for the Project. As the operational workforce will not increase as a result of the Project, increases in road traffic accessing the Mount Owen and Ravensworth East Mines once the Project is operational are not anticipated.

Hebden Road connects with the New England Highway at two locations. These intersections are located immediately north of Lake Liddell with the southern location at Ravensworth. The southern connection point receives the majority of movements for traffic accessing the Mount Owen, Ravensworth East and Glendell Mines. The Main Northern Rail Line runs parallel to the New England Highway in this area, directly to the east. There is an existing rail level crossing at the location where Hebden Road crosses the Main Northern Rail Line. Approximately 400 metres to the east of the rail level crossing, a single lane bridge crossing Bowmans Creek further constrains existing traffic movements with northbound traffic given right-of-way over the bridge. The Mount Owen rail line joins the Main Northern Rail Line to the south-east of Hebden Road and trains associated with the Mount Owen Complex do not cross Hebden Road at the rail level crossing. However, with anticipated future increases in train movements on the Main Northern Rail Line, Mount Owen is looking to alleviate constraints to vehicle traffic movement by constructing a rail overpass over the Main Northern Rail Line and new dual lane bridge over Bowmans Creek.

Areas for construction lay down and site facilities are located on the eastern side of the Main Northern Rail Line (refer to **Figure 2.13**). These areas have been included in the Proposed Disturbance Area for the Project and will be rehabilitated once construction activities have been completed.

2.3.13.1 Proposed Bowmans Creek Bridge and Rail Overpass

Further to the east of the Main Northern Rail Line, Hebden Road crosses over Bowmans Creek via a single lane bridge (refer to **Figure 2.15**). As part of the Project, within one year of the commencement of mining beyond the currently approved mining limit, Mount Owen proposes to commence construction of a new dual lane bridge to allow for two-way traffic movements (refer to **Figure 2.16**). The purpose of the new bridge is to provide further road traffic safety improvements. The proposal includes the construction of a new two way bridge across Bowmans Creek, positioned approximately 10 metres south of the existing Bowmans Creek bridge. The proposed bridge has been designed to minimise the disturbance within the vicinity of the creek bank due to the existing cultural significance and the piers for the proposed bridge have been designed to sit outside of the low flow channel of Bowmans Creek. Upon completion of works associated with archaeology and cultural heritage, construction works would commence in conjunction with installation of erosion and sedimentation controls.

umwelt

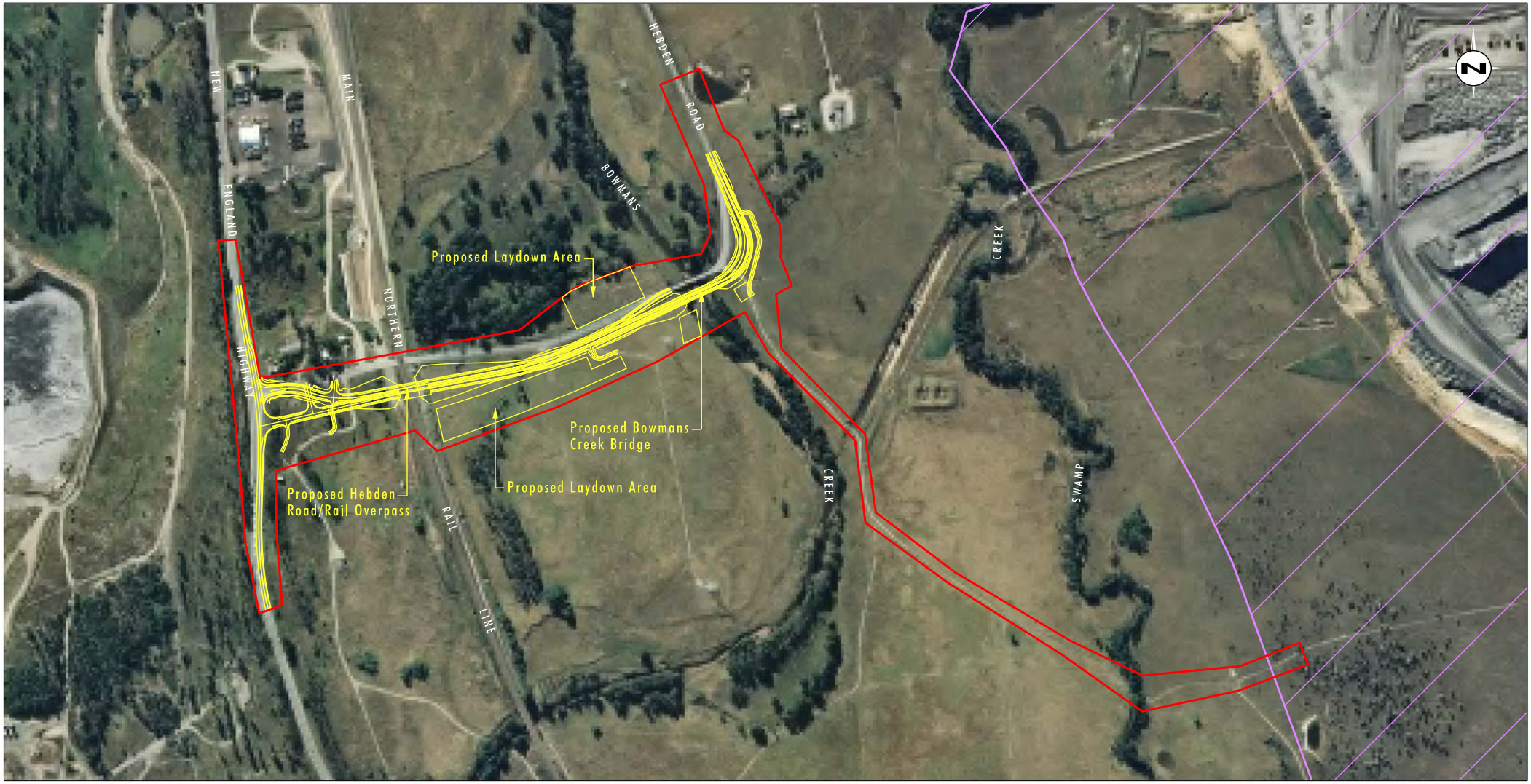


Image Source: Mount Owen (2013)
Data Source: Mount Owen (2014)

0 100 200 400m
1:7 500

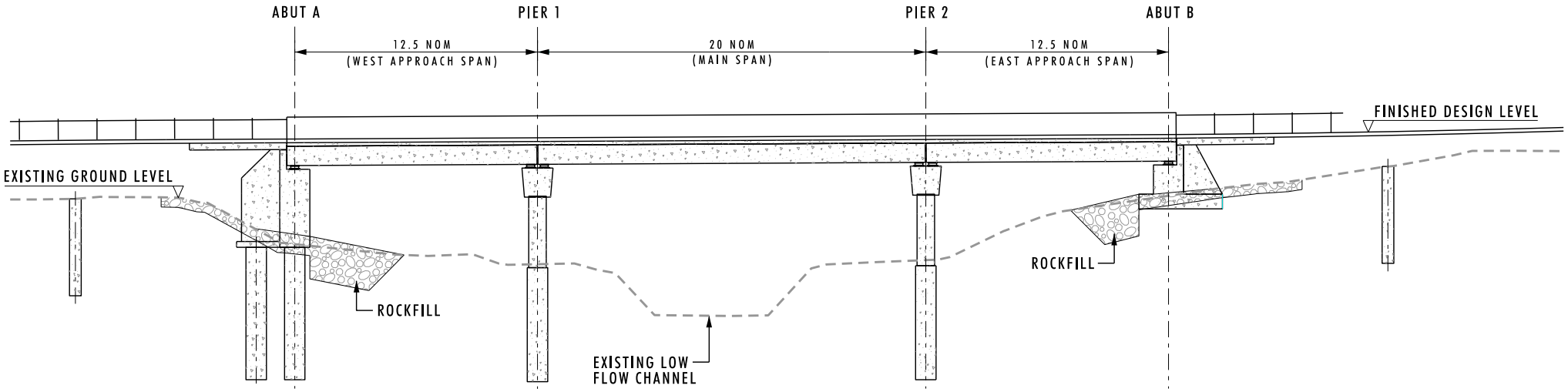
Legend

- Project Area
- Proposed Hebden Road Upgrade Works
- Approved Glendell Disturbance Area

FIGURE 2.15

Hebden Road Upgrade Works Conceptual Design

File Name (A4): R02/3109_837.dgn
20140925 13.05



TYPICAL CROSS SECTION

0 5.0 10.0 15.0m
1:300

FIGURE 2.16

Proposed Bowmans Creek Road Bridge
Conceptual Design

Data Source: Parsons Brinckerhoff (2013)
Note: All dimensions are in metres

File Name (A4): R02/3109_691.dgn
20131126 16.29

To reduce the requirement for the Project to import construction material, it is proposed to utilise suitable rock and fill material sourced from within the previously approved Glendell Mine disturbance area for the cut and fill works required for the proposed Hebden Road works. The material will be transported from the Glendell disturbance area along an existing access road which will require minor maintenance works (grading) (refer to **Figure 2.15**).

Mount Owen proposes to construct a new road to replace the existing section of Hebden Road between the existing Bowmans Creek Bridge and the New England Highway intersection. The new section of road will include a rail overpass for road traffic adjacent to the existing level crossing where Hebden Road crosses the Main Northern Rail Line (refer to **Figure 2.15**). The existing level crossing is located in close proximity to Hebden Road, New England Highway intersection and there is the potential for traffic to queue along Hebden Road and out on to the New England Highway at times. Due to the anticipated increase in future train movements on the Main Northern Rail Line as a result of proposed future operations west of the Project Area, the purpose of the proposed rail overpass is to improve traffic flow and reduce traffic hazards by eliminating the potential for traffic to queue back onto the New England Highway.

2.3.14 Ancillary Activities and Services

Mount Owen is currently supported by a range of ancillary services such as water management, electricity supply, internal communication, monitoring and access infrastructure.

The existing approved ancillary services will be utilised or modified if required to minimise the surface disturbance associated with constructing new infrastructure. Conceptual locations and disturbance footprints for the various surface infrastructure components have been determined based on mine requirements, topography and ecological and archaeological constraints and are located within existing operational areas and / or the Proposed Disturbance Area for the Project. Minor refinement of these locations may be required during the detailed design phase of the Project. Where surface infrastructure is required to be moved as a result of the detailed design process, it will be relocated to ensure that the impacts associated with the final design and location are not significantly greater or different than those associated with the conceptual locations.

The key ancillary services required for the Project include, for example:

- dewatering and potable water bores;
- surface water management infrastructure including water treatment facilities, water fill points and associated infrastructure;
- internal power supply infrastructure – power lines (local 11 kV near proposed Hebden Road upgrade), substations, switch yards, etc (no major power supply infrastructure changes / upgrades are required for the Project);
- piped services - potable water supply, mine waste water removal, process and fire water supply, etc;
- internal communications and monitoring services including communication towers, etc;
- internal access roads and other minor infrastructure within the existing and Proposed Disturbance Area; and

- portable buildings as required.

2.3.15 Final Landform and Rehabilitation

Mount Owen has undertaken progressive rehabilitation throughout the life of the Mount Owen and Ravensworth East Mines. Rehabilitation works have included extensive flora and fauna monitoring and research projects in order to develop rehabilitation techniques and ensure the development and success of the rehabilitation programs in place. Mount Owen intends to continue to rehabilitate all disturbed areas as soon as practicable throughout the life of the Project. The anticipated future rehabilitation is shown on the conceptual mine plans on **Figures 2.9** to **2.12**.

The rehabilitation strategy for the Project is consistent with the existing rehabilitation strategies for the Mount Owen and Ravensworth East Mines which is to create native woodland areas as well as rehabilitated pasture. The native woodland areas will be contiguous with adjacent and existing native vegetation areas with the aim to supplement local and regional linkages to aid the movement of fauna across the local area and throughout the region. Rehabilitated pasture will provide some areas suitable for sustaining potential future agricultural activities such as grazing. The proposed revegetation activities aim to recreate similar ecosystems and vegetation communities removed by mining activities.

Progressive rehabilitation of the Mount Owen and Ravensworth East Mines will consist of the shaping of overburden emplacement areas to create a suitable final landform. The rehabilitation works will include optimisation of ongoing overburden emplacement and final landform shaping to achieve an undulating natural final landform with adequate surface drainage which is in keeping with the surrounding landscape (refer to **Section 5.19**). Topsoil generally will then be spread over the shaped overburden emplacement areas and revegetation works will commence. Monitoring of the success of the revegetation works will continue throughout the life of the mining operations and also the closure process. Temporary rehabilitation measures such as the planting of a cover crop will also be implemented as required in areas that will not form part of active mining operations for extended periods of time for erosion and sediment control or for dust control. Proposed rehabilitation has been designed to integrate with the currently approved rehabilitation and final land use of other Glencore mines within the greater Ravensworth area.

Further detail regarding mine rehabilitation and the closure strategy for the Project is provided in **Section 5.19**.

2.3.16 Mine Workforce and Hours of Operation

The Project will not involve any change to the current hours of operation at the Mount Owen and Ravensworth East Mines, that is 24 hours a day 7 days a week. As the Project is not increasing the production rates or operational equipment, the total number of the current operational workforce will not be increased as a result of the Project.

2.3.17 Construction Phase and Hours of Work

The Project will require a construction phase of approximately 12 to 18 months with construction activities being undertaken by a peak workforce of up to approximately 330 people. Construction activities will include:

- additional rail line and northern turn-out;
- Hebden Road upgrade works including Main Northern Rail Line overpass and new Bowmans Creek Bridge;
- CHPP upgrades, including product coal stockpile extension and covered storage areas and process improvements;
- MIA extensions and upgrades; and
- other ancillary works.

It is anticipated that construction of the Hebden Road works would start within one year of the commencement of mining beyond the currently approved mining limit. Construction of the Hebden Road upgrade works and the proposed rail line will 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. However, limited activities such as track work involving the Main Northern Rail Line will be required to be undertaken during outage windows (periods of no or highly restricted rail activity on the Main Northern Rail Line) where construction activities may need to be continuous over a 24 hour period or more. Prior to activities occurring during outage windows, Mount Owen will consult with any residents potentially affected by construction noise during these discrete periods. Construction activities undertaken outside the standard construction hours will be managed to ensure that total noise emissions from the Project will be in compliance with the operational noise criteria for the Project unless otherwise agreed with affected landholders.

Construction of the other infrastructure including the MIA and CHPP upgrades and improvements, product stockpiles and ancillary works will be undertaken 24 hours per day, 7 days per week as required.

As previously noted, additional road traffic associated with the proposed construction activities is anticipated and further details regarding the management of traffic impacts in relation to construction activities associated with the Project is provided in **Section 5.12**.

2.4 Ongoing Exploration Activities

Mount Owen undertakes exploration and prospecting activities across the approved lease areas for the purposes of geotechnical, geological, hydro geological and gas investigations. The techniques used for exploration and prospecting include but are not limited to:

- Aerial photograph interpretation.
- Field assessments (soil, vegetation, etc).
- Drilling allowing for lithological and geophysical logging.

- Drilling associated with collecting gas concentration samples throughout the gas bearing strata across the approved lease areas to meet the required greenhouse gas management and National Greenhouse and Energy Reporting (NGER) objectives.

- Geophysical investigations (verticality, gamma, caliper, resistivity, neutron, sonic and magnetic susceptibility tool, etc).

- Magnetic surveys.

- Seismic surveys.

- Excavation and bulk samples (within the Proposed Disturbance Area).

To allow for these activities to occur, Mount Owen may be required to establish temporary access tracks, drill pads and survey lines. A review of the potential environmental impacts from exploration activities will be completed prior to any works to ensure that the activities are located and designed, as far as practical, to have minimal environmental impact. Following the environmental assessment of the proposed disturbance footprint, these areas will be prepared using earthmoving equipment to allow for the work to be undertaken safely and in a manner that minimises environmental impacts. These works will continue to comply with NSW Trade and Investment, Division of Resources and Energy (DRE) EDG10 Surface Disturbance Notice for exploration activities or other relevant guidelines.

Access to the exploration and prospecting sites and access tracks will be via the internal road network and / or via the network of public roads or private property tracks where access agreements have been reached.

Following the completion of exploration and prospecting activities, bore holes will be decommissioned in accordance with DRE requirements. All disturbed areas including access tracks and drill pads or survey lines will be rehabilitated.

2.5 Project Design Considerations and Alternatives

As discussed in **Section 2.3.3**, Mount Owen has completed detailed iterative environmental studies to inform the proposed conceptual design for the Project. As part of these studies a range of different mine design options including mine disturbance areas, overburden emplacement schedules, infrastructure design, fleet numbers, equipment type and location, and scheduling were considered. The purpose of the iterative environmental studies and project design was to identify potential mining options and the requirement for associated infrastructure that would allow the Project to achieve its objectives.

The key Project objectives are:

- the continued operation of the Mount Owen and Ravensworth East Mines with a focus on:
  - maximising resource recovery from within the existing Glencore mining tenements;
  - optimising the use of existing infrastructure;
- maximising economic returns of the Mount Owen and Ravensworth East Mines and providing ongoing employment for the existing workforce;

- further development of the existing environmental mitigation and management strategies, expanding the existing commitments to mitigate and manage the predicted impacts associated with the Project;
- maximising the use of previously disturbed areas and existing mining infrastructure, thereby minimising the overall Proposed Disturbance Area as far as practicable;
- avoidance of existing Biodiversity Offset Areas and the Ravensworth State Forest;
- continuing to actively engage and consult with the surrounding community; and
- establishing a final landform that is safe and stable and provides sustainable post mining land use options.

Details regarding the various conceptual design options and other alternatives considered during iterative project design, including proposed mining and associated infrastructure are provided below.

2.5.1 Viability of Underground Mining

Mount Owen reviewed the potential option of conducting underground mining for the Project. Given that the current operation is an existing open cut operation and that the steep seam dips and complex geology preclude the option for economic extraction utilising underground mining methods this mining option was discounted very early in the concept design phase.

2.5.2 Mining Domains

The following information describes the range of mining alternatives considered as part of the Project that set the mining domain that enabled the Project to achieve its objectives.

The mining alternatives focussed on the avoidance of disturbance within the Ravensworth State Forest and the existing Biodiversity Offset Areas which are located within the Project Area. The studies reviewed other constraints in the development of a mining domain that allowed maximising the resource recovery in Glencore owned tenements and maintaining the economic life of the Mount Owen Mine and Ravensworth East Mines the existing infrastructure. These plans optimised the use of previously approved disturbance areas, whilst providing a safe, stable and environmentally sound North Pit Continuation mining limit.

Avoidance of Existing Biodiversity Offset Areas and Ravensworth State Forest

There are known economic coal resources located under the existing Mount Owen Biodiversity Offset Areas and the Ravensworth State Forest. The Mount Owen Biodiversity Offset Areas were set aside as an ecological offset for the previous Mount Owen development consent (2004) (refer to **Figure 2.17**). In addition to the ecological considerations, condition 45e of the current development consent for the Mount Owen Mine provides for the management and protection of Aboriginal archaeological sites within the Biodiversity Offset Areas. There are a number of known Aboriginal archaeological sites within the existing Biodiversity Offset Areas including a stone arrangement in the southern portion. Mount Owen recognises the importance of these sites to the Aboriginal community and their value to long term conservation and intergenerational equity outcomes. Therefore, Mount Owen intends to maintain the existing commitments to protect and maintain these areas as part of previous mining approvals. Accordingly, the option to mine coal to the east of the existing North Pit mining limit into the Biodiversity Offset Areas was discounted in

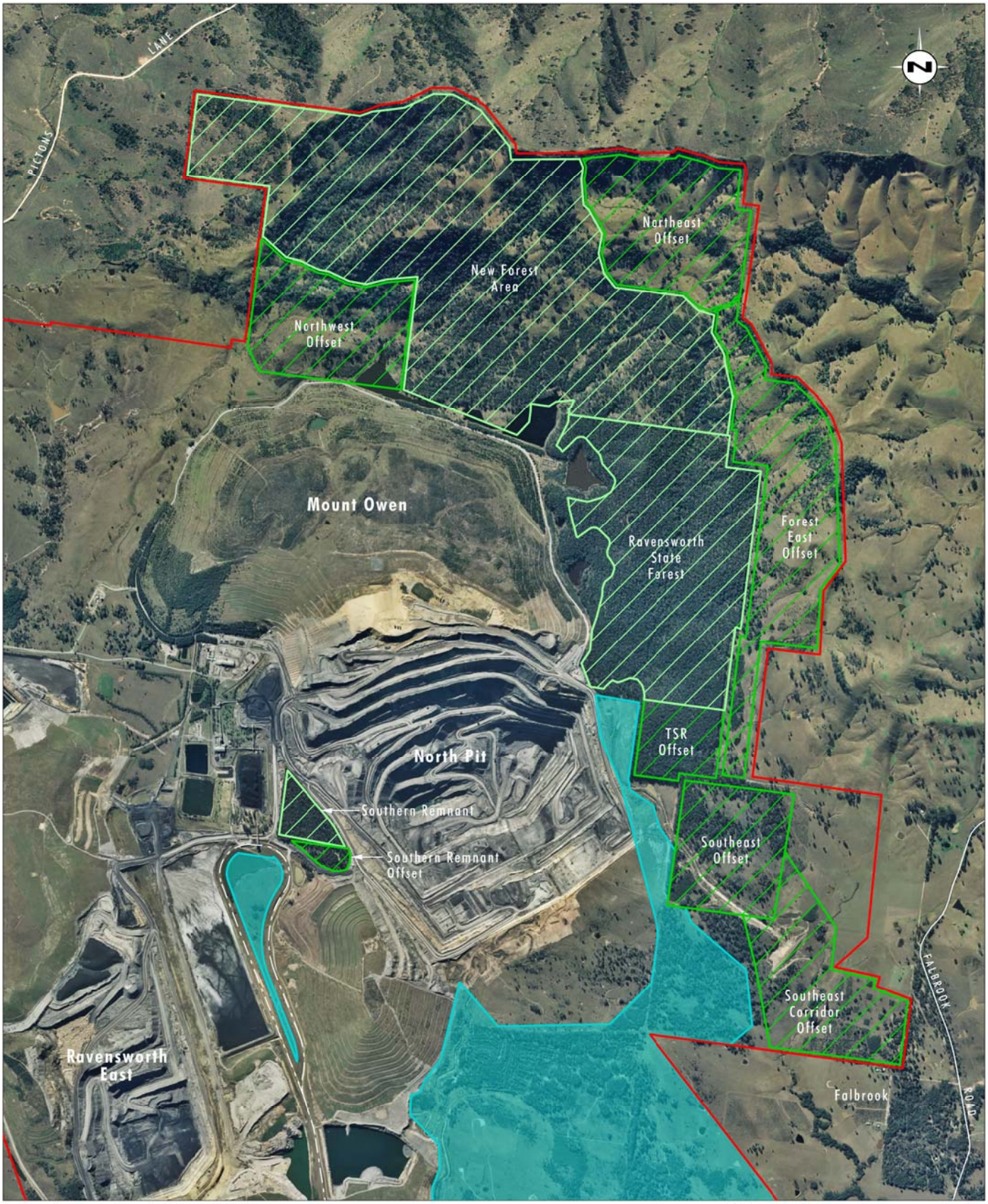


Image Source: Mount Owen (2013)
Data Source: Mount Owen (2014)

0 0.5 1.0 2.0km
1:35 000

Legend

- Project Area
- Proposed Disturbance Area
- Existing Mount Owen Biodiversity Offset Area
- Ravensworth State Forest

FIGURE 2.17

Proposed Disturbance Area and Existing Offset Areas

order to maintain the long term conservation of the offset areas committed to in the 2004 approval.

Early disturbance area designs also identified potential impact to the Hunter Lowlands Red Gum Forest Endangered Ecological Community (EEC) in the north-east portion of the Proposed Disturbance Area. A review of the concept design determined that the Proposed Disturbance Area could be revised and the extent of disturbance was reduced, thus avoiding any impact to the Hunter Lowlands Red Gum Forest community.

The Ravensworth State Forest, New Forest Area and the Southern Remnant are all located within the Project Area (refer to **Figure 2.17**). The extent of the Proposed Disturbance Area was designed to ensure these three State Forest areas were not disturbed as a result of the Project.

Meeting Minimal Harm Requirement to Main Creek

As outlined in **Section 2.3.3**, a section of Main Creek is located in the eastern portion of the Project Area, in the vicinity of the North Pit Continuation. The known coal resource extends to the east in this area and the initial eastern extent of the North Pit Continuation extended within close proximity to Main Creek (refer to **Figure 2.18**). The proposed mining limit was originally designed to provide a minimum standoff of 150 metres between the proposed highwall and the alluvium of Main Creek in accordance with Management of stream / aquifer systems in coal mining developments, Department of Infrastructure, Planning and Natural Resources (DIPNR) (2005).

Upon release of the NSW Aquifer Interference Policy (AIP), the location of the proposed mining limit was reviewed with respect to the minimal harm criteria, specifically that 'no mining activity to be below the natural ground surface within 200 metres laterally from the high bank or 100 metres vertically beneath (or the three dimensional extent of the alluvial water source – whichever is the lesser distance) of a high quality connected surface water source that is defined as reliable water supply'. The final Project conceptual design of the proposed mining limit is greater than 200 metres off the high bank of Main Creek.

Providing Landform Stability

During the Project design phase, the geotechnical studies for the North Pit Continuation mining limit and design were completed. The study noted a reduced factor of safety of the designed eastern lowwall. A review of this design to improve the long term stability of the landform resulted in the North Pit Continuation mining limit being moved west, which also resulted in a number of benefits for the Project including:

- a further reduction of the mining limit in this location (refer to **Figure 2.18**);
- increased separation distance between the mining operation and the residential receivers to the east; and
- a safe and stable final landform.

Use of Mine Owned Tenements

The extent of the North Pit Continuation has been optimised to maximise resource recovery in Mount Owen's southern mining tenement area, where Integra owns the underlying mining lease. Within these constraints, the studies examined its boundaries and the safe and efficient mining of the available resource.

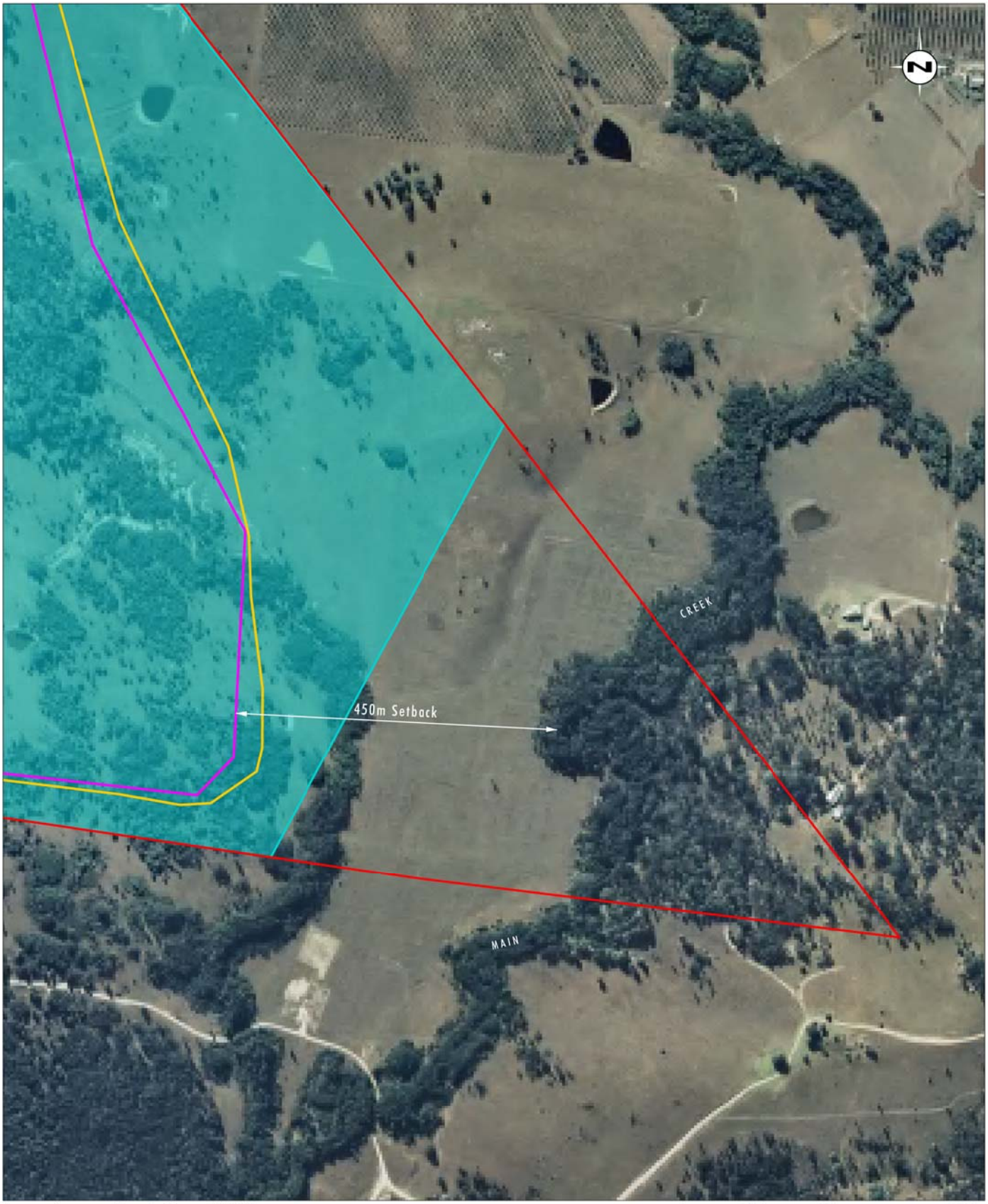


Image Source: Mount Owen (2013)
Data Source: Mount Owen (2014)

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1:7 500

Legend

- Project Area
- Proposed Disturbance Area
- Previous Proposed Disturbance Area Boundary
- Proposed North Pit Mining Extent
- Previous Proposed North Pit Mining Extent

FIGURE 2.18

Stand Off Main Creek

File Name (A4): R02/3109_839.dgn
20140915 16.36

In the area overlying the Integra lease, the initial mine plan extracted all coal from the surface to the floor of the Bayswater seam. Optimisation of the mine plan was undertaken so that economic resource recovery was maximised through the area where the tenements transition from an unlimited depth to stratified. As a result further coal has been targeted from the Lemington seam to the floor of the Hebden seam. There is an estimated 12 Mt ROM coal that may be recovered from this area.

2.5.3 Mine Plan Development

2.5.3.1 Mine Plan Design and Practice

Two of the key issues for the local community identified through Project consultation were noise and air quality impacts. Mount Owen undertook significant preliminary and ongoing modelling to determine the potential impacts to air quality and noise associated with different mine plan options, fleet numbers and type, and equipment location and scheduling.

This process identified the key drivers for air quality and noise impacts and allowed the Project team to optimise mining options to reduce the predicted air quality and noise impacts associated with the Project. This optimisation process has allowed the Project to meet several objectives including maximising the resource recovery and maintaining the economic life of the Mount Owen Mine, whilst developing environmental mitigation and management strategies to minimise the predicted impacts associated with the Project.

Analysis of the meteorological data showed that adverse conditions which have potential to result in increased propagation of noise impacts from the Project can occur more frequently during winter months at night.

The following sections describe the refinements of the mine plans undertaken as part of the Project to address these key issues.

Haul Road Design – North Pit Continuation

Early mine plan designs included haul roads at natural surface level located on the eastern side of the North Pit Continuation to reduce haul distances to the overburden emplacement area and improve the overall efficiencies in mining operations. The majority of the nearest private residences, specifically those in the Falbrook and Middle Falbrook area, are located to the east, south-east and south of the Project Area. As the North Pit Continuation mining area progresses south, the distance to the local residences in these areas reduces. To reduce the potential air quality and noise impact associated with the Project, the option of locating these haul roads deeper within the mine, or to the western side of the North Pit Continuation was investigated. Through this investigation it was determined that a number of in-pit haul roads could be located on the western side of the North Pit Continuation, when mining has progressed beyond the currently approved North Pit into the Continuation area. This allows for a substantial increase in the distance (approximately 1.5 kilometres) between these haul roads and the nearest local residences.

As part of the original design the haul roads that were located on the eastern edge of the North Pit Continuation were at natural surface level and thus machines operating on those haul roads would be in exposed locations whilst hauling. This is consistent with the current operational design used at the existing North Pit. The revised mine design considered locating the haul roads, for as far as practical, within the North Pit Continuation mining area and below the natural surface of the local topography. The design goal was to use the active mining area highwall and surrounding topography as a ‘shield’ to reduce potential noise impacts. This shielding permitted haulage to be undertaken on both the east and

western side of the North Pit Continuation, although the primary coal haul road to the Mount Owen CHPP is designed to be on the western side of the North Pit Continuation in the later years of the Project. This design goal was achieved with the majority of the proposed haul roads being located below the natural surface, extending to the surface when overburden emplacement activities were further to the north or where they meet the northern haul roads to the ROM stockpile.

This integrated haul road design and impact modelling process has identified a range of practicable haul road design options that can be implemented to provide flexibility such that operational changes can be employed in adverse meteorological conditions, to ensure that noise emissions are consistent with predicted levels.

Haul Roads Practice – North Pit Continuation and BNP

To further reduce potential impacts, the alternative of bunding the longer, more permanent haul roads at strategic locations within the North Pit Continuation and BNP was considered. The locations for the bunds were chosen in areas where haul roads were aligned generally perpendicular to the dominant wind direction (from the north-west) to provide additional 'shielding' for the operational equipment. The preliminary quantitative review of the effectiveness of these bunds identified that, when located appropriately, they do assist in the reduction of predicted noise emissions. Accordingly, the inclusion of bunds in strategic locations along some haul roads has been included in the Project, and modelling has shown benefits and a reduction in noise at the source.

Dust emissions from haul roads was one of the key drivers of potential air quality impacts. Currently, Mount Owen and Ravensworth East operates in accordance with its Pollution Reduction Program (PRP) on EPL 4460 and EPL 10860 respectively, which specifies that a haul road emission control factor of 80 per cent must be achieved during operation. As mining progresses to the south, haul distances to the ROM stockpile increase. An initial review was completed using the current haul road emission factor of 80 per cent, however given the increased length of haul roads this resulted in an increase in the potential air quality impacts.

Mount Owen completed a study over three separate days in different seasons, on the baseline haul road emissions to monitor what was being achieved and what could be achieved during future operations. This baseline monitoring identified that, on the days of sampling, haul road emission factors were in excess of 80 per cent as outlined in the PRP. Based on this, the Project completed further sensitivity modelling utilising a haul road emission factor of 85 per cent, which reduced the potential air quality impacts associated with the Project. A haul road emission factor of 85 per cent is considered readily achievable for the Project and has been included in the concept design for the Project.

Ravensworth East Resource Recovery Mining Area

A proposed mining area located slightly to the south of the current RERR Mining Area was considered in the early design phase. During the preparation of the EIS, a number of constraints were identified including the adjoining Bettys Creek Habitat Management Area (HMA) and an existing archaeological site. This alternative would also require the disturbance of previously undisturbed ground and the disturbance of a larger area of rehabilitation. Based on these factors, this option was refined through a redesign of the mine plans by moving the boundary of the RERR Mining Area to the north to ensure that impact on the Bettys Creek HMA and the known archaeological site was avoided. This redesign resulted in an improved strip ratio and provides an overall reduction of impacts as the RERR Mining Area is located entirely on previously disturbed land.

The Project plans to surrender the existing Ravensworth East development consent, and accordingly operations associated with concurrent mining within the RERR Mining Area and the North Pit Continuation are considered.

For Year 10 of the Project, iterative modelling of potential noise impacts indicated that should adverse weather conditions occur, operations within the RERR Mining Area combined with the proposed North Pit Continuation have potential to result in greater noise impacts. To reduce these potential impacts, two options were considered for modelling purposes. The first option included reducing activities specifically on the high overburden emplacement areas within the RERR Mining Area. While the proposed reduction in overburden emplacement activity at these locations in adverse weather conditions during the winter night period resulted in a reduced predicted impact, it was considered that further reduction in potential impact could be achieved. The second option considered was the potential shutting down of fleet, in adverse weather conditions during the winter night period, within the RERR Mining Area. The quantitative review of this option indicated that it would achieve a reduction in potential noise impacts while still maintaining the viability of the RERR Mining Area and has been applied to the Project's design, (refer to **Section 5.3**).

Outcomes Based Approach

The iterative noise emission modelling and mine design process outlined above have demonstrated that practicable mitigation measures exist that can be implemented to manage predicted noise from the mine to within the levels predicted in the Noise Impact Assessment. A range of mitigation measures including mine and haul road design processes as well as mine operational practices will be implemented by Mount Owen, in combination with a monitoring program to ensure that noise impacts are consistent with those predicted. Further details on proposed air quality and noise impact mitigation measures are provided in **Sections 5.2** and **5.3**, respectively.

2.5.3.2 Mining Fleet – North Pit Continuation

Mount Owen Mine is currently a truck and excavator operation. Consideration was given to an alternate mobile fleet composition for the Project; however given the complex geological conditions in North Pit, the current fleet composition is considered the most suitable.

Mount Owen also considered the potential option of a conveyor within the pit to convey ROM coal to the ROM stockpile. However as the Mount Owen Mine is a deep mine with complex geology and overburden being placed within pit in addition to the substantial distance from the active workings to the Mount Owen CHPP in the later years of the Project, the use of haul trucks was determined to be the most efficient.

2.5.3.3 Final Landform

Mount Owen has reviewed a number of final landform options as part of the Project and is seeking to plan for and design a final landform that will be undulating and natural looking post mining. The initial conceptual final landform was designed based on the optimal in-pit overburden emplacement plan that resulted in a flat topped, uniform landform typical of previous mining landforms in the Hunter Valley. The conceptual final landform that is discussed further in **Section 5.19** has been designed to meet the objectives of being safe and stable whilst providing opportunities for sustainable post mining land use options. This final landform will continue to be refined as part of the development of the Closure Plan.

Mount Owen reviewed a number of potential options to reduce the need for final voids as a result of the Project. Mount Owen also reviewed the potential for the use of material from WOOP Emplacement Area (refer to **Figure 2.3**) to backfill the proposed final voids. Mount Owen estimates it would take approximately an additional five years to use the material from the WOOP Emplacement Area in the final voids and the double handling of overburden would severely impact the economic viability of the Project. This additional time would result in increased air quality and noise impacts during the emplacement. Based on these considerations the option to rehandle overburden from the WOOP Emplacement Area was discounted.

The initial design for the BNP final void had very steep batter angles that would render successful rehabilitation very difficult. Mount Owen subsequently reviewed these batter angles and amended the design to reduce these batter angles to improve the potential for rehabilitation success. The use of RERR overburden material considerably improved the final landform shape of BNP. Additionally, Mount Owen is currently reviewing the potential option of using the BNP void for beneficial reuse for water storage. The potential use of the BNP void in this capacity may eliminate the need for water storages to be developed within other Glencore mines in the Greater Ravensworth Area and also realise a beneficial reuse for a final void.

The RERR Mining Area will be mined in the later stages of the Project and will be used for tailings emplacement during the final years of the Project to enable the West Pit tailings area to consolidate prior to capping. It is anticipated that the RERR Mining Area will have tailings capacity remaining. There is the potential option for the RERR Mining Area to be used for tailings emplacement from other Glencore mines within the Greater Ravensworth Area. The potential for continued use of this area for tailings emplacement and implications for mine closure, will be considered as part of detailed mine closure planning, initiated five years prior to cessation of mining as part of this Project.

2.5.4 Detailed Infrastructure Design Process

The following sections describe the refinements of the detailed design for the proposed infrastructure works in order to optimise the use of the existing infrastructure and previously approved disturbance areas in accordance with the key Project objectives.

2.5.4.1 Rail Alignment

A portion of the proposed rail line dissects the current Bettys Creek HMA in the southern portion of the Project Area. The Bettys Creek HMA was set aside as an offset area as a result of the 2007 modification approval for Glendell Mine, and in this modification a corridor was identified and excluded from the HMA for a potential future rail line. The design of the proposed rail line has sought to use this area as far as practicable. It should be noted that during the preparation of the Glendell Mine Aboriginal Cultural Heritage Management Plan (ACHMP) (Umwelt 2008), the HMA was identified by the Registered Aboriginal Parties as being a suitable area for the management of Aboriginal cultural values.

The boundary of the Bettys Creek HMA was originally identified as conceptual within the Glendell Mine Operations Environmental Assessment (2007) and required confirmation, which Mount Owen has sought from DP&E as part of an update to the Mount Owen Complex Landscape Management Plan. The confirmation of the Bettys Creek HMA boundary will allow for the requirements under the applicable consent to be maintained while also providing for the construction and operation of the proposed rail line and northern turn out.

Two alignment options were initially considered for the proposed rail line. One option ran in a northerly direction along the eastern side of the Glendell Mine out-of-pit overburden emplacement area before heading to the east between TP1 and the RERR Mining Area and connecting to the existing rail loop. This potential option was not considered feasible as it would have been constructed on old mine overburden emplacement areas, which would have resulted in constructability and operability issues associated with differential settlement. Additionally, this rail alignment required a heavy vehicle overpass for mining equipment to access the RERR Mining Area.

The second, preferred option also runs along the eastern side of the Glendell Mine out-of-pit overburden emplacement area, maximising the use of the previously approved disturbance area, however it skirts to the south of the RERR Mining Area before connecting to the existing Mount Owen rail line. An early alignment for the second option had the rail line impacting two known archaeological sites, namely MORL-2 (37-3-0294) and Bettys Creek 22 (37-3-0612), which were previously identified for conservation. The alignment was subsequently modified to avoid this impact (refer to **Figure 2.19**).

The proposed rail line (second option) has been located within the existing approved Glendell Mine disturbance area as far as practicable. This design objective has resulted in a reduction in the total disturbance area required for the construction and operation of the proposed rail line. The proposed rail line alignment is also planned to cross Bettys Creek. Mount Owen has designed the bridge to be a single span bridge, which will not require any piers in the existing Bettys Creek.

2.5.4.2 Hebden Road Upgrade Works

Hebden Road Realignment

The proposed Hebden Road upgrade works include the construction of a new section of Hebden Road to the south of the existing alignment between the existing Hebden Road / New England Highway intersection, extending to just beyond the proposed Bowmans Creek Bridge. The initial design for the proposed Hebden Road upgrade included the construction of a new intersection replacing the existing Hebden Road / New England Highway intersection. Further assessment of the existing and proposed traffic volumes indicated the existing intersection, which was upgraded in 2013, is sufficient to provide the level of service required. The proposed design was revised to remove a new intersection and as a result reduces the impact of the construction phase for the Project on traffic flow on both Hebden Road and the New England Highway. It also makes appropriate use of existing infrastructure.

The Proposed Disturbance Area for the Hebden Road upgrade works also allows for construction lay down areas. The proposed lay down areas have been located on the eastern side of the Main Northern Rail Line to minimise disturbance to the former Ravensworth Village and the former Ravensworth School. The former Ravensworth School is listed as a heritage item of local significance.

Access to the former Ravensworth School, Main Northern Rail Line and Ravensworth Underground Mine (RUM) ventilation fan has been provided off the realigned Hebden Road to the north. Access has also been provided to the south to the existing Telstra microwave tower and exchange. The height of the realigned Hebden Road at these minor intersection locations has been kept close to grade (whilst still allowing for a suitable approach grade to the proposed rail overpass) to minimise the extent of earthworks and disturbance required for these accesses, and assist with pavement tie-in works during construction.

umwelt

Image Source: Mount Owen (2013)
Data Source: Mount Owen (2014)

0 100 200 400m
1:7 500

Legend

- Project Area
- Previous Disturbance Area
- Proposed Disturbance Area
- Rail Upgrade Works
- Artefact Scatter

FIGURE 2.19

Proposed Rail Alignment and Known Archaeological Sites

File Name (A4): R02/3109_840.dgn
20140922 8.31

Bowmans Creek Bridge Design

The initial Project design included duplicating the existing single lane Bowmans Creek Bridge with another single lane bridge to the south. This option was discounted as it was considered that greater safety and efficiency gains would be created by the construction of a new dual lane bridge over Bowmans Creek. The proposed bridge is a two lane bridge located to the south of the existing single lane bridge across Bowmans Creek. The bridge has been designed to avoid direct impact to the low flow channel of Bowmans Creek by locating the piers and columns outside of this area.

Beneficial Re-use of Material

Materials for the proposed Hebden Road upgrade works such as engineered fill and rock will be extracted from within the approved Glendell Mine disturbance area with access provided by an existing access track which will require minor upgrade works. Sourcing fill and rock from the existing disturbance areas will negate the requirement to transport this material to site and will utilise material which would otherwise be transported to the overburden emplacement areas. Pavement materials for Hebden Road will be sourced from local quarries.

2.5.4.3 Alternative of Not Proceeding with the Project

The option of not proceeding with the Project would mean the closure of the Mount Owen and Ravensworth East Mine in approximately 2018 and 2021, respectively. 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 and there would be a significant reduction in employee numbers. The employment opportunities for approximately 660 employees (North Pit) and up to 260 (Ravensworth East) would be lost as would the significant flow on effect to the local, regional and state economy. Additionally, the economic viability of BNP would be at risk if the Project did not proceed as the BNP would not extract enough ROM coal to keep the Mount Owen CHPP sufficiently utilised.

The Project will extract approximately 92 Mt of ROM coal during the life of the Project. The extraction of this ROM coal by extending the existing open cut operations and utilising existing equipment is more efficient than reopening operations following closure. Not proceeding with the Project will make it considerably more expensive to extract the coal in the future, relative to the continuation of mining as part of the Project 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 infrastructure are not likely to be available if mining of the resource was delayed.

Closing the operations following the extraction of the existing approved ROM coal 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 economic and social benefits provided to the community at a local, regional and state level by the implementation of the Project. These benefits are discussed in detail in **Section 2.6** below. Benefits would not be realised should the Project not proceed.

As outlined in **Section 7.3**, 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 5.18**, the Project would inject approximately $1,288 million into the Hunter Valley regional economy and approximately $1.9 billion in the State economy.

On this basis, it would be reasonable to conclude that with the implementation of appropriate management, mitigation and offset measures as outlined in **Section 5.0**, the benefits of the Project outweigh the potential impacts. Mount Owen therefore considers that not proceeding with the Project is not an appropriate alternative.

2.6 Benefits of Preferred Project Design

As outlined above, the conceptual Project design phase has led to a number of optimisation opportunities for the Project. These benefits have been realised whilst also achieving the Project objectives as outlined **Section 1.0**. This includes:

- extending the mine life of the North Pit and Ravensworth East (from current approved mine life) allowing the extraction of approximately an additional 92 Mt of ROM coal from within existing Glencore mining tenements and optimising the use of existing infrastructure;
- maximising the use of previously disturbed areas and existing mining infrastructure, thereby minimising the overall Proposed Disturbance Area as far as practicable;
- combining of the Mount Owen and Ravensworth East consents to allow for more efficient operational and compliance management;
- avoidance of impact to existing Biodiversity Offset Areas and the Ravensworth State Forest;
- design of the mining area to be greater than 200 metres from the high bank of Main Creek;
- Minimising the potential air quality and noise impacts through a thorough review of design options including mining sequencing and the incorporation of management and mitigation measures into the Project;
- public road upgrades proposed for the Project will improve traffic safety and flow for users on Hebden Road;
- further development of the existing environmental mitigation and management strategies, expanding the existing commitments to mitigate and manage the predicted impacts associated with the Project;
- establishing a final landform that is safe and stable which provides sustainable post mining land use options which integrates with other Glencore mines in the area to maximise opportunities for regional biodiversity corridors; and
- maintaining the economic life of the Mount Owen Mine and providing ongoing employment for the existing workforce and continued economic benefit to the local (approximately $306 million Net Present Value (NPV)), regional (approximately $1.3 billion NPV) and State (approximately $1.9 billion NPV) economies.

3.0 Statutory Provisions

The following section identifies relevant State and Commonwealth legislation and discusses the application of these planning provisions to the Project.

3.1 Commonwealth Legislation

Table 3.1 provides a review of the relevant Commonwealth environment and planning legislation and its relevance to the Project.

Table 3.1 - Summary of Commonwealth Legislation and Relevance to the Project

Planning Provision	Comments	Approval Required
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	The EPBC Act is the primary environmental and planning regulatory instrument relevant to the Project at a Commonwealth level. 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 any matters of national environmental significance (MNES). MNES are as follows: • World Heritage property; • National heritage place; • wetlands of international importance (listed under the Ramsar Convention); • threatened species and communities listed under the EPBC Act; • migratory species listed under the EPBC Act; • nuclear actions; • marine areas or reserves; • a water resource, in relation to coal seam gas development and large coal mining development; and • Commonwealth land. As outlined in **Section 5.7**, an ecological assessment was undertaken within the Proposed Disturbance Area which identified species and communities listed under the EPBC Act that would potentially be impacted by the Project. The Project was considered not to have a significant impact on water resources, from both a Project specific and cumulative perspective, as discussed in **Section 5.5**.	Yes

Table 3.1 - Summary of Commonwealth Legislation and Relevance to the Project - cont.

Planning Provision	Comments	Approval Required
	The proposed activities in the Proposed Disturbance Area (the 'Action') were referred to the Department of the Environment to determine whether the Project is a controlled action under the EPBC Act and therefore requiring approval from the Commonwealth Minister for the Environment. On 24 October 2013 the DoE determined that the Project is a controlled action. In August 2014, Mount Owen sought a variation to the controlled action to allow for the optimisation of the North Pit Continuation. This application for variation was approved on 25 August 2014. A copy of this documentation is provided in **Appendix 1**. Supplementary DGRs for the Project were provided by DP&E to identify additional assessment requirements, in addition to the assessment contained in the original DGR's. On 19 September, DoE confirmed that the supplementary DGRs would remain applicable to the varied action. A separate assessment of the Project's potential impact on the relevant MNES is contained in **Appendix 4**.	
Native Title Act 1993	The *Native Title Act* is administered by the National Native Title Tribunal. The Tribunal is responsible for maintaining a register of native title claimants and bodies to whom native title rights have been granted. These native title holders and claimants must be consulted prior to the granting of a mining lease over land to which the native title claim or right applies. This Act prescribes that native title can be extinguished under certain circumstances, including the granting of freehold land. The *Native Title Act* has implications for the grant of mining leases under the *Mining Act 1992* where there is potentially claimable land within the lease application area. There are no mining lease applications required as part of the Project, therefore the Act is not relevant. Further, a Native Title Extinguishment Assessment has been completed by Mount Owen's legal advisors for landholdings within the Mount Owen Complex, including the Project Area. This assessment has confirmed that native title has been extinguished for all land parcels within the Proposed Disturbance Area.	No

3.2 New South Wales Legislation

3.2.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning & Assessment Act 1979* (EP&A Act) is the primary legislation governing environmental planning and assessment for NSW.

The objects of the EP&A Act are set out in Section 5 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,

(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 objects, 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 prepared under Part 3 of the Act.

The State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP) prescribes ‘coal mining’ as a being a State significant development meaning development consent under Part 4 of the EP&A Act is required before coal mining can be carried out.

3.2.1.1 Approval Pathway

State Significant Development

As discussed in **Section 2.1**, the Project Area is currently subject to two development consents issued under Part 4 of the EP&A Act (i.e. Mount Owen and Ravensworth East). The Project will extend the life of the Ravensworth East Mine and the life and footprint of the North Pit and includes the construction of additional mining and related infrastructure; as such, the Project will require further assessment and approval under the EP&A Act before it can be carried out.

The Project is properly characterised as being 'coal mining' and is therefore State Significant Development as defined by the provisions of the SRD SEPP and requires development consent under Part 4 of the EP&A Act. The Minister for Planning is the consent authority for State Significant Development. The development application may be determined by the Planning Assessment Commission (PAC) under delegation from the Minister for Planning.

Permissibility

The Minister cannot approve the carrying out of a State Significant Development that would be wholly prohibited under an environmental planning instrument.

The Project is located wholly within the area to which the Singleton Local Environment Plan (LEP) 2013 applies. Under the Singleton LEP (Singleton Council 2013a) the whole of the land on which the Project is proposed to be carried out is zoned Rural RU1 Primary Production.

Both coal mining and agriculture are permissible land uses within the Rural RU1 Primary Production zone under the Singleton LEP, and therefore the Project is permissible with consent.

There are no other environmental planning instruments that regulate the permissibility of mining in the Project Area except to the extent that the operation of the Singleton LEP in relation to mining is constrained by the State Environmental Planning Policies, which prevail over LEPs to the extent of any inconsistency.

The *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries*) 2007 also provides that mining is permissible where agriculture is also permissible under the provision of an Environment Planning Instrument.

3.2.1.2 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 delegate, must have regard to the matters set out in section 79C of the Act. These are matters for consideration by the consent authority and the sections where they have been addressed in this EIS are provided in **Table 3.2**.

Table 3.2 – Section 79C Matters for Consideration

Matters for Consideration	Relevant EIS Section
(a) The provisions of: Any environmental planning instrument.	**Section 3.2.2**
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 Director-General has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved).	**Section 3.2.2**
Any development control plan.	**Not applicable due to Clause 11 of SRD SEPP**

Table 3.2 – Section 79C Matters for Consideration – cont.

Matters for Consideration	Relevant EIS Section
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.	**Section 4.0**
The regulations (to the extent that they prescribe matters for the purposes of this paragraph).	**Table 3.3 below**
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 – the Project is not subject to any coastal zone 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 5.0**
(c) The suitability of the site for the development.	**Section 7.0**
(d) Any submissions made in accordance with this Act or the regulations.	**Comments to be received on the EIS during exhibition period**
(e) The public interest.	**Section 7.3 and 7.4**

In addition to the requirements under section 79C, the consent authority must also have regard to an environmental impact statement which meets the requirements of section 78A(8A) of the EP&A Act. Specifically, section 78A(8A) requires the EIS to be prepared in accordance with the requirements of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (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 3.3**.

Table 3.3 – Schedule 2 EP&A Regulation Requirements

Regulation Clause	Requirement	Where addressed in EIS
Clause 6(a)	Name, Address and Professional qualifications of person preparing the EIS.	**Appendix 2**
Clause 6(b)	Name of the Consent Authority.	**Section 1.4**
Clause 6(c)	Address of Land.	**Appendix 2**
Clause 6(d)	Description of development.	**Section 2.3**
Clause 6(e)	Assessment of the environmental impact of the Project.	**Section 5.0**
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**
Clause 7(1)(b)	A statement of the objectives of the development.	**Section 1.0**
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 2.5**
Clause 7(1)(d)(i)	A full description of the development, activity or infrastructure.	**Section 2.3**

Table 3.3 – Schedule 2 EP&A Regulation Requirements – cont.

Regulation Clause	Requirement	Where addressed in EIS
Clause 7(1)(d)(ii)	A general description of the environment likely to be affected by the development.	**Sections 1.3 and 5.1**
Clause 7(1)(d)(iii)	The likely impact on the environment of the development.	**Section 5.0**
Clause 7(1)(d)(iv)	A full description of the measures proposed to mitigate any adverse effects of the development on the environment.	**Sections 5.0 and 6.0**
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 3.0**
Clause 7(1)(e)	A compilation of the mitigation measures referred to in Clause 7(1)(d)(iv).	**Section 6.0**
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.	**Section 7.0**

The EIS has also addressed the DGRs provided for the Project. The DP&E issued DGRs for the Project on 13 March 2013 and supplementary DGRs[2] dated 8 November 2013. The DGRs outline the specific requirements to be addressed by this EIS. A copy of the DGRs and supplementary DGRs are contained in **Appendix 1**. In 2014, Mount Owen undertook consultation with both DP&E and the DoE regarding the DGRs with consideration to the proposed Project changes as outlined in **Section 2.0**. Both DP&E and the DoE confirmed that the DGRs originally issued for the Project were appropriate.

A checklist of the DGRs and where they have been addressed within the EIS is presented in **Table 3.4** with the supplementary DGRs provided in **Table 3.5**. **Appendix 4** addresses the supplementary DGRs, and includes a checklist and separate report to provide clarity on where all relevant matters under the EPBC Act are addressed in that report. The specific government agency requirements included as an attachment to the DGRs have been addressed where relevant, throughout the EIS and the relevant specialist studies.

[2] Supplementary DGRs issued following determination of the Project as a controlled action by the Department of Environment.

Table 3.4 – Director-General's Requirements for the Environmental Impact Statement

General Requirements	Relevant EIS Section
The Environmental Impact Statement (EIS) for the development must meet the form and content requirements in clauses 6 and 7 of schedule 2 of the Environmental Planning and Assessment Regulation 2000.	**Table 3.3**
In addition, the EIS must include a: ▪ Detailed description of the development, including: ▪ need for the proposed development; ▪ justification for the proposed mine plan, including alternatives considered, efficiency of resource recovery, mine safety, environmental protection, and any changes to existing biodiversity offset obligations; ▪ likely staging of the development - including construction, operational stage / s and rehabilitation; ▪ consideration of opportunities for integration between the development and Xstrata's existing, approved and proposed mining operations in the region; and ▪ interactions with other mines, including the Integra Underground Mine. ▪ The DA must be accompanied by a certified report from a qualified quantity surveyor providing a detailed calculation of the capital investment value (as defined in Clause 3 of the Environmental Planning and Assessment Regulation 2000) of the proposed development including details of assumptions and components from which the capital investment value is derived	**Section 2.2** **Sections 2.3 and 2.5** **Section 2.3** **Sections 2.3 and 2.6** **Section 2.3.3** **This report is commercial in confidence and has been provided separately to DP&E**
▪ Consideration of all relevant environmental planning instruments (including Part 3 of the Mining, Petroleum Production and Extractive Industry State Environmental Planning Policy 2007), and identification and justification of any inconsistencies with these instruments.	**Section 3.0**
▪ Detailed assessment of the key issues specified below, and any other significant issues identified in this risk assessment, which includes: ▪ a description of the existing environment, using sufficient baseline data; ▪ an assessment of the potential impacts of all stages of the development, including any cumulative impacts, taking into consideration relevant guidelines and policies; and ▪ a description of the measures that would be implemented to avoid, minimise and, if necessary, offset the potential impacts of the development, including proposals for adaptive management and / or contingency plans to manage any significant risks to the environment.	**Section 5.0**

Table 3.4 – Director-General's Requirements for the Environmental Impact Statement – cont.

Key Issues – The EIS must address the following specific matters:	Relevant EIS Section
▪ Air Quality - including a quantitative assessment of potential construction, operational and cumulative air quality impacts on potential receivers including: ▪ dust impacts on privately-owned properties, mine-owned properties, and properties in the acquisition zone of Mount Owen or any other mine; ▪ 24-hour cumulative PM_{10} emissions using an appropriate probabilistic methodology, project-specific and cumulative $PM_{2.5}$ emissions, and dust generated by the transportation of coal; ▪ fumes from diesel, blasting activities and spontaneous combustion; ▪ reasonable and feasible mitigation measures to minimise dust, diesel and blast fume emissions, including evidence that there are no such measures available other than those proposed; and ▪ monitoring and management measures, in particular real-time air quality monitoring and adaptive management protocols.	**Section 5.2**
▪ Noise, Vibration & Blasting - including a quantitative assessment of potential: ▪ construction, operational and off-site road / rail noise impacts; ▪ blasting impacts on nearby mining operations; ▪ blasting impacts on people, livestock and property; ▪ reasonable and feasible mitigation measures, including evidence that there are no such measures available other than those proposed; and ▪ monitoring and management measures, in particular real-time attended noise monitoring, and predictive meteorological forecasting.	**Sections 5.3 and 5.4**
▪ Agricultural Resources - including an Agricultural Impact Statement that includes a specific focussed assessment of the impacts of the proposal on strategic agricultural land, having regard to the gateway criteria in the Strategic Regional Land Use Policy. The EIS must also include a detailed description of the potential impacts on: ▪ soils and land capability; ▪ landforms and topography; and ▪ other land uses within the vicinity of the mine, including land within the nearby Ravensworth State Forest.	**Section 5.8**

Table 3.4 – Director-General's Requirements for the Environmental Impact Statement – cont.

Key Issues – The EIS must address the following specific matters:	Relevant EIS Section
▪ Water resources – including: ▪ Detailed assessment of potential impacts (including cumulative impacts) on the quality and quantity of existing surface and groundwater resources, including: - detailed modelling of potential groundwater impacts, including any potential impacts on alluvial aquifers; - impacts on affected licensed water users and basic landholder rights; - impacts on riparian, ecological, geo-morphological and hydrological values of watercourses, including environmental flows; - a flood assessment including identification of any necessary flood impact mitigation measures; ▪ a detailed site water balance, including a description of site water demands, water disposal methods (inclusive of volume, salinity and frequency of any water discharges), water supply infrastructure and water storage structures; ▪ an assessment of proposed water discharge quantities and quality against receiving water quality and flow objectives; ▪ assessment of impacts of salinity from mining operations, including disposal and management of coal rejects and modified hydrogeology, a salinity budget and the evaluation of salt migration to surface and groundwater sources; ▪ assessment of groundwater impacts against the minimal impact considerations in the NSW Aquifer Interference Policy; ▪ identification of any licensing requirements or other approvals under the *Water Act 1912* and / or *Water Management Act 2000*; ▪ demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP); ▪ a description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant WSP or water source embargo; ▪ a detailed description of the proposed water management system (including sewage), water monitoring program and measures to mitigate surface and groundwater impacts; and ▪ compliance with the Hunter River Salinity Trading Scheme.	**Section 5.5** (Surface Water and Water Balance Assessment) **Section 5.6** (Groundwater Assessment)

Table 3.4 – Director-General's Requirements for the Environmental Impact Statement – cont.

Key Issues – The EIS must address the following specific matters:	Relevant EIS Section
▪ Biodiversity - including: ▪ measures taken to avoid, reduce or mitigate impacts on biodiversity; ▪ identification of existing vegetation within disturbance areas, and the ecological values of this habitat; ▪ accurate estimates of proposed vegetation clearing; ▪ a detailed assessment of potential impacts of the development on any: - terrestrial or aquatic threatened species or populations and their habitats, endangered ecological communities and groundwater dependent ecosystems; - remnant vegetation, habitat corridors, and existing Biodiversity Offset Areas; and ▪ a comprehensive offset strategy for the development including a justification of how the strategy would maintain or improve the terrestrial and aquatic biodiversity values of the region in the medium to long term, and how the strategy would be integrated with the Upper Hunter Strategic Assessment process.	**Section 5.7**
▪ Heritage - including: ▪ an Aboriginal cultural heritage assessment (including both cultural and archaeological significance) which must: - demonstrate effective consultation with Aboriginal communities in determining and assessing impacts, and developing and selecting mitigation options and measures; - outline any proposed impact mitigation and management measures (including an evaluation of the effectiveness and reliability of the measures); and ▪ a Historic heritage assessment (including archaeology) which must: - include a statement of heritage impact (including significance assessment) for any State significant or locally significant heritage items; and - outline any proposed mitigation and management measures (including an evaluation of the effectiveness and reliability of the measures).	**Section 5.9** (Aboriginal Cultural Heritage) **Section 5.10** (Historical Heritage)
▪ Greenhouse Gases - including: ▪ a quantitative assessment of potential Scope 1, 2 and 3 greenhouse gas emissions; ▪ 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 emissions and ensure energy efficiency.	**Section 5.11**

Table 3.4 – Director-General's Requirements for the Environmental Impact Statement – cont.

Key Issues – The EIS must address the following specific matters:	Relevant EIS Section
▪ Traffic & Transport - including: ▪ accurate predictions of the road and rail traffic generated by the development; ▪ justification for the proposed road or rail upgrade works, and a clear description of how the upgraded road / rail operations would be integrated with the existing road / rail network; ▪ a detailed assessment of the potential impacts of the development on the capacity, efficiency and safety of the: - local and regional rail network, having regard to the strategic objectives and cumulative impacts for the passenger and freight rail network, and the impacts of coal trains on level crossings; - local and regional road network, with particular regard to a cumulative traffic impact assessment; condition assessment of the existing network; and the operation of the proposed new infrastructure on Hebden Road; ▪ details of mine to port or other domestic customer transport movements, train path availability and any required rail infrastructure works on the Main Northern Rail Line; and ▪ a detailed description of the measures that would be implemented to maintain and / or improve the capacity, efficiency and safety of the road and rail networks in the surrounding area over the life of the development, including consideration of road maintenance contributions to Singleton Council.	**Section 5.12**
▪ Visual - including: ▪ a detailed assessment of the: - changing landforms on the site during the various stages of the development; - potential visual impacts of the development on private landowners in the surrounding area as well as key vantage points in the public domain, including lighting impacts; and ▪ a detailed description of the measures that would be implemented to minimise the visual impacts of the development.	**Section 5.13**
▪ Waste - including: ▪ accurate estimates of the quantity and nature of the potential waste streams of the development, including tailings and coarse reject; ▪ a tailings and coarse reject disposal strategy; and ▪ a description of measures that would be implemented to minimise production of other waste, and ensure that that waste is appropriately managed.	**Section 5.14**
▪ Hazards - including bushfires and public safety.	**Sections 5.15** and **5.16**

Table 3.4 – Director-General's Requirements for the Environmental Impact Statement – cont.

Key Issues – The EIS must address the following specific matters:	Relevant EIS Section
▪ Social & Economic - including an assessment of the: ▪ potential direct and indirect economic benefits of the development for local and regional communities and the State; ▪ potential impacts on local and regional communities, including increased demand for local and regional infrastructure and services; ▪ a detailed description of the measures that would be implemented to minimise the adverse social and economic impacts of the Project, including any infrastructure improvements or contributions and / or voluntary planning agreement or similar mechanisms; and ▪ a detailed assessment of the costs and benefits of the development as a whole, and whether it would result in a net benefit for the NSW community.	**Sections 5.17** and **5.18**
▪ Rehabilitation - including the proposed rehabilitation strategy for the site, having regard to the key principles in the Strategic Framework for Mine Closure, including: ▪ rehabilitation objectives, methodology, monitoring programs, performance standards and proposed completion criteria; ▪ nominated final land use, having regard to any relevant strategic land use planning or resource management plans or policies; and ▪ the potential for integrating this strategy with any other rehabilitation and / or offset strategies in the region, including The Upper Hunter Strategic Assessment.	**Section 5.19**
▪ Consolidated summary of all the proposed environmental management and monitoring measures, highlighting commitments included in the EIS.	**Section 6.0**

Table 3.4 – Director-General's Requirements for the Environmental Impact Statement – cont.

Key Issues – The EIS must address the following specific matters:	Relevant EIS Section
▪ Consultation – During the preparation of the EIS, the Proponent must consult with the relevant local, State or Commonwealth government authorities, service providers, community groups or affected landowners. In particular the Proponent must consult with the: ▪ Commonwealth Department of Sustainability, Environment, Water, Population and Communities; ▪ Office of Environment and Heritage (including the Heritage Branch); ▪ Environment Protection Authority; ▪ Division of Resources and Energy within the Department of Trade and Investment, Regional Infrastructure and Services; ▪ 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; ▪ NSW Rural Fire Service; ▪ Australian Rail Track Corporation and the Hunter Valley Coal Co-ordinator; ▪ Dams Safety Committee; ▪ Hunter-Central Rivers Catchment Management Authority; and ▪ Singleton Council. The EIS must describe the consultation process and the issues raised, and identify where the design of the development has been amended in response to these issues. Where amendments have not been made to address an issue, a short explanation should be provided.	**Section 4.0**

Table 3.5 provides the details of the Supplementary DGRs and a full checklist of where each requirement is addressed in the MNES Report, (refer to **Appendix 4**).

Table 3.5 – Supplementary Director-General's Requirements for the Environmental Impact Statement

Requirement	**MNES Report Section Reference (refer to Appendix 4)**
General Information	
1. The background of the action, including:	
a. the title of the action	**2.1**
b. the full name and postal address of the designated proponent	**2.2**
c. a clear outline of the objective of the action	**2.3**
d. the location of the action	**2.4**
e. the background to the development of the action	**2.5**
f. how the action relates to any other actions (of which the proponent should reasonably be aware) that have been, or are being, taken or that have been approved in the region affected by the action	**2.6**
g. the current status of the action, and	**2.5**
h. the consequences of not proceeding with the action	**2.7**
Description of the controlled action	
2. A description of the action, including:	
a. all the components of the action	**3.1**
b. the precise location of any works to be undertaken, structures to be built or elements of the action that may have relevant impacts	**3.2**
c. 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	**3.2**
d. the timing and duration of the works to be undertaken, and	**3.1**
e. to the extent reasonably practicable, a description of any feasible alternatives to the controlled action that have been identified through the assessment, and their likely impact, including:	**3.3**
i. if relevant, the alternative of taking no action	**2.7**
ii. a comparative description of the impacts of each alternative on the matters protected by the controlling provisions for the action, and	**3.3**
iii. sufficient detail to clarify why any alternative is preferred to another	**3.3**
Description of the existing environment	
3. A description of the existing environment of the proposal location and the surrounding areas that may be affected by the action, including but not limited to:	**4.0**
a. surveys using accepted methodology for targeting listed threatened species, ecological communities and their respective habitat, including but not limited to OEH's Survey and assessment guidelines (2009), available at: http://www. environment.nsw.gov.au/threatened species/surveymethodsfauna.htm and the Department of the Environment's species-specific survey guidelines for nationally threatened species, available at: http://www. environmentgov.au/cgibin/spraVpublic/sprat.pl	**4.1.1**

Table 3.5 – Supplementary Director-General's Requirements for the Environmental Impact Statement – cont.

Requirement	MNES Report Section Reference (refer to Appendix 4)
b. a description of the distribution and abundance of threatened species and ecological communities, as well as suitable habitat (including breeding, foraging, roosting habitat, habitat critical to the survival of threatened species) within the site and in surrounding areas that may be impacted by the proposal. Specifically, this must include but not be limited to the species in Appendix A (refer to **Appendix 1**).	**4.1.2**
c. the regional distribution and abundance of suitable and potential habitat for threatened species and ecological communities surrounding the site	**4.1.3**
d. a description of the important water resources within the site and in surrounding areas, including detailed information addressing the department's Water Resources Terms of Reference, currently in preparation, and	**4.2**
e. a description of water related assets that are dependent on any important water resources, including an estimation of the water requirements of those assets (i.e. regional water use).	**4.2.3**
Description of the relevant impacts of the controlled action	
4. An assessment of all relevant impacts[3] with reference to the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines Matters of National Environmental Significance (2009), Draft significant impact guidelines: Coal seam gas and large coal mining developments - impacts on water resources* and species specific guidelines as relevant (available at: www.environment.gov.au/epbc/guidelines-policies.html) that the controlled action has, will have, or is likely to have. Information must include:	**5.0**
a. a description of the relevant impacts of the action on matters of national environmental significance:	**5.1.5**
• listed species and communities (including, but not limited to, those listed in Appendix A (refer to **Appendix 1**), and	**Section 5.1.5**
• water resources	**5.2**
b. a detailed assessment of the nature and extent of the likely short term and long term relevant impacts	**5.1.1**
c. a statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible	**5.1.2**
d. analyses of the significance of the relevant impacts, and	**5.1.3**
e. any technical data and other information used or needed to make a detailed assessment of the relevant impacts.	**5.1.4**

[3] The term "relevant impact" is defined in section 82 of the EPBC Act. Note that the action has been found to be likely to have a significant impact on listed species and communities, under sections 18 and 18A of the EPBC Act, and water resources, under sections 24D and 24E of the Act.

Table 3.5 – Supplementary Director-General's Requirements for the Environmental Impact Statement – cont.

Requirement	MNES Report Section Reference (refer to Appendix 4)
5. Where there is a potential habitat for EPBC Act listed species (Appendix A (refer to **Appendix 1**)), surveys must be undertaken. These surveys must be timed appropriately and undertaken for a suitable period of time by a qualified person[4]. A subsequent description of the relevant impacts on such EPBC Act listed species should include, inter alia, direct, indirect, cumulative and facilitative impacts on the:	**5.1.5**
a. population of the species at the site	**5.1.5**
b. area of occupancy of the species	**5.1.5**
c. habitat critical to the survival of the species	**5.1.5**
d. breeding cycle of the population, and	**5.1.5**
e. availability or quality of habitat for the species	**5.1.5**
If an endangered ecological community or threatened species listed at Appendix A (refer to **Appendix 1**) is not believed to be present on the proposed site, detailed information must be included in the Environmental Impact Assessment to demonstrate that this community will not be impacted.	**5.1.5**
6. Under sections 24D and 24E of the EPBC Act, a water resource in relation to coal seam gas and large coal mining development has been determined a controlling provision in relation to this project. The documentation provided must include information addressing all relevant impacts on water resources and water related values. The information must be consistent with the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development's *Information Guidelines for Proposals Relating to the Development of Coal Seam Gas and Large Coal Mines where there is a Significant Impact on Water Resources*. The Guidelines are available at: http://www.environment.gov.au/coal-seam-gasmining/pubs/iesc-information-guidelines.pdf. The information must include:	**5.2, 5.4**
• a detailed assessment of potential impacts (including cumulative impacts) on the quality and quantity of existing surface and ground water resources, including:	**5.2**
a. detailed modelling of potential groundwater impacts, including any potential impacts on alluvial aquifers	**5.3.2**
b. impacts on affected licensed water users and basic landholder rights	**5.3.1.7, 5.3.2.2**
c. impacts on riparian, ecological, geo-morphological and hydrological values of watercourses, including environmental flows, and	**3.2, 5.3.1.1, 5.3.1.5, 5.3.1.6, 5.3.2.5**
d. a flood assessment including identification of any necessary flood impact mitigation measures	**5.3.1.2**
• a detailed site water balance, including a description of site water demands, water disposal methods (inclusive of volume, salinity and frequency of any water discharges), water supply infrastructure and water storage structures	**5.5**

[4] Where available, species-specific survey guidelines can be obtained on the department's *Species Profile and Threats Database*: http ://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

Table 3.5 – Supplementary Director-General's Requirements for the Environmental Impact Statement – cont.

Requirement	MNES Report Section Reference (refer to Appendix 4)
• an assessment of proposed water discharge quantities and quality against receiving water quality and flow objectives	**5.5.1, 5.3.1.1, 5.3.1.3, 5.3.1.7, 5.3.1.4, 5.3.2.1, 5.3.2.3, 5.3.2.4, 5.3.2.6**
• assessment of impacts of salinity from mining operations, including disposal and management of coal rejects and modified hydrogeology, a salinity budget and the evaluation of salt migration to surface and groundwater sources	**5.5.2**
• assessment of groundwater impacts against the minimal impact considerations in the *NSW Aquifer Interference Policy*	**5.6.1**
• identification of any licensing requirements or other approvals under the *Water Act 1912* and/or *Water Management Act 2000*	**5.6.2, 8.0**
• demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP)	**5.5, 5.6.2**
• a description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant WSP or water source embargo	**5.6.2, 5.7.2.1, 5.7.3**
• a detailed description of the proposed water management system (including sewage), water monitoring program and measures to mitigate surface and groundwater impacts, and	**5.7**
• information on how the project will comply with the Hunter River Salinity Trading Scheme	**5.2**
Proposed safeguards and mitigation measures	
7. A description of feasible mitigation measures, changes to the action or procedures, which have been proposed by the proponent or suggested in public submissions, and which are intended to prevent or minimise relevant impacts on matters of national environmental significance. Information must include:	**6.0**
a. a description of the mitigation measures that will be undertaken to prevent or minimise the relevant impacts of the action. These mitigation measures should be justified and based on best available practices	**6.1**
b. an assessment of the expected or predicted effectiveness of the mitigation measures including the effect on abundance and condition of species, suitable habitat and ecological communities	**6.2**
c. any statutory or policy basis for the mitigation measures	**6.3**
d. the cost of the mitigation measures	**6.4**
e. an environmental management plan that sets out the framework for continuing management, mitigation and monitoring programs (including any relevant thresholds for corrective actions) for the relevant impacts of the action. Include the person or agency responsible for implementing these programs and the effectiveness of all mitigation measures, including any provisions for independent environmental auditing	**6.5**
f. the name of the agency responsible for endorsing or approving each mitigation measure or monitoring program	**6.6**

Table 3.5 – Supplementary Director-General's Requirements for the Environmental Impact Statement – cont.

Requirement	MNES Report Section Reference (refer to Appendix 4)
g. identification of mitigation measures proposed to be undertaken by State governments, local governments or the proponent, and	**6.7**
h. any changes to the action which prevent or minimise relevant impacts on listed threatened species and communities	**6.8**
Offsets	
8. Where impacts cannot be avoided or mitigated, an offset package to compensate for any predicted or potential residual significant impacts on matters of national environmental significance. Offsets should demonstrate consistency with the Commonwealth EPBC Act Environmental Offsets Policy (October 2012, or subsequent versions), available at: www.environment.gov.au/epbc/publications/environmental-offsets-policy.html. The department's information requirements in relation to EPBC Act offset proposals is provided at Appendix B (refer to **Appendix 1**). Information must include:	**7.0**
a. the description of any offset package should include how the offset compensates for the residual impacts, when the offset will be delivered and how the offset will be managed	**7.1**
b. an assessment of the impact of the offsets on other matters of environmental, economic, or social significance and	**7.2**
c. analysis of cost, both financial and other, related to offsets.	**7.2**
Other approvals and conditions	
9. Any other requirements for approval or conditions that apply, or that the proponent reasonably believes are likely to apply, to the proposed action. Information must include:	**8.0**
a. details of any local or State government planning scheme, or plan or policy under any local or State government planning system that deals with the proposed action, including:	**8.1**
i. what environmental assessment of the proposed action has been, or is being, carried out under the scheme, plan or policy, and	**8.1**
ii. how the scheme provides for the prevention, minimisation and management of any relevant impacts	**8.1**
b. a description of any approval that has been obtained from a State, Territory or Commonwealth agency or authority (other than an approval under the EPBC Act), including any conditions that apply to the action	**8.2**
c. a statement identifying any additional approval that is required, and	**8.2**
d. a description of the monitoring, enforcement and review procedures that apply, or are proposed to apply, to the action	**8.3**
Economic and social matters	
10. A description of the short-term and long-term social and economic implications and / or impacts of the project.	**9.1**
Environmental record of person proposing to take the action	
11. 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:	**10.0**
a. the proponent, and	**10.0**
b. for an action for which a person has applied for a permit, the person making the application.	**10.0**

Table 3.5 – Supplementary Director-General's Requirements for the Environmental Impact Statement – cont.

Requirement	MNES Report Section Reference (refer to Appendix 4)
12. Details of the proponent's environmental policy and planning framework.	**10.1**
Information Sources	
13. For information given in an environment assessment, the draft must state:	**11.0**
a. the source of the information	**11.0**
b. how recent the information is	**11.0**
c. how the reliability of the information was tested, and	**11.0**
d. what uncertainties (if any) are in the information.	**11.0**
Consultation	
14. Any consultation about the action, including:	**12.0**
a. any consultation that has already taken place	**12.0**
b. proposed consultation about relevant impacts of the action, and	**12.0**
c. if there has been consultation about the proposed action - any documented response to, or result of, the consultation	**12.0**
15. Identification of affected parties, including a statement mentioning any communities that may be affected and a description of their views.	**12.1**

3.2.2 Environmental Planning Instruments

The environmental planning instruments that are applicable to the Project are discussed in **Sections 3.2.2.1** and **3.2.2.2**.

3.2.2.1 Local Environmental Plans

Singleton Local Environmental Plan 2013

Under the Singleton LEP 2013, the Mount Owen Complex is located with an area zoned as RU1 Primary Production. The objectives of the RU1 zone are outlined below.

- 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.

Open cut mining is identified as development which is permissible with consent within the RU1 Primary Production zone and the Project is considered to be consistent with the objectives of the zone. Compatibility with other land uses is discussed further in **Section 5.1**.

3.2.2.2 State Environmental Planning Policies

The following State Environmental Planning Policies are relevant to the consideration of the development application for the Project.

State Environmental Planning Policy (State and Regional Development) 2011

The SRD SEPP identifies development to which the State Significant Development assessment and determination process under Division 4.1 of Part 4 of the EP&A Act applies.

As discussed in **Section 1.4**, the Project is State Significant Development as defined by the provisions of the SRD SEPP and requires development consent under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

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

The Mining SEPP regulates the permissibility and assessment requirements for mining, petroleum production and extractive industries and related development. Both the Mining SEPP and the Singleton LEP 2013 provides that the Project is permissible with consent under the current zoning of the land.

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. These requirements are set out below, and the section of the EIS in which each matter is addressed is shown in bold, where relevant.

Significance of Resource

Clause 12AA (1) & (2), provided below (refer to **Table 3.6**), requires the consent authority to consider the significance of the resource in terms of its economic benefits both to the State and the region, and in comparison with other resources across the State.

Table 3.6 – Clause 12AA of State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

12AA Significance of resource - Condition	**Relevant EIS Section**
1. In determining an application for consent for development for the purposes of mining, the consent authority must consider the significance of the resource that is the subject of the application, having regard to:	
a) the economic benefits, both to the State and the region in which the development is proposed to be carried out, of developing the resource, and	**Section 5.18**
b) any advice by the Director-General of the Department of Trade and Investment, Regional Infrastructure and Services as to the relative significance of the resource in comparison with other resources across the State.	
2. The following matters are (without limitation) taken to be relevant for the purposes of subclause (1)(a):	
a) employment generation;	**Sections 2.0** and **5.17**
b) expenditure, including capital investment;	**Section 5.18**
c) the payment of royalties to the State;	**Section 5.18**

Table 3.6 – Clause 12AA of State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 – cont.

12AA Significance of resource - Condition	Relevant EIS Section
3. In providing advice under subclause (1) (b), the Director-General of the Department of Trade and Investment, Regional Infrastructure and Services is to have regard to such matters as that Director-General considers relevant, including (without limitation):	
a) the size, quality and availability of the resource that is the subject of the application, and	**Sections 2.0** and **5.18**
b) the proximity and access of the land to which the application relates to existing or proposed infrastructure, and	**Section 2.0**
c) the relationship of the resource to any existing mine, and	**Section 2.0**
d) whether other industries or projects are dependent on the development of the resource.	**Section 5.18**
4. In determining whether to grant consent to the proposed development, the significance of the resource is to be the consent authority's principle consideration under this Part;	
5. Accordingly, the weight to be given by the consent authority to any other matter for consideration under this Part is to be proportionate to the importance of that other matter in comparison with the significance of the resource;	
6. To avoid doubt, the obligations of a consent authority under this clause extend to any application to modify a development consent.	

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 below in italics, with the relevant assessment outcomes noted below each criteria in normal type.

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 Project meets all relevant cumulative noise criteria as outlined in Table 2.1 of the Industrial Noise Policy (INP).

Cumulative Air Quality Level

- *the development does not result in a cumulative annual average level greater than 30 µg/m3 of PM10 for private dwellings;*

The air quality assessment identifies that three private dwellings would be subject to air quality impacts above the *30 µg/m^3.* However, the contribution from the Project to these three residences is in the order of 1 to 3 *µg/m^3.* Each of these residences are predicted to exceed or equal (Year 5) the 30 *µg/m^3* criteria from other sources including background irrespective of the Project.

Airblast Overpressure

- *airblast overpressure caused by the development does not exceed the following at any private dwelling or sensitive receiver:*
  - *120 dB (Lin Peak) at any time;*
  - *115 dB (Lin Peak) for more than 5 per cent of the total number of blasts over any period of 12 months;*

Blasting activities associated with the Project will be designed such that the criteria as outlined above will not be exceeded.

Ground Vibration

- *ground vibration caused by the development does not exceed the following at any private dwelling or noise sensitive receiver:*
  - *10 mm/sec (peak particle velocity) at any time;*
  - *5 mm/sec (peak particle velocity) for more than 5 per cent of the total number of blasts over any period of 12 months; and*

Blasting activities associated with the Project will be designed such that the criteria as outlined above will not be exceeded.

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 in 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.*

The groundwater modelling and impact assessment indicates that the Project will cause negligible impacts to the alluvial aquifers associated with Glennies Creek and Bowmans Creek. Drawdown of water tables in alluvial aquifers associated with Bettys and Main Creeks (minor tributaries) of Glennies Creek and Bowmans Creek are predicted to locally exceed two metres. This triggered further, level 2 assessment under the NSW Aquifer Interference Policy (2012). Both Bettys Creek and Main Creek are ephemeral surface water features that largely act as drainage lines for the local area and only generate incidental baseflow following sustained rain. Peak incremental groundwater losses from the Bettys Creek alluvium (representing maximum potential baseflow loss to the creek, assuming groundwater intercepts and flow within the creek) are predicted to be less than 6 ML/year and correlate to mining of the RERR Mining Area. Mining in the BNP is not predicted to impact on the alluvial aquifers. Peak incremental groundwater losses from the Main Creek alluvium (representing maximum potential baseflow loss to the creek, assuming groundwater intercepts and flow within the creek) are predicted to be less than 15 ML/year and correlate to continuation of the North Pit. As stated, these creek systems are ephemeral and as such it is considered that the modelled baseflow impacts in the Bettys Creek and Main Creek systems are overestimated in the modelling and are in reality negligible.

It is important to note that the consent authority can still approve the development if these impact criteria are exceeded.

Further details of the results of the relevant assessments are provided in the following sections - air quality (**Section 5.2**), noise (**Section 5.3**), blast (**Section 5.4**), surface water (**Section 5.5**) and groundwater (**Section 5.6**).

Compatibility with other Land uses

Clause 12, provided 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, and*
>
> *(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, and*
>
> *(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 a continuation of an existing operation which has been coexisting with neighbouring land uses for more than 20 years for Mount Owen and 50 years for Ravensworth East. Importantly, many of the surrounding land uses are for mining. The Project is considered to be broadly compatible with surrounding land uses and there has been extensive iterative Project design to minimise the impact of the Project on surrounding land uses. The compatibility of the Project with surrounding land uses is considered in more detail in **Section 5.0**.

The Proposed Disturbance Area will be located entirely within existing Glencore mining tenements. The geology in the Project Area is well understood and the location of infrastructure has been chosen to minimise the potential sterilisation of known coal resources in the area and will utilise as much as possible the existing mine infrastructure.

The Mount Owen Complex mining leases and the Integra mining leases overlap within the Project Area. Based on the current conceptual mine plans, the North Pit Continuation will result in Mount Owen mining over a portion of the current approved Integra underground workings (refer to **Figure 2.7**). Mount Owen holds the extraction rights of the upper seams (extending down to the Bayswater seam) and Integra holds the extraction rights of the lower seams extending from the currently mined Upper Liddell seam to the Middle Liddell and Barrett seams. The vertical separation between the North Pit Continuation pit floor and the Integra underground workings will be a minimum of 250 metres (refer to **Figure 2.8**), which is considered adequate to enable the management of safety and operational issues. **Section 6.0** details strategies for the management of operations in the area of overlap.

The Project is unlikely to impact on the potential for viable petroleum production from within the Project Area as the deeper coal seams typically targeted for petroleum production will not be impacted by the Project.

The Project will not adversely impact on any known extractive material resources.

Environmental Management

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 should be imposed on the development if approved. The Project's potential impact on natural resources is discussed in detail in **Section 5.0** and commitments regarding the management of potential environmental impacts are contained in **Section 6.0**. Clause 14 (3) requires that the consent authority must consider any certification by the Office of Environment and Heritage (OEH) for measures to mitigate or offset the biodiversity impact of the Project.

> ***Clause 14 Natural resource management and environment management***
>
> 3. *Without limiting subclause (1), in determining a development application for development for the purposes of mining, the consent authority must consider any certification by the Chief Executive of the Office of Environment and Heritage that measures to mitigate or offset the biodiversity impact of the proposed development will be adequate.*

Mount Owen has consulted with OEH during the ecological assessment and development of the biodiversity offset strategy. Specifically, Mount Owen met with OEH in October 2013 to outline the proposed offset strategy for the Project including details regarding the proposed approach, areas of land and the ecological characteristics of those areas.

Resource Recovery

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. The Project has been developed to optimise the recovery of coal resources from within the existing lease area. This is discussed in more detail in **Section 2.3** and **Section 2.5**.

Transport

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 the Port of Newcastle by rail. ROM coal will be transported to Liddell Coal Operations and / or Bayswater and Liddell power stations on an as required basis via the existing conveyor. Road traffic impacts are considered in **Section 5.12**.

Rehabilitation

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. Mount Owen and Ravensworth East Mines will be rehabilitated as part of the closure process following completion of mining. The Mount Owen Rail Line would be rehabilitated if no other appropriate future use is identified. Rehabilitation is discussed in more detail in **Section 5.19**.

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 lease areas.

As discussed in **Section 3.2.3**, the Proposed Disturbance Area will be wholly within existing mining tenements. Accordingly, the gateway process is not triggered by the Project. The Upper Hunter SRLUP and the Project's potential impact on strategic agricultural land and agriculture in general is discussed in more detail in **Section 5.8**.

3.2.2.3 Draft State Environmental Planning Policy Amendment (Gas Exploration and Mining) 2014

On 18 November 2014, a draft amendment to the Mining SEPP was publically exhibited which included a new proposed clause 12A which, if the amendment is made, would require the consent authority to have regard to any 'voluntary land acquisition and mitigation policy' when determining development applications for mining projects. A draft voluntary land acquisition and mitigation policy (Draft Voluntary Acquisition Policy) was also publically exhibited.

The Draft Voluntary Acquisition Policy provides guidance around triggers for the inclusion of conditions requiring mining projects to implement mitigation measures or acquire land at the request of a landholder if noise or air quality (particulate matter) impacts (including cumulative impacts) from a project are predicted to exceed identified triggers. Information regarding predicted air quality and noise impacts at individual properties is detailed in Appendix 6 (air quality) and Appendix 7 (noise) for consideration by the consent authority when determining the development application.

3.2.2.4 State Environmental Planning Policy No 33 – Hazardous and Offensive Development

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 Project will not result in any changes to the existing Mount Owen and Ravensworth East Mines which would alter this classification (refer to **Section 5.15**). Therefore no further consideration of SEPP 33 is required.

3.2.2.5 State Environmental Planning Policy No 44 – Koala Habitat Protection

SEPP 44 restricts a Council from granting development consent for proposals on land identified as core koala habitat without preparation of a plan of management. Singleton Local Government Area (LGA) is listed in Schedule 1 of SEPP 44 and therefore the SEPP applies to the Project.

An extensive ecological assessment (refer to **Section 5.7** and **Appendix 11**) has been conducted for the Project and includes a Koala habitat assessment. The Project Area does not provide core koala habitat. Consequently, the requirement for preparation of a koala plan of management does not apply.

3.2.2.6 State Environmental Planning Policy No 55 – Remediation of Land

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 Mount Owen Complex have the potential to cause contamination if not properly managed. The management of contamination risks is discussed further in **Section 5.14**. Any contamination of the land will not affect the suitability of the site for operating as a mine.

3.2.3 Upper Hunter Strategic Regional Land Use Plan 2012

The key strategic policy guiding the assessment of mining development is the NSW Government's SRLUP. The Upper Hunter SRLUP was approved in September 2012 and applies to the Project Area.

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.

The gateway process under the Upper Hunter SRLUP has been prescribed through amendments to the Mining SEPP. The DGRs require consideration of the gateway criteria in the assessment of the Project. As discussed in **Section 2.1.2,** the Project including the Proposed Disturbance Area is located wholly within existing Glencore mining tenements and therefore the gateway process does not apply to the Project.

The land proposed to be disturbed as a result of the proposed Hebden Road upgrade works was mapped as BSAL at the regional scale and identified within the Upper Hunter SRLUP; however, assessment of this area in accordance with the *Agricultural Impact Statement Technical Notes* (DPI 2013) has concluded this land does not meet BSAL criteria. Further information regarding the Upper Hunter SRLUP and its relevance to the Project Area is provided in **Section 5.8**.

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 DGRs for the Project require the EIS to include an AIS which has been prepared and is presented in **Appendix 12**. A summary of the AIS is provided in **Section 5.8**.

3.2.4 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 result in a loss of water from an overlying source covered by a water sharing plan (WSP), a water access licence is required under the *Water Management Act 2000* (WM Act) to account for this loss of water. In addition, the AIP

requires proponents of mining projects seeking project approval 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 Jacobs as part of the Groundwater Impact Assessment (refer to **Appendix 10** and **Section 5.6**).

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. The Project was determined to result in a level 2 impact as identified by the AIP and therefore was subject to a detailed Groundwater Impact Assessment (refer to **Section 5.6.3** and **Appendix 10**).

In addition, any impacts on GDEs, landholder rights and existing registered bores are assessed in **Appendix 10**.

3.2.5 Other State Legislation

The Project will be subject to a number of separate regulatory approval processes if approved. As an existing operation, 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 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, must be granted consistent with the terms of any development consent granted for the development. Where these approvals apply to the Project, they are discussed in **Section 3.2.5.1** below. Section 89J removes the requirement for a number of approvals for approved State Significant Developments. These approvals are discussed further in **Section 3.2.5.2**.

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 provided in **Section 3.2.5.3**.

3.2.5.1 Approvals Legislation to be applied consistently

If development consent for the Project is granted under Part 4 of the EP&A Act, the approvals identified in **Table 3.7** which are required for the Project, must not be refused by the relevant authority and must be substantially consistent with the terms of the development consent.

Table 3.7 – Approvals Legislation to be Applied Consistently with Development Consent

Act	Approval	Authority
Mine Subsidence Compensation Act 1961 (MSC Act)	An approval under section 15 for development within a mine subsidence district.	NSW Mine Subsidence Board (MSB)
Fisheries Management Act 1994 (FM Act)	An aquaculture permit under section 144. An aquaculture permit will not be required for the Project.	Department of Primary Industries

Table 3.7 – Approvals Legislation to be Applied Consistently with Development Consent – cont.

Act	Approval	Authority
Mining Act 1992 (Mining Act)	No new mining leases are required for the Project. The *Mining Act 1992* requires all mining operations be subject to a Mining Operations Plan (MOP) approved by the Director-General of the NSW Trade and Investment - Division of Resources and Energy (DRE). The relevant MOPs will be revised to include the proposed BNP and RERR Mining Area, North Pit Continuation area, and associated operations.	DRE
Protection of the Environment Operations Act 1997 (POEO Act)	The POEO Act regulates pollution to the environment and requires licences for environmental protection including waste, air, water and noise pollution control. Coal mining and coal works are scheduled activities which require licensing under the POEO Act. The existing Environment Protection Licence (EPL) for Mount Owen (No. 4460) will require a variation to cover changes associated with the Project and any specific licence conditions that are required to be amalgamated from the Ravensworth East EPL (No. 10860), which will be surrendered, should the Project be approved.	OEH
Roads Act 1993 (Roads Act) 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. Consent under section 138 will be required for: ▪ the road works associated with the rail overpass on Hebden Road (near the intersection with the New England Highway); and ▪ the proposed Bowmans Creek Bridge.	Singleton Council – local roads

The various matters regulated by each of the above approvals are assessed in **Section 5.0.**

3.2.5.2 Approvals Legislation Which Does Not Apply

Under section 89J of the EP&A Act, if development consent is granted for the Project under Part 4 of the EP&A Act, the following authorisations (refer to **Table 3.8**), which may otherwise have been relevant, will not be required to carry out the Project.

Table 3.8 – Authorisations Which Do Not Apply

Act	Approval
Fisheries Management Act 1994	A permit under section 201 (dredging or reclamation work), s. 205 (harming marine vegetation) or s. 219 (blocking of fish passage).
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 Act.
National Parks and Wildlife Act 1974	An Aboriginal heritage impact permit under s. 90 (Aboriginal Heritage Impact Permit).

Table 3.8 – Authorisations Which Do Not Apply – cont.

Act	Approval
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.

The various matters regulated by each of the above approvals are assessed in **Section 5.0**.

3.2.5.3 Other Potentially Relevant State Legislation

A summary of other State environmental and planning legislation potentially relevant to the Project is provided in **Table 3.9**.

Table 3.9 – Other State Legislation of Potential Relevance to the Project

Planning Provision	Comments	Further Approval Required?
Aboriginal Land Rights Act 1983	Under Sections 34 and 35 of the *Aboriginal Land Rights Act 1983* Land Rights claims can be lodged by the New South Wales Local Aboriginal Land Council (LALC) over any Crown Lands. There is one crown road (subject to closure application) in the Proposed Disturbance Area for the Project. It should also be noted that a Native Title Extinguishment Assessment has been completed by Mount Owen's legal advisors for landholdings within the Mount Owen Complex, including the Proposed Disturbance Area, which has determined that Native Title has been extinguished.	No

Table 3.9 – Other State Legislation of Potential Relevance to the Project – cont.

Planning Provision	Comments	Further Approval Required?
Coal Mine Health and Safety Act 2002 (CMHS Act)	The principal aim of the CMHS Act is to secure the objectives of the *Work Health and Safety Act 2011* in relation to coal operations. It achieves this by imposing certain specific safety requirements on coal mines. This includes the requirement to obtain consent from the Minister for Mineral Resources (NSW Trade and Investment (Division of Resources and Energy)) for the establishment of emplacement areas. There are no new emplacement areas associated with the Project with all overburden being emplaced either in-pit or on previously disturbed areas. The proposed emplacement of tailings is conducted in a manner consistent with currently approved operations. Proposed additional tailings emplacement areas in the RERR Mining Area and North Pit Continuation will require an approval under Section 100 of the Act. The *Workplace Health and Safety (Mines) Act 2013* (WHS(M) Act) will repeal the Coal Mine Health and Safety Act 2002 on commencement. Under the WHS(M)Act there are no approval requirements however notification requirements apply to a number of activities and mine operators are required to have in place management systems to address potential safety risks arising from the activities undertaken at the mine site. The WHS(M) Act is currently scheduled to commence 1 February 2015.	Yes Section 100 approval will be required for the RERR Mining Area and North Pit Continuation tailings areas. Section 101 approval will also be required for decommissioning and rehabilitation of all emplacement areas.
Crown Lands Act 1989 (Crown Lands Act)	The Crown Lands Act provides for the administration and management of Crown land in the eastern and central divisions of NSW. Crown land may not be occupied, used, sold, leased, dedicated, reserved or otherwise dealt with unless authorised by this Act or the *Crown Land (Continued Tenures) Act 1989*. There is one crown road (subject to closure application) in the Proposed Disturbance Area for the Project.	Yes

Table 3.9 – Other State Legislation of Potential Relevance to the Project – cont.

Dams Safety Act 1978 (Dams Safety Act)	This Act requires that the NSW Dams Safety Committee (DSC) periodically review large dams that may constitute a hazard to human life and property. These dams are known as prescribed dams and are listed in Schedule 1 of the Dams Safety Act. Any new prescribed dams are to be designed to the satisfaction of the DSC. Although no significant dams are proposed for water storage, the proposed use of the Ravensworth East voids for tailings emplacement will be subject to assessment in accordance with the DSC requirements to determine if the tailings emplacement areas will be prescribed dams.	Yes
Explosives Act 2003 (Explosives Act)	A licence is required for the storage of explosives on site. This Act is administered by WorkCover NSW. Mount Owen's explosives contractor holds the relevant licence to possess and store explosives on the Mount Owen site. There will be no change in the quantities of explosive materials as a result of the Project.	Yes
Environmentally Hazardous Chemicals Act 1985 (EHC Act)	Under the EHC Act, 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, Mount Owen, or the relevant contractor, will obtain a licence prior to the storage, transport or use of prescribed chemicals.	If required
Threatened Species Conservation Act 1995 (TSC Act)	Under the EP&A Act, impacts on threatened species listed under the TSC Act are required to be assessed. All threatened species listed in the TSC Act potentially located within the Project Area have been assessed by the Ecological Assessment (refer to **Section 5.7**). No further approvals are required under the TSC Act.	No

Table 3.9 – Other State Legislation of Potential Relevance to the Project – cont.

Water Management Act 2000 (WM Act)	The Hunter Unregulated and Alluvial Water Sources Water Sharing Plan (WSP) (in force under the WM Act) applies to the surface waters and alluvial groundwaters of Bowmans Creek (Jerrys Water Source) and Main Creek (Glennies Water Source) and their catchments. The Hunter Regulated River WSP applies to extractions from the Hunter River and Glennies Creek under the WM Act. Relevant consideration is required for impacts on surface water, in particular Bowmans Creek, Yorks Creek, Swamp Creek, Bettys Creek and Main Creek, which, as outlined above, are all regulated within the framework of the WM Act. A WSP indicates that water extraction and interference licensing is required to account for any water loss over the life of the mine and until such time as those losses are negated. The Project will not require approval under sections 89, 90 or 91 (other than an aquifer interference approval) of the WM Act due to the exemptions outlined under section 89J of the EP&A Act; however, an approval may be required for aquifer interference under the WM Act.	Yes
Water Act 1912 (Water Act)	The licensing provisions of the Water Act apply to water sources that are not subject to a water sharing plan gazetted under the WM Act. The Water Act is administered by the NSW Office of Water (NOW). A permit and / or licence must be obtained to extract groundwater (Part 5 of the Act) not covered by a WSP. Extraction of groundwater that flows into the open cut pits (from hard rock aquifers) will require licensing under Part 5 of the Water Act. It is not anticipated that any additional water licences will be required for the Project.	No

4.0 Consultation and Key Environmental and Community Issues

To support Mount Owen's aim of developing a project which will coexist with the local community, a comprehensive stakeholder engagement program was implemented for the Project.

Mount Owen's aim for the engagement program was to:

- inform and seek feedback from stakeholders during the development of Project design;
- identify key issues of interest or concern to be considered during the assessment process;
- work together with stakeholders in an effort to mitigate or address those issues; and
- inform and seek feedback from stakeholders of the results of the EIS studies prior to finalisation and public exhibition.

This section of the EIS presents the details of the consultation with these stakeholders. It describes the consultation process and the issues raised and identifies where the feedback has been taken into account in the Project design and the EIS process.

The DGRs for the Project require that during the preparation of this EIS, consultation must be undertaken with relevant local, State and Commonwealth authorities, services providers, community groups, RAPs and affected landowners.

As illustrated in **Figure 4.1**, the program involved a number of components, including reinvigorating ongoing engagement with existing operations and the local community, in addition to Project specific engagement with a range of stakeholder groups. The engagement program commenced during the early planning phases of the Project and has continued throughout the project design and assessment process. The engagement program was also specifically designed to support the comprehensive Social Impact and Opportunities Assessment (SIOA) (refer to **Section 4.2.3**, **Section 5.17** and **Appendix 5**). Further details of the stakeholder engagement program are included in **Sections 4.1** to **4.3**.

Figure 4.1 – Stakeholder Engagement Program

4.1 Community Engagement Plan

Community engagement for the Project was a four phase program which aligned with the phases of Project development and the environmental assessment process. Engagement processes were selected based on a detailed stakeholder analysis completed during the profiling stage; however, engagement methods and processes were varied throughout program implementation to respond to evolving stakeholder issues or to respond to changing levels of interest by stakeholders.

The four phases of the engagement program, including the key consultation processes for each phase, are outlined below. Both Phase 1 and 2 sought stakeholder feedback on aspects of the Project design. Phases 3 and 4 presented results and outcomes of the assessment and engagement process and sought feedback on predicted impacts and the proposed management and mitigation measures. In conjunction with consultation specific to the Project, Mount Owen also focussed on maintaining and building the relationships established as part of the existing operations.

As outlined in **Section 1.2**, the EIS was submitted to the DP&E and the DoE for the adequacy review process in December 2013. Prior to the submission of the EIS for adequacy review, an extensive community consultation program was undertaken, as described in the following sections. In late 2013, a drilling exploration program was completed in the northern portion of the Ravensworth East Mine to verify the extent of known coal reserves in an area previously approved for mining. Further evaluation in early 2014 confirmed this area as being economically feasible to mine and is referred to as the BNP. The inclusion of the BNP and the change in the timing of mining within the RERR Mining Area resulted in the need to update the EIS for the proposed Project. This led to further community consultation activities on the amended Project being undertaken in 2014 (Phase 4) which are also described in the sections below.

Phase 1: September to November 2012

In Phase 1, stakeholders were provided with an introduction to the Project, feedback was sought on their initial views and issues for consideration in Project planning and environmental assessment and information was provided about how they would be consulted during subsequent phases.

Phase 2: February to September 2013

Phase 2 involved discussions of further details of the proposed Project including the proposed approach to mining the resource and the consideration of impact mitigation measures. This phase provided further opportunities for community and other stakeholders input to the Project design and assessment process and further consideration of the issues.

Phase 3: October to December 2013

Phase 3 was conducted upon completion of key technical studies as part of the environmental assessment process. The main focus of this phase of the engagement program was to present project details and the results of the environmental, social and cultural heritage impact studies to the community and other stakeholders, in addition to seeking feedback on proposed management and mitigation measures. This phase included feedback on how key issues identified in earlier phases were addressed in the Project.

Phase 4: April to December 2015

The proposed Project changes were communicated to key stakeholders during this Phase. Additionally, the outcomes of the updated environmental studies were also presented to the community and other key stakeholders. Activities undertaken in this phase included provision of Community Information Sheets 4 and 5 to stakeholders, face to face meetings, a third community information day and ongoing briefings to the workforce and the Mount Owen Complex Community Consultative Committee (CCC).

Further details of the engagement processes undertaken in each of these phases are outlined in the following sections, with a summary of the issues raised by stakeholders included in **Section 4.2.4**.

4.2 Community Engagement

4.2.1 Existing Community Engagement

Mount Owen has an ongoing community engagement program which includes regular engagement with both individuals and groups from the local and regional communities via a range of mechanisms including:

- regular newsletters (biannual) to update the community on the existing operations and Mount Owen Complex initiatives;
- face to face meetings with individuals and / or groups as required / requested, including any meetings required in response to complaints; and
- regular meetings (three per year) with the Mount Owen Complex CCC. The Mount Owen Complex CCC comprises eight community representatives, one Singleton Council representative and Mount Owen representatives, and is periodically attended by State government agency representatives.

Local residents have also been engaged via Glencore's regular 3-yearly Community Survey. The survey assesses community attitudes, perceptions and engagement effectiveness in relation to Glencore operations in the Hunter Valley. Glencore, with the assistance of the Hunter Valley Research Foundation (HVRF), undertakes a regular survey for this purpose, initially undertaken in 2006 and subsequently in 2009 and 2012. The survey provides a means for Glencore to evaluate its social and environmental performance by keeping track of community issues to ensure engagement mechanisms employed across operations are targeted and provide a means of identifying areas of community need.

The survey is undertaken across six main areas in which Glencore operates within NSW and involves parallel telephone surveys of landholders and local community residents, local and State government representatives and community group representatives. The main findings of the survey undertaken in 2012 (HVRF 2012) within the Hebden, Camberwell and Glennies Creek area (which relates to the Mount Owen operation) are summarised below:

- a high level of awareness of Glencore's mines in the local area among all stakeholder groups, particularly local landholders and residents;
- dust issues in general, noise from vehicles / machinery, dust related health impacts, and noise and vibration from blasting were seen as the main negative impacts of Glencore's activities in the area;

- increased employment opportunities was identified as the main positive impact on the local community; other positive impacts were contribution to the local economy and the company's willingness to try and redress negative impacts. Some feedback noted no positives, no comment or 'don't know';

- local residents who had received information from Glencore were generally satisfied with all aspects of the information they had received, outlining a preference for information to be provided at least monthly;

- local residents who had contact with their local mine in the previous 12 months were satisfied to very satisfied about the process of contact, but more critical in their ratings regarding the outcomes of the contact; and

- there was a lack of awareness of Glencore's Corporate Social Involvement (CSI) Program, but a desire to see this program continued with more support to be directed towards the following areas in order of importance: health services, environmental projects, job creation and training, community support services, school and university education programs and arts, music and other cultural activities.

In general, the survey provides tracking of a number of key indicators relating to Glencore's social and environmental performance and provides a local community specific evaluation of the approach that Glencore's operations undertake in relation to stakeholder engagement and consultation.

Information obtained from these established community engagement and evaluation processes fed directly into the Project design and environmental assessment process, and also provided valuable information to design an effective engagement program for the Project.

4.2.2 Project Community Engagement Program

As discussed above, Mount Owen is committed to working with the community to develop a Project which can coexist with the local community. Mount Owen has sought to build on the existing engagement program and relationships with the community to implement a detailed stakeholder engagement program for the Project. The engagement program aimed to:

- identify community needs, concerns and opportunities;

- obtain information for Mount Owen to consider in its project planning; and

- continue to build strong and constructive relationships with stakeholders.

The program provided Mount Owen with valuable input from the community and other stakeholders about the impacts of the existing operations and potential impacts associated with preliminary designs of the proposed Project. This information was then fed back into the Project design process with an additional focus placed on the impacts or design aspects identified as being most important to the community.

A summary of the key community engagement meetings undertaken for the Project is provided in **Table 4.1**. Additional engagement was also undertaken through Project specific Community Information Sheets, telephone discussions, written correspondence, biannual Mount Owen operations newsletters and the Mount Owen Community Information Days.

Table 4.1 - Community Stakeholder Engagement: Summary of Key Meetings

Consultation	Stakeholder	Number of Participants and / or Meetings	Comments
Neighbouring Landholders and Local Community (face to face meetings)	Landholders in Hebden, Camberwell, Falbrook, Middle Falbrook and Goorangoola with properties in closest proximity to the Project, or in areas considered with most potential for possible impact from the Project.	47 landholders 40 landholders in the second round of consultation. 14 landholders in third round of consultation.	Face to face interviews and discussions to gather feedback regarding Mount Owen's existing operations and provide an introduction to the Project. Follow up meetings in 2013 to discuss outcomes of the EIS studies, including discussions regarding specific impacts and proposed mitigation in relation to individual landholder properties. Face to face meetings held in October 2014 to discuss outcomes of the updated EIS studies, including discussions regarding specific impacts and proposed mitigation in relation to individual landholder properties.
Local Community (Mount Owen Community Information Session 1) **(Mount Owen)**	As above.	22 attendees	A Community Information Day at the Mount Owen Mine site for neighbouring landholders. Included displays on the existing operation and the Project, and provided an opportunity for a guided site tour.
Mount Owen Tenants	Residents tenanting Mount Owen owned properties in closest proximity to the Project.	14 tenants	Telephone interviews to gather feedback regarding Mount Owen's existing operations and providing an introduction to the Project. Follow up phone calls to discuss outcomes of the EIS studies, including discussions regarding specific impacts and proposed mitigation, were also undertaken.

Table 4.1 - Community Stakeholder Engagement: Summary of Key Meetings – cont.

Consultation	Stakeholder	Number of Participants and / or Meetings	Comments
Regional issues assessment stakeholders	Regional service providers (e.g. education, community, health) and other regional stakeholders.	58 stakeholders	Consultation to inform the SIOA regarding an assessment of regional issues. This consultation focused on feedback regarding mining in the Upper Hunter generally and was not specific to Mount Owen or the Project.
NGOs and other Regional Interest Groups	• Hunter Environment Lobby • Singleton Chamber of Commerce • Hebden Wild Dogs Association • Rural Fire Service (Glennies Creek) • Mount Owen Flora and Fauna Interagency Advisory Group	Seven meetings	Meetings held to discuss items of specific interest for each stakeholder, provide information and seek feedback on the proposed management arising from EIS studies.
Mount Owen Complex CCC	Mount Owen Complex CCC comprising 8 community members, 1 Singleton Council representative and Mount Owen personnel (and periodically attended by State government agency representatives).	Seven meetings	Regular updates during the progression of the Project design and EIS processes.
Mount Pleasant School	Principal and Parents and Citizens representative.	Two meetings	Meetings to discuss items of specific interest, provide information and seek feedback on the proposed management arising from EIS studies.

Table 4.1 - Community Stakeholder Engagement: Summary of Key Meetings – cont.

Consultation	Stakeholder	Number of Participants and / or Meetings	Comments
Community Information Session 2 (Mount Pleasant School)	Local landholders Community groups Regional stakeholders	December 2013	Information session to inform community stakeholders regarding the outcomes of EIS studies, seek feedback on the proposed mitigation measures and outline the process going forward. Invitations were sent to all stakeholders participating in the consultation program.
Community Information Session 3 (Mount Owen)	Local landholders Community groups Regional stakeholders	Update sessions conducted 31 October and 1 November 2014	Information session to inform community stakeholders regarding the outcomes of EIS studies including the proposed Project changes and an opportunity for a guided site tour.
Workforce briefings	Existing workforce at Mount Owen Complex.	Four briefings in 2013 and ongoing briefings throughout 2014	Workforce briefings to inform employees of Project plans, processes and study outcomes.
Employee / contractor and Supplier Survey	Existing workforce at Mount Owen.	135 employees surveyed	Survey conducted by Coakes Consulting; to model current patterns of workforce expenditure and community infrastructure usage to inform SIOA report.
Industry	Ashton Coal mine Integra Coal Mine Hebden Quarry	Five Meetings	To provide briefings and discuss potential interactions with the Project.

Further details regarding the key engagement mechanisms implemented as part of each phase of the engagement program are included below.

Phase 1

As discussed in **Section 4.1**, Phase 1 provided stakeholders with an introduction to the Project, an opportunity to provide their initial views and issues for consideration in Project planning, and information about how they would be consulted during subsequent consultation phases.

Key consultation carried out during this Phase included:

- an initial Community Information Sheet (copy provided in **Appendix 3**) issued December 2012 to the local community providing an overview of the Project, EIS process and key issues identified at that time;
- briefings with Singleton Council and key state government agencies;
- briefings, meetings, telephone calls and discussions with local landholders in the vicinity of the Project Area, specifically Hebden, Camberwell, Falbrook, Middle Falbrook and Goorongoola;
- telephone interviews with tenants of Mount Owen owned properties in the vicinity of the Project Area;
- commencement of the SIOA for the Project, including community profiling and reviews of previous impacts / community involvement, from throughout the life of the existing Mount Owen operations;
- commencement of the Aboriginal cultural heritage assessment process;
- briefing the neighbouring Integra Mine, Ashton Mine and Hebden Quarry;
- briefing local, Federal and State members of parliament; and
- briefing the Mount Owen Complex CCC.

Phase 2

Phase 2 involved discussions of further details of the proposed Project including the proposed approach to mining the resource, available assessment outcomes and the consideration of potential impact mitigation measures as the environmental impact studies were being undertaken. This phase provided further opportunities for stakeholder input to the Project design and assessment process during those impact studies to ensure the consideration by Mount Owen of community and other stakeholder concerns.

Key consultation carried out during this Phase included:

- Community Information Sheet 2 (issued in April 2013 - refer to **Appendix 3**) which provided further Project details and information regarding content and status of specialist studies for the Project;
- land visits by RAPs and Elders commenced during this Phase and included a number of cultural values and management workshops;
- Mount Owen Community Information Day to provide landholders with poster displays, visual demonstrations and project team discussions on the key issues being assessed in EIS studies, and potential mitigation measures. An opportunity was also provided (which many took up) for a guided tour of the existing Mount Owen operations;
- commencement of regular briefing sessions with Singleton Council's Coal Advisory Committee;
- Mount Owen Complex CCC and Flora and Fauna Interagency Advisory Group meetings;
- further briefings to Mount Owen Complex workforce; and
- interviews and survey to inform a 'workforce and purchasing spend survey' as part of the SIOA socio-economic analysis (i.e. Town Resources Cluster (TRC) report).

Phase 3

Phase 3 was conducted upon completion of the technical studies as part of the environmental assessment process. The main focus of this phase was to present final proposed Project details and the results of the environmental and social impact assessment process to the community and other stakeholders, whilst providing them with further opportunity for input to proposed management and mitigation measures.

Key consultation carried out during this Phase included:

- further consultation (face to face meetings) with neighbouring and affected landholders including the preparation of individualised Property Information Sheets detailing predicted impacts specific to the property, and processes for seeking and achieving effective mitigation and management presentation to the Mount Owen Complex CCC;
- feedback sessions regarding values, care and control and management outcomes to the Project's RAPs before and after the 28 day review period of the draft Aboriginal Cultural Heritage Assessment report;
- continued meetings with Singleton Council's Coal Advisory Committee to discuss the outcomes of key technical studies;
- presentation regarding the key Project outcomes to open Council meeting, November 2013;
- invitation to all residents of Camberwell, Falbrook, Middle Falbrook and Goorangoola to a Community Information Day. This provided an opportunity for the community to talk to the Project Team regarding key EIS studies through face to face discussions;
- Community Information Sheet 3 (refer to **Appendix 3**) which provided details on the outcomes of all EIS studies, was delivered to households in Hebden, Camberwell, Falbrook, Middle Falbrook and Goorangoola and provided to other key stakeholders including DP&E and the RAPs. The information sheet included a concise overview of the Project development, EIS outcomes and discussion of where stakeholder input has influenced the Project design and assessment outcomes; and
- consultation with various government agencies in relation to the detail of key studies and to seek further input in relation to proposed mitigation, management and offsets.

Phase 4

Phase 4 commenced with the provision of further details of the Project, as revised which included mining within the BNP and RERR Mining Area and the optimisation of the North Pit. This phase provided further opportunities for stakeholder input to enable the consideration by Mount Owen of community and other stakeholder concerns.

Key consultation carried out during this Phase included:

- meeting with DP&E in May 2014 to provide an overview of Project changes, the proposed consultation program going forward, and the proposed Project timeline and approval pathway;
- Community Information Sheet 4 (refer to **Appendix 3**) which provided details on the updated Project, revised to include mining in the BNP and RERR Mining Area and the optimisation of the North Pit. The information sheet outlined the key Project changes and provided an update on assessment progress;
- consultation with, and land visits by, RAPs and Elders;

- meetings with Singleton Council and DRE to discuss the key Project changes and to provide an update on the progress of key technical studies;
- meeting with the DoE on 8 August 2014 to provide an overview of Project changes (i.e. inclusion of mining in the BNP and RERR Mining Area), discussion of Mount Owen's application for variation of Proposed Action and confirmation of supplementary DGRs, and the proposed Project timeline and approval pathway;
- Community Information Sheet 5 (refer to **Appendix 3**) which provided details on the updated outcomes of all EIS studies, was delivered to households in Hebden, Camberwell, Falbrook, Middle Falbrook and Goorangoola and provided to other key stakeholders including relevant government and non-government organisations and the RAPs;
- Mount Owen open day;
- further consultation (face on face meetings) with neighbouring and affected landholders in October 2014;
- presentation to Singleton Councillors;
- presentation to interested Non-Government Organisations; and
- presentations to the Mount Owen Complex CCC and Flora and Fauna Advisory Committee.

4.2.3 Consultation Feedback Informing the Social Impact and Opportunities Assessment

A comprehensive SIOA was undertaken as part of the environmental assessment process. The SIOA 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 5** and is discussed further in **Section 5.17**.

As described in the preceding sections, as part of the SIOA program for the Project, a wide range of stakeholders have been identified and involved. A total of 356 stakeholders participated in the consultation process. The consultation mechanisms utilised as part of the SIOA varied and, where possible, were matched to stakeholder groups to facilitate participation in the assessment program.

4.2.4 Community Issues

Detailed constructive feedback on the existing operations, the Project and the environmental assessment process was received from the community as a result of the stakeholder engagement process.

The most common perceived impact themes identified by landholders associated with the current Mount Owen and other mining operations in the local area, related to cumulative air quality and noise, with approximately 70 per cent of landholders (N=43[5]) identifying one or both as a current issue. These issues were followed by economics (60 per cent); land management (58 per cent), blasting (55 per cent) and road infrastructure (51 per cent) (refer to **Figure 4.2**).

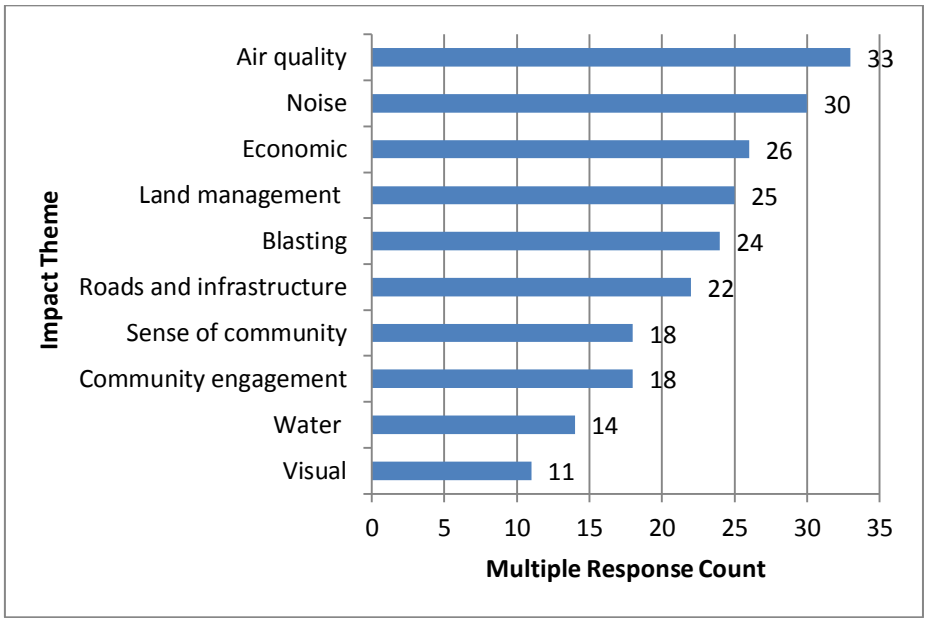

Figure 4.2 - Perceived Impact Themes identified by Neighbouring Landholders

Note: Includes both positive and negative issues / impacts. Multiple responses permitted.
Source: Coakes Consulting (2013)

Whilst some of the perceived impacts were raised in terms of direct attribution to the existing Mount Owen operation, the majority were discussed in cumulative terms with residents reporting difficulties in fully distinguishing issues and impacts associated with individual mining operations, given their proximity to multiple mines.

Less prominent issues related to other environmental impacts, such as water and visual amenity, as well as more socially oriented concerns such as sense of community, community contribution and community engagement. The latter were discussed mainly in terms of positive impacts or opportunities.

Issues raised by landholders are consistent with findings from Glencore's (formerly Xstrata Coal) 2012 Community Survey undertaken by the Hunter Valley Research Foundation (HVRF 2012) (refer to **Section 4.2.1**), which included interviews with 37 residents from the localities of Hebden, Camberwell and Glennies Creek. This survey identified air quality (46 per cent of respondents) and noise (30 per cent) as the top perceived issues relating to Mount Owen's mining operations in the area. Some differences emerge, however, when analysing historical patterns of landholder complaints to the Mount Owen Complex operations, which exhibit a focus on blasting and noise, with very little comparative attention to air quality. Further detailed discussions of the issues raised by the community are provided in **Section 5.17** and **Appendix 5**.

[5] Number of private landholders in vicinity of Mount Owen.

In relation to the Project specifically, some landholders expressed concerns regarding the progression of the Project towards their properties and the potential for acquisition of property depending upon the outcomes of noise and air quality studies. Notwithstanding these concerns, some landholders acknowledged the rail overpass and dual lane bridge over Bowmans Creek as a positive outcome for the Project.

The Project team considered this community feedback in refining the Project design to address these issues. **Table 4.2** contains a summary of the aspects of the Project that address the top five issues raised by stakeholders in the consultation process.

Table 4.2 - Top 5 Stakeholder Issues and Key Project Aspects

Issue	Key Project Aspects
Air Quality	• Mine Planning and Design: ▪ As discussed in **Section 5.2**, mine design was subject to an optimisation process to reduce the potential impacts on local landholders. Mine plan refinements included minimisation of haul road length, design of select haul roads below natural surface, and identification of areas that would be temporarily treated to reduce potential for air quality impacts. ▪ A review of Best Practice Management procedures was completed to enable the adoption of management options to reduce potential impacts. • Air Quality Monitoring and Management: ▪ As discussed further in **Section 5.2**, a range of air quality controls and monitoring exist, and are proposed, for the Project. This includes an extensive real time monitoring network which collects data that is fed back into existing operations.
Noise	• Mine Planning and Design: ▪ As discussed in **Section 5.3**, mine design was subject to an optimisation process to reduce the potential impacts of noise to local landholders. Mine plan refinements included design of selected haul roads below natural surface, and inclusion of bunds on well established and exposed long term haul roads. ▪ The location and scheduling of equipment within the proposed North Pit Continuation and RERR Mining Area during certain times of the year was reviewed with the objective of designing the mine such that when the likelihood of noise propagation increased (winter nights), equipment would be operating where maximum shielding could be achieved. • Noise Monitoring and Management: ▪ As discussed further in **Section 5.3**, a range of noise controls and monitoring exist and are proposed, for the Project. This includes the maintenance of the existing performance based management and monitoring system. Mount Owen has an extensive noise monitoring network that collects real time noise data which feeds back to operations. Mount Owen also monitors the predicted weather conditions daily to understand and plan operations to reduce likely noise impacts on a daily basis.

Table 4.2 - Top 5 Stakeholder Issues and Key Project Aspects –cont.

Issue	Key Project Aspects
Economic	• The economic impact of the Project is positive. Mine planning and design has been undertaken to enable efficient extraction of coal to ensure the Project is an economically viable operation which will allow for continued employment of Mount Owen workforce and Ravensworth East workforce for an additional 12 and 6 years, respectively. The results of the Cost Benefit analysis completed as part of the Project indicate that the Project would have a net benefit and add approximately $1.9 billion (NPV terms) to the economy of the State of NSW.
Land Management	• Mine Planning and Design: ▪ As discussed in **Section 5.19**, the Project has been designed to be progressively rehabilitated. Moreover, the Project is seeking to optimise the final landform design to achieve an undulating and more natural looking landform. • Mine Closure Planning and Rehabilitation: ▪ As outlined in **Section 5.19** mine closure and rehabilitation considerations: – include the development of a safe and sustainable landform with provision of ecological habitat and connectivity; – do not discount other future land uses that may be viable; and – identify that closure planning will continue over the life of the development. • Consultation: ▪ During the development of the Project, Mount Owen consulted with Singleton Council and DRE in relation to final landform, land use and mine closure. ▪ Community consultation, social impact and cultural heritage assessments for the Project considered stakeholder interests in mine closure and final land use (refer to **Section 4.2.2**, **Section 5.17**, and **Appendix 5**). • Other Land Management Measures ▪ A range of other land management measures are in place, and are proposed for the Project, such as feral animal and noxious weed management and bushfire management (refer to **Sections 5.7** and **5.16** respectively).
Blasting	• Blast Design ▪ Mount Owen has well established blast design and blast practices as part of current operations that will be continued as part of the Project. • Blast Monitoring and Management: ▪ As discussed further in **Section 5.4**, a range of blasting controls and monitoring exist and are proposed for the Project. This includes a range of blast monitors, review of local meteorological conditions prior to blasting, appropriate design of each blast including the size of blasts and the use of blast techniques such as electric detonation.

As noted, the issues raised by the community also played an important role in informing the detailed studies undertaken as part of the environmental assessment process. This is discussed further in **Section 5.0**.

4.3 Registered Aboriginal Parties Consultation

A comprehensive Aboriginal Cultural Heritage Assessment (ACHA) program was undertaken as part of the environmental assessment process. The ACHA invited those Aboriginal parties who expressed an interest in the Project to participate in the Archaeological Assessment of the Proposed Disturbance Area, and to attend workshops to share their cultural heritage values on the Proposed Disturbance Area and local region.

Extensive consultation has been undertaken with 60 RAPs, including three knowledge holder groups, being the Wonnarua Traditional Custodians (WTC), Wonnarua Nation Aboriginal Corporation (WNAC) and the Plains Clans of the Wonnarua People (PCWP) to complete the Aboriginal Cultural Heritage and Aboriginal Archaeology Assessment process for the Project (refer to **Sections 5.9** and **Appendix 13a**).

The process undertaken by Mount Owen and the majority of RAPs, was seen as a positive and constructive assessment of the Project on traditional Wonnarua land.

4.4 Government Agencies and Authorities Consultation

In addition to the formal consultation and correspondence in relation to the DGRs for the Project, there has been ongoing consultation with government authorities throughout the Project design refinement and environmental assessment process including:

- briefings regarding Project details, the approach to Project design and the proposed environmental assessment approach; and
- various meetings and site visits with relevant agencies to discuss assessment outcomes, approach to management, mitigation and offset measures, and other specific issues relevant to the agency.

4.4.1 Singleton Council

Mount Owen conducted a series of meetings with the Singleton Council in regard to the Project through the Coal Advisory Committee. This provided for detailed issue specific briefings to key Council representatives and for good discussion and feedback from the Council.

The Singleton Mayor attended the Mount Owen Open Day which included a guided tour of the Mount Owen site.

Mount Owen has consulted with the Coal Advisory Committee with regular Project update meetings held since 17 May 2013 as preliminary results of the various studies became available. Seven meetings have been held to date which provided briefings on the following issues:

- overview of Project (including an update on the Project in May and August 2014) and key impact areas and mitigation strategies;
- heritage;
- ecology and biodiversity offsets;
- final landform, land use and mine closure;

- traffic and roads;
- noise and air quality impacts; and
- social impacts and opportunities.

Mount Owen will continue regular briefings and updates to this Committee throughout the Project assessment and determination process.

Prior to the meetings with the Coal Advisory Committee, Mount Owen held four meetings with Singleton Council relating to the Project for general Project introductions and two specifically in relation to the proposed Hebden Road works. Mount Owen representatives also presented to the Singleton Councillors at the Council meeting held on 18 November 2013, and another on 10 October 2014.

4.4.2 Government Agencies

A summary of the key State agency consultation undertaken to date is included in **Table 4.3** below. Further consultation with agencies was undertaken through various mediums throughout the assessment process.

Table 4.3 – Consultation with State Government Agencies and Authorities

Stakeholder	Meetings	Comments
NSW Department of Planning and Environment	Three meetings	Project briefings including discussion regarding approach for assessments, outcomes of technical assessments including proposed mitigation and management measures in addition to proposed offsets. The DP&E Planning Officer has also attended site meetings and participated in some key agency meetings. Meeting in May 2014 to provide an overview of Project changes (i.e. inclusion of mining in the BNP and RERR Mining Area), the proposed approach to updated environmental studies and the consultation program going forward, and the proposed Project timeline and approval pathway.
NSW Office of Environment and Heritage (OEH) / NSW Environment Protection Authority	Five meetings	Project briefings including discussion regarding approach for assessments, outcomes of technical assessments including proposed mitigation and management measures in addition to proposed offsets. Technical studies specifically discussed included historic heritage, Aboriginal Archaeology and Cultural Heritage, ecology, air quality and noise.

Table 4.3 – Consultation with State Government Agencies and Authorities – cont.

Stakeholder	Meetings	Comments
NSW Trade and Investment (DRE)	Six meetings	Project briefings including two conceptual mine plan design meetings and discussion regarding approach for assessments, outcomes of technical assessments including proposed mitigation and management measures. Additionally, one on site meeting was held to discuss final landform options for the Project; this meeting included a tour of the Proposed Disturbance Area. Meeting in July 2014 to discuss the key Project changes including the conceptual mine plan and to provide an update on the progress of key technical studies. A further two meetings were held on-site at Mount Owen in October 2014 and December 2014 to discuss specific requirements in relation to Clause 12AA of the Mining SEPP.
NSW Department of Primary Industries (NSW Office of Water)	Two meetings	Project briefings including discussion regarding approach for assessments, outcomes of technical assessments including proposed mitigation and management measures. A site meeting was also held which included a tour of the Proposed Disturbance Area.
Forestry Corporation of NSW	Three meetings	Project briefings including discussion regarding outcomes of technical assessments including proposed mitigation and management measures. One of these meetings included a site visit. Additionally a site visit for the Institute of Retired Foresters to inspect Ravensworth State Forest and rehabilitation areas was also undertaken.
NSW Department of Primary Industries (Agricultural Sustainability and Food Security)	One Meeting	Project briefing including discussion regarding outcomes of technical assessments including proposed mitigation and management measures. This also included a site tour of the Proposed Disturbance Area and existing operations.
NSW Department of Primary Industries (Fisheries)	One Meeting	Project briefing.
Local Land Services NSW	Two meetings	Project briefing and discussions regarding Crown road closures and other land tenure issues.
Roads and Maritime Service (RMS)	One Meeting	Meeting held to discuss Hebden Road upgrade works.
Department of Health	One Meeting	Project briefing and discussion of health related aspects of the Project and outcomes of technical assessments including proposed mitigation and management measures.
Dams Safety Committee	Two Meetings	Project briefings.
Former Hunter-Central Rivers Catchment Management Authority (now the Hunter Local Land Services)	One Meeting	Project briefing.

Table 4.3 – Consultation with State Government Agencies and Authorities – cont.

Stakeholder	Meetings	Comments
ARTC and Hunter Valley Coal Chain Coordinator	Multiple Meetings	Glencore has regular meetings with ARTC and coal chain coordinators focussed on port and track allocations for all its NSW operations and has included discussions regarding the Project. Mount Owen has also discussed separately with ARTC the proposed Hebden Road overpass and off take works for the proposed rail upgrade.

4.4.3 Commonwealth Government

A meeting was held with the DoE in May 2013 to discuss the Project, with specific reference to Matters of National Environmental Significance (MNES). Mount Owen also submitted a referral under the EPBC Act in August 2013 for consideration by the DoE. As outlined in **Section 3.1** the Project was declared a Controlled Action on 24 October 2013.

As outlined in **Section 3.0**, Mount Owen applied for a variation to the Proposed Action that was required as a result of the mine plan optimisation process. A further meeting with the DoE was held on 8 August 2014 to provide an overview of Project changes, discussion of Mount Owen's application for variation of Proposed Action and confirmation of supplementary DGRs. On 25 August 2014, DoE advised that the variation application had been approved. Further, DoE advised on 18 September 2014 that the original supplementary DGRs would be appropriate for the Proposed Action.

4.4.4 Service Provider Consultation

There are limited services (primarily local 11 kV electricity) that would be directly impacted as part of the Project. Notwithstanding, Mount Owen has undertaken detailed consultation with service providers in the vicinity of the Project Area. The key service providers consulted as part of the project design and assessment phase include TransGrid (330 kV transmission lines), Ausgrid (other power infrastructure), ARTC (rail network), and Telstra and AAPT (telecommunications).

Consultation has been undertaken with these service providers so that relevant design or management issues could be identified and addressed through Project design. It is proposed that ongoing consultation with these asset owners and managers in regard to the final details and design of the relevant aspects of the Project will continue.

4.4.5 Nearby Mining Operations

4.4.5.1 Integra Underground Mine

As discussed in **Section 2.3.3**, although considered unlikely, there is the potential for interaction with Integra Underground Mine. Throughout the project design phase Mount Owen has had two meetings to specifically discuss the Project and any potential interaction that may eventuate.

Mount Owen provided a letter on 11 October 2013 to Integra detailing the status of consultation, specific blasting protocol and formally seeking in principle agreement to manage any potential interaction issues, should they arise, in a mutually beneficial manner.

The Environment and Community department also receives the Project Community Information Sheets.

4.4.5.2 Ashton Coal Mine

Mount Owen met with the Ashton Coal Mine Environment and Community team in November 2012 to provide a Project briefing, including a presentation on the proposed Project. Additionally, Mount Owen have consulted with Ashton regarding the sharing of environmental monitoring data. The Environment and Community department also receives the Project Community Information Sheets.

4.4.5.3 Hebden Quarries

In addition to providing the first two community information sheets in December 2012 and April 2013, Mount Owen met with the quarry manager of Hebden Quarries on 24 July 2013. The meeting was held to introduce the Project and seek any feedback. Hebden Quarries were supportive of the proposed upgrades to Hebden Road.

4.5 Identification of Key Environmental and Community Issues

Identification of key environmental and community issues for the EIS for the Project is based on consideration of:

- the planning and environmental context for the locality (refer to **Sections 1.0**, **3.0** and **5.0**);
- outcomes of the stakeholder engagement process and learnings from 20 years of history of operations at the Mount Owen Mine (refer to **Section 4.0**);
- the DGRs for the Project (refer to **Table 3.4**); and
- baseline studies completed as part of preparation of the EIS (refer to **Section 5.0**).

The extensive stakeholder engagement process undertaken for the Project as detailed above identified issues which stakeholders consider to be the key issues for the Project.

The 10 highest ranking stakeholder issues (based on number of responses) and where they are assessed in the EIS are:

- Air Quality (refer to **Section 5.2**);
- Noise (refer to **Section 5.3**);
- Economics (refer to **Section 5.18**);
- Land Management (including post mining rehabilitation, feral animal and weed control, and bushfire) (refer to **Sections 5.19**, **5.7** and **5.16**);
- Blasting (refer to **Section 5.4**);
- Roads and infrastructure (refer to **Section 5.12**);
- Sense of Community (refer to **Section 5.17**);

- Community Engagement (refer to **Section 5.17**);
- Water (refer to **Section 5.5** and **5.6**); and
- Visual (refer to **Section 5.13**).

Further details of the issues raised by stakeholders are outlined in **Appendix 5**.

5.0 Environmental and Social Assessment

This section provides a detailed assessment of each of the key environmental and community aspects identified in the stakeholder engagement program and DGRs. It also identifies reasonable and feasible management and mitigation measures to minimise environmental impacts.

5.1 Landform and Land Use

The Project will impact on the existing landform within the Proposed Disturbance Area by modifying existing topography and soil resources. The Project will also result in varying degrees of impact on air quality, noise amenity, water resources, visual amenity and other environmental and social aspects and some of these impacts have the potential to interact with surrounding land uses. The existing topography, soil resources and land use of the Project Area and surrounding areas are discussed below. **Section 5.8** outlines the potential impacts of the Project on agricultural productivity in more detail, whilst other parts of **Section 5.0** of the EIS address other environmental aspects that have the potential to result in impacts on surrounding land uses (i.e.: air quality, noise, visual, water resources).

5.1.1 Landforms and Topography

The Project Area is situated centrally on the floor of the Hunter Valley (Central Lowlands) and occurs within the wider Hunter River catchment which covers approximately 22,000 km^2 of land bordered by the Liverpool Ranges, the Great Dividing Range, the Mount Royal Range and the Barrington Tops. The Project Area is situated approximately 87 kilometres from the coast and 150 kilometres from the western extremity of the Hunter catchment at the Great Dividing Range.

The Project Area is typical of the Central Lowlands of the Hunter Valley, which are characterised by undulating to low rolling hills formed on weak sedimentary rocks with low local relief (Kovac and Lawrie 1991). The topography of the Project Area is characterised by an undulating and hilly landscape extending to lower areas associated with the creek lines that traverse the Project Area. Elevations range between 80 metres AHD in the south and 400 metres AHD in the northern extent of the Project Area.

Approximately 18 kilometres to the south of the Project Area are the dissected sandstone plateau of Wollemi and Yengo National Parks, while approximately 30 kilometres to the north, the foothills of the Barrington Tops and Mount Royal Range adjoin the Hunter Valley floor, which is bounded by the Hunter Thrust System (Peake 2006). To the east and west of the Project Area extend the highly eroded Permian lowlands of the floor of the Hunter Valley.

The topography across the majority of the Project Area is generally flat to gently undulating with 0 to 5 degree slopes (refer to **Figure 5.1**), with the exception of Ravensworth State Forest and those steeper slopes created by the existing approved mining operations.

The Project Area is located within both the Bowmans Creek and Glennies Creek catchments. Bowmans Creek and Glennies Creek are both tributaries of the Hunter River. Mining in the Proposed Disturbance Area is primarily within three sub-catchments of Bowmans Creek, namely Yorks Creek, Swamp Creek and Bettys Creek; although part of the Proposed Disturbance Area is located within the catchment of Main Creek, a subcatchment of Glennies Creek. Areas associated with the alluvial plains of Bettys Creek, Main Creek and the Hunter River, are generally flat to gently sloping. Further description of surface water catchments is provided in **Section 5.5**.

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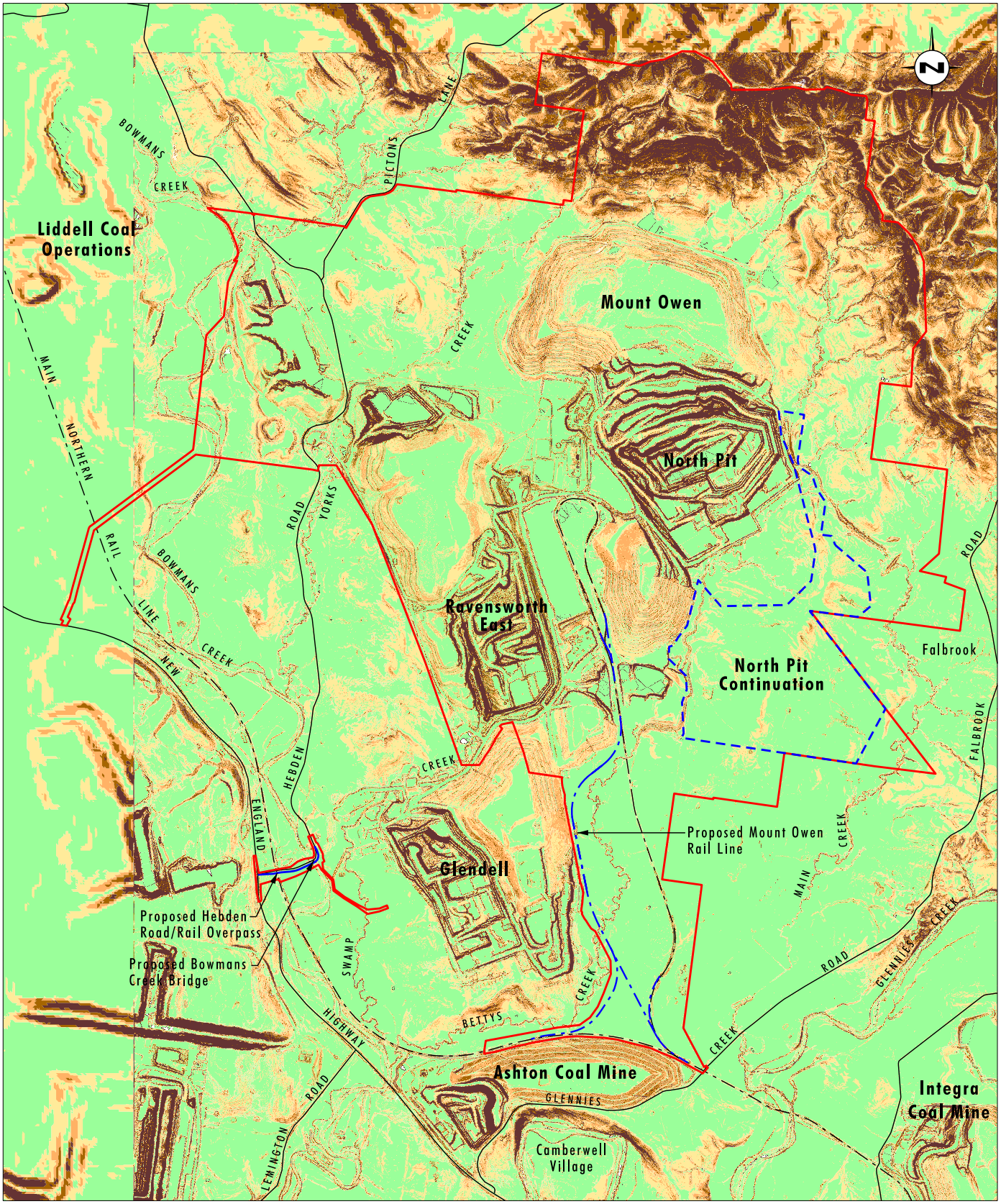

Data Source: Mount Owen (2014)

0 1 2 3km
1:60 000

Legend

- Project Area
- Proposed North Pit Continuation
- Rail Upgrade Works
- Hebden Road Upgrade Works
- Slope 0° - 5°
- Slope 5° - 10°
- Slope 10° - 15°
- Slope 15° - 20°
- Slope Greater than 20°

FIGURE 5.1

Slope Analysis of Project Area Based on Existing Topography

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5.1.2 Soil Resources

The Soil Landscapes occurring within the Project Area are mapped on the Singleton 1:250,000 Soil Landscapes Map Sheet (Kovac and Lawrie 1991). There are four soil landscapes that occur within the Project Area with the Bayswater Soil Landscape the dominant soil type, while small areas of Hunter, Rosevale and Liddell also occur (refer to **Figure 5.2**).

The main soils of the Bayswater Soil Landscape are yellow solodic and yellow and brown podzolic soils occurring on slopes, and alluvial soils in drainage lines. The soils of this landscape are susceptible to moderate sheet and gully erosion on slopes. Salt scalds and associated erosion are also common in some areas. The soils within this soil landscape have a low fertility, are typically moderately well drained and have a moderate water-holding capacity. Soil pH varies between 5.5 and 7.0 and mass movement hazard is low.

The Hunter Soil Landscape occurs throughout the floodplains of the Hunter River and its tributaries (Matthei 1995) (refer to **Figure 5.2**). The main soils of this landscape are all formed in alluvium. The soils of the Hunter Soil Landscape are susceptible to erosion along stream banks with minor sheet erosion on the adjacent terraces. The soil types within this soil landscape vary between moderately and rapidly draining, with moderate to low fertility levels. The available water-holding capacity is high throughout the landscape with the exception of sands and loams which have a low water-holding capacity. Typically soil pH varies between 5.5 and 7.5.

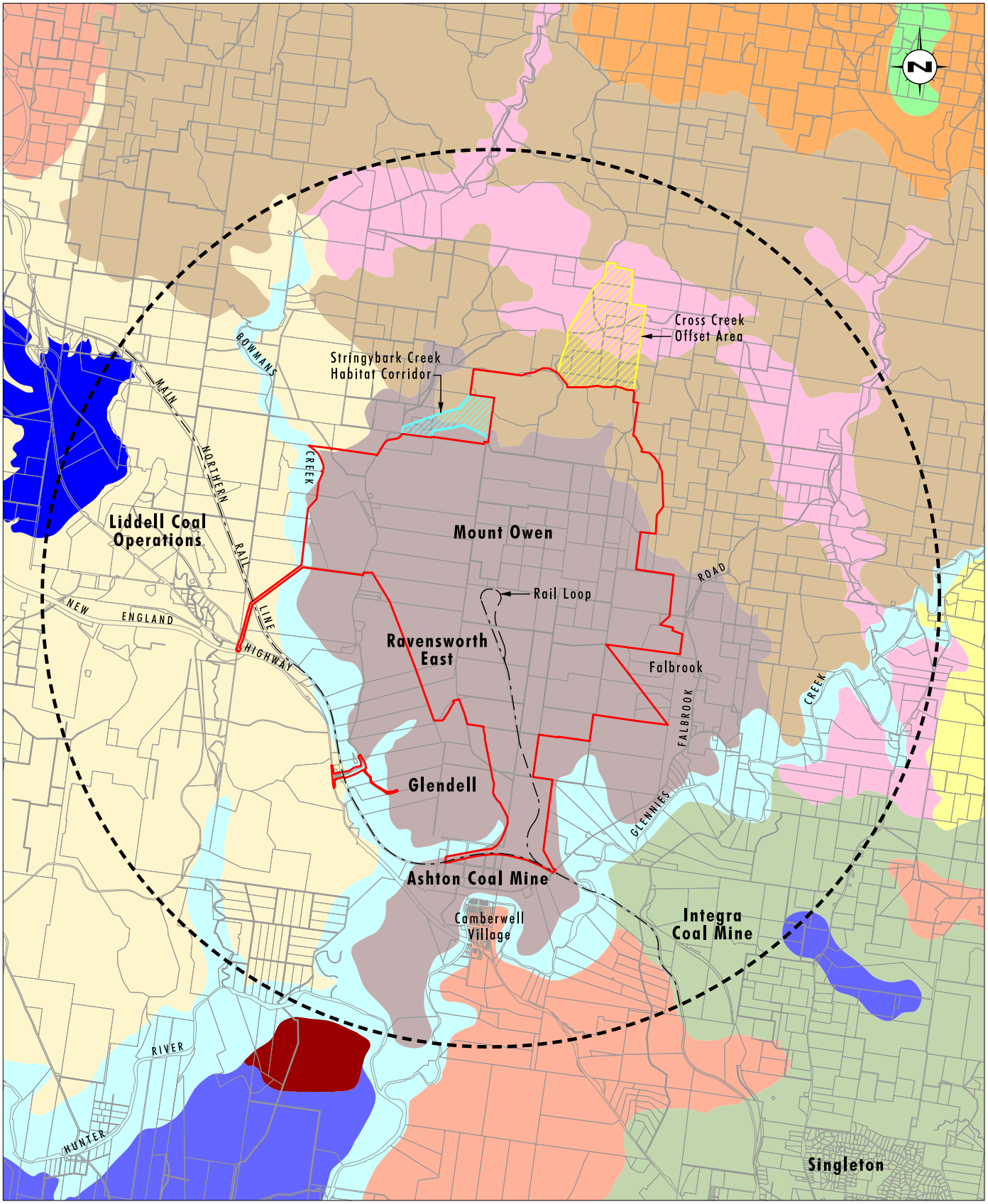
The Rosevale Soil landscape covers rolling hills to the north of Glennies Creek Dam and is present within the north of the Project Area (refer to **Figure 5.2**). The main soils are red and brown podzolic soils on the upper to lower slopes and on the steeper sections of footslopes. Drainage varies from rapid and imperfectly drained, to well drained. The soils are susceptible to minor to moderate sheet erosion on cleared areas and mass movement on steeper slopes. Typical soil pH varies between 5.5 and 8.0.

The Liddell Soil Landscape covers undulating low hills and undulating hills in the Liddell Power Station area and is present in small patches within the Project Area (refer to **Figure 5.2**). The main soils are yellow soloths on the slopes with some Yellow Solodic Soils on concave slopes. There are Earthy and Siliceous Sands on mid to lower slopes where the parent material is more sandy. The soils are susceptible to low to high topsoil erosion and have high to very high erosion hazard. The soil types are poorly to well drained, with low fertility levels. Typically soil pH is 6.0 to 6.5.

Further detailed soil analysis, including soil surveys, is provided in **Section 5.8**. As discussed in **Section 5.8.3**, there is no BSAL in the Proposed Disturbance Area.

5.1.3 Land Use

As discussed in **Section 1.3.1**, the land uses of the Project Area and surrounds is dominated by mining operations. Glencore operates other mining operations in the area including Glendell Mine to the south-west; Liddell Coal Operations to the north-west and Ravensworth Surface Operations to the south-west (refer to **Figure 5.3**). Ashton Coal Mine is located to the south of the Project Area while Integra Coal Mine is located to the south-east of the Project Area (refer to **Figure 5.3**). Integra Coal Mine is currently in a care and maintenance phase, with underground mining operations having ceased in May 2014 and open cut operations ceased in September 2014.



Data Source: Mount Owen (2014)
Soils Landscape: NSW Department of Environment, Climate Change and Water (DECCW) (2010)

0 2.0 4.0 6.0km
1:120 000

Legend

- Project Area
- Mount Owen Locality (10km Radius from Rail Loop)
- Cross Creek Offset Area
- Stringybark Creek Habitat Corridor
- Water

Soil Landscapes:

- Hunter
- Rosevale
- Greenland
- Bayswater
- Liddell
- Bridgelands
- Roxburgh
- Sedgefield
- Branxton
- Scrumlo
- Lethbridge
- Jerrys Plains

FIGURE 5.2

Regional Soil Landscapes

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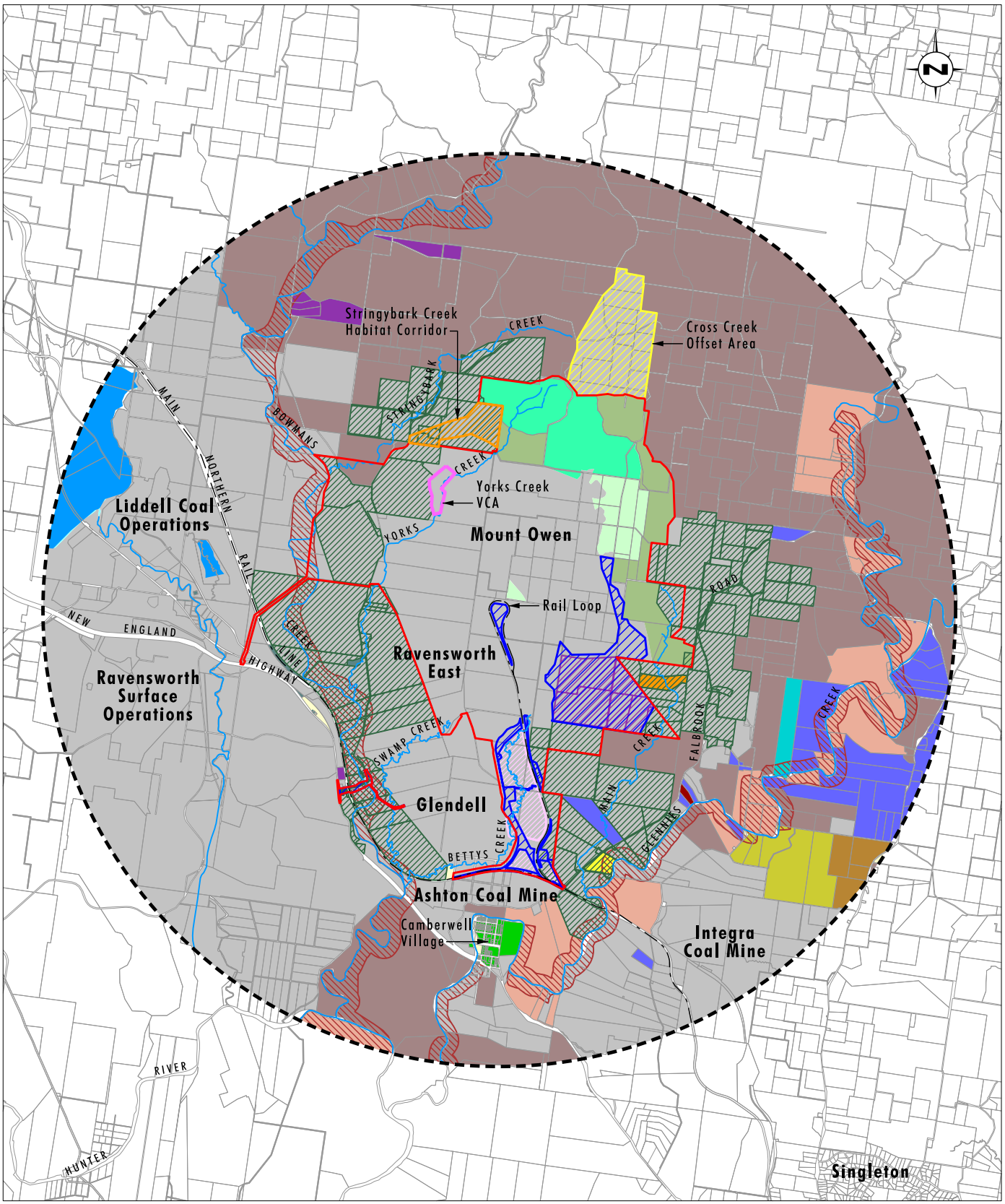

Data Source: Mount Owen (2014), Department of Lands (2006)

0 2.0 4.0 6.0km

1:120 000

Legend

- Project Area
- Proposed Disturbance Area
- Yorks Creek VCA
- Cross Creek Offset Area
- Stringybark Creek Habitat Corridor
- Land with Potential for Irrigation/Cropping
- Colinta Agriculture (Cattle Grazing)
- Colinta Agriculture (Ungrazed)
- Bettys Creek Habitat Management Area
- Mount Owen Locality (10km Radius from Rail Loop)
- Drainage Line
- Colinta Feedlot
- Grazing - Native Pastures, Some Improved Pastures
- Rural Residential/Horse Breeding
- Integra Coal Operations Biodiversity Offset Areas
- Mixed, Grazing and Irrigation/Cropping/Improved Pasture
- Olive Grove - Glencore
- Regenerating Forest (Ravensworth State Forest)
- Ravensworth State Forest
- Current Mount Owen Biodiversity Offset Area
- Regenerating Forest
- Mining Operations
- Quarry/Industrial
- Rural Residential
- Vacant
- Village/Small Holdings
- Water
- Government Authority
- Crown Land

FIGURE 5.3

Land Use

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Other land uses within the surrounding area include grazing and rural residential holdings, the Hebden and Wild Quarries to the north-west of the Project Area. The Bayswater and Liddell Power Stations are located further to the west of the Project Area. With a variety of landscapes and climates, the Upper Hunter region supports a diverse range of agricultural industries. Similarly, Singleton and Muswellbrook LGAs have a long history of agricultural land use; particularly in regard to cropping and grazing. Further details on agricultural land uses are provided in **Section 5.8**.

Land surrounding the Project Area currently owned by Glencore and its subsidiaries is utilised for cattle grazing and breeding, currently managed and operated by Colinta Holdings Pty Limited, a Glencore subsidiary. RHA Pastoral Company Pty Ltd is affiliated with Integra Coal and currently utilise large areas of land owned by Integra Coal surrounding the Integra Mining operations for agricultural purposes (refer to **Figure 5.3**).

There are a number of localities within proximity to the Project Area including Goorangoola to the north-east, Falbrook and Middle Falbrook to the east and south-east. Camberwell Village is located approximately 4.5 kilometres from the southern boundary of the North Pit Continuation where the majority of the existing residences are mine owned or have acquisition rights under approved mining development consents. Other rural residential land holdings are present within the surrounding area. These are predominantly located to the south-east of the Project Area (refer to **Figure 5.3**). Further privately owned land is located to the north and north-west of the Project Area, and continued mining operations will be moving further away from the existing residences in these northern and north-western localities.

The Ravensworth State Forest is located within the north-eastern corner of the Project Area, the New Forest area is located to the north of the Project Area and the Southern Remnant Offset is located between the existing North Pit and the MIA. Surrounding these State Forest areas is the existing Mount Owen Biodiversity Offset Areas (refer to **Figure 5.3**). Adjoining the State Forest to the south is a Travelling Stock Reserve (TSR89694) managed by the NSW Local Land Services (LLS). There are no direct impacts on Ravensworth State Forest, existing Offset Areas or the TSR proposed as part of the Project.

Further discussion of existing land uses and potential issues specific impacts on land uses are provided on the following sections.

5.2 Air Quality

A comprehensive assessment of potential air quality impacts for the Project has been prepared by Pacific Environment Limited. This detailed assessment has been undertaken in accordance with the DGRs for the Project (refer to **Section 3.2**). Specifically in relation to air quality, the DGRs required a detailed quantitative assessment of potential construction, operational and cumulative air quality impacts on all potential receivers as detailed in **Table 5.2.1** below.

Table 5.2.1 – Air Quality Assessment Director-General's Requirements

Air Quality Assessment Requirements	Section of Report
Dust impacts on privately-owned properties, mine-owned properties, and properties in the acquisition zone of Mount Owen or any other mine.	**Section 5.2.4**
24-hour cumulative PM10 emissions using an appropriate probabilistic methodology, project-specific and cumulative PM2.5 emissions, and dust generated by the transportation of coal.	**Section 5.2.4** and **Appendix 6**
Fumes from diesel, blasting activities and spontaneous combustion.	**Sections 5.2.4.3** to **5.2.4.5** and **Appendix 6**
Reasonable and feasible mitigation measures to minimise dust, diesel and blast fume emissions, including evidence that there are no such measures available other than those proposed.	**Section 5.2.5** and **Appendix 6**
Monitoring and management measures, in particular real-time air quality monitoring and adaptive management protocols.	**Section 5.2.5**

As outlined in **Section 4.2.4**, air quality impacts were identified by the community as a key issue of concern. The Project planning and design process includes the identification of air quality mitigation and management measures to reduce potential air quality impacts associated with the Project. The management and mitigation measures that have been adopted for the Project (refer to **Section 5.2.5**) are considered reasonable and feasible options to minimise predicted air quality impacts.

Additionally, the Air Quality Impact Assessment was subject to peer review by an independent expert. This process was undertaken to ensure that the Air Quality Impact Assessment was prepared in accordance with appropriate polices and guidelines; uses appropriate methodologies; and provides accurate predictions of the likely air quality impacts associated with the Project. A summary of the key findings of the Air Quality Impact Assessment is provided in this section and the full report, including the outcomes of the peer review process, provided in **Appendix 6**.

5.2.1 Air Quality Criteria

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 Environment Protection Measures for Ambient Air Quality (referred to as the Ambient Air-NEPM) (NEPC 1998a and 1998b).

Air quality concentration refers to airborne dust and is measured in micrograms per cubic metre (µg/m^3). Relevant criteria for dust concentration are defined in terms of two classes, total suspended particulates (TSP) and particulate matter (PM). TSP relates to all suspended particles which are usually in the size range of zero to 50 micrometres (µm). Particle sizes larger than 50 µm are measured in dust deposition levels. PM_{10} refers to particulate matter with a diameter less than 10 micrometres (µm) and $PM_{2.5}$ refers to particulate matter with an aerodynamic diameter less than 2.5 µm.

In 2003, the National Environment Protection Council (NEPC) released a variation to the Ambient Air-NEPM (NEPC 2003) to include advisory reporting standards (ARS) for particulate matter with an equivalent aerodynamic diameter of 2.5 µm or less ($PM_{2.5}$). It is important to note that the Ambient Air NEPM $PM_{2.5}$ advisory reporting standards are not impact assessment criteria. Notwithstanding, in the absence of any other relevant standard /

goal, the advisory reporting standards have been used for comparison against dispersion modelling results.

While the assessment of TSP and dust deposition was not specifically required in the DGRs for this Project, they have been included to provide comprehensive information for the community as this provides indicators of potential impacts to amenity rather than health.

The relevant long term and short term dust concentration goals are specified in **Table 5.2.2**.

Table 5.2.2 – Air Quality Criteria for Particulate Matter Concentrations

Pollutant	Averaging Period	Criteria/ARS	Agency
PM_{10}	24 hr maximum	50 µg/m^3	DP&E acquisition criteria (Project only). EPA impact assessment criteria (cumulative). Ambient Air-NEPM reporting goal, allows five exceedances per year for bushfires and dust storms.
	24 hr	150 µg/m^3	Total impact (i.e. incremental increase in concentrations due to the Project plus background concentrations due to all other sources).
	Annual mean	30 µg/m^3	EPA impact assessment criteria (cumulative).
$PM_{2.5}$	24-hour maximum	25 µg/m^3	Ambient Air-NEPM Advisory Reporting Standard.
	Annual mean	8 µg/m^3	
TSP	Annual mean	90 µg/m^3	National Health and Medical Research Council (NH&MRC) criteria.

Dust fall out can soil materials and generally degrade aesthetic elements of the environment. These are generally assessed for nuisance or amenity impacts.

Table 5.2.3 shows the maximum acceptable increase in dust deposition over the existing dust levels from an amenity perspective. These criteria for dust fallout levels are set to protect against nuisance impacts.

Table 5.2.3 – Dust Deposition Criteria

Pollutant	Averaging Period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited dust	Annual	2 g/m^2/month	4 g/m^2/month

Oxides of nitrogen (NOx) are produced when fossil fuels are combusted in internal combustion engines (e.g. motor vehicles, mine equipment). NOx emitted by fossil fuel combustion are comprised mainly of nitric oxide (NO) and nitrogen dioxide (NO2). **Table 5.2.4** summarises the air quality criteria for concentrations of nitrogen dioxide (NO_2) that are relevant to this study in relation to the diesel fume and blast assessments.

Table 5.2.4 – NO_2 Criteria

Pollutant	Averaging Period	Criteria
Nitrogen dioxide (NO_2)	1-hour	246 µg/m^3
	Annual	62 µg/m^3

5.2.2 Existing Air Quality Environment

5.2.2.1 Meteorological Conditions

The Air Quality Impact Assessment reviewed data from two meteorological stations, namely SX8 and SX13 (refer to **Figure 2.4**) between January 2009 and August 2012 to determine the most representative one year period for air dispersion modelling. The period chosen for modelling was the 12 month period from 1 September 2011 to 31 August 2012.

On an annual basis, winds are predominantly from the north-west and south-east. The predominant wind directions in summer are from the south-south-east and south-east while winter shows more prominent winds from the north-west and north-north-west. Spring and autumn also reflect this pattern. This pattern is typical of that found in the Hunter Valley and is shown in both the complete data set as well as the modelling year (i.e. 1 September 2011 to 31 August 2012).

Further discussion of the meteorological conditions at and surrounding the Project Area are included in the Air Quality Impact Assessment (refer to **Appendix 6**).

5.2.2.2 Climate Conditions

The nearest Bureau of Meteorology (BoM) site to collect climatic information in the vicinity of the Project is Jerrys Plains. A range of climatic information has been collected from Jerrys Plains (Post Office) since 1884. This station is located approximately 19 kilometres from the Project Area.

The annual average maximum and minimum temperatures experienced at Jerrys Plains are 25.2°C and 10.6°C respectively. On average, January is the hottest month, with an average maximum temperature of 31.7°C. July is the coldest month, with average minimum temperature of 3.8°C.

Rainfall data collected at Jerrys Plains shows that January is the wettest month, with an average rainfall of 76.7 millimetres over 8 rain days. The average annual rainfall is 645 millimetres with an average of 87 rain days.

5.2.2.3 Existing Monitoring

Air quality standards and goals refer to pollutant levels that include the contribution from specific projects and existing sources. To fully assess impacts against all the relevant air quality standards and goals it is necessary to have information or estimates on existing dust concentration and deposition levels in the vicinity of the Project. It is also important to note that the existing air quality conditions are influenced to some degree by the existing mining operations and other sources.

Dust deposition and dust concentration (TSP and PM_{10}) are monitored in the vicinity of the Project Area in accordance with the Mount Owen Complex air quality monitoring program.

The locations of the monitoring sites are shown in **Figure 2.4**. A network of High Volume Air Samplers (HVAS) measures both TSP and PM_{10} 24-hour average concentrations on a six day cycle. Five Tapered Element Oscillating Microbalance instruments (TEOMs) measure PM_{10} on a continuous basis. The Mount Owen Complex has a total of 25 dust deposition gauges which measure the monthly average of deposited dust. While monitoring $PM_{2.5}$ is not currently part of the Mount Owen Complex network, there are measurements taken at Camberwell as well as in Singleton and Muswellbrook as part of the Upper Hunter Air Quality Monitoring Network.

5.2.2.4 Monitoring Results

A summary of the annual average PM_{10} concentration from 2002 to 2013 is provided in **Table 5.2.5**.

Table 5.2.5 – Annual Average PM_{10} Concentrations from 2002 to 2013 (All Sources)[1]

Year	PM10 -1[a]	PM10-2[a]	PM10-3iii[b]	PM10-4	PM10-3ii	TEOM1-SX8[e]	TEOM2-SX10[e]	TEOM3-SX9[e]	TEOM4-SX13[f]	TEOM5-SX14[f]
2002	-[2]	-	-	26	**31**	-	-	-	-	-
2003	-	-	-	25	**38**	-	-	-	-	-
2004	16	18	-	23	**36**	-	-	-	-	-
2005	21	19	-	25	30	-	-	-	-	-
2006	17	19	20	22	27	-	-	-	-	-
2007	21	25	24	25	24	-	-	-	-	-
2008	24	26	25	25	22	-	-	-	-	-
2009	28	29	22	28	27	-	-	-	25	30
2010	22	24	21	22	20	-	-	-	18	23
2011	20	24	20	25	21	18	22	20	18	20
2012	18	25	23	29	**32**	21	24	22	23	13
2013	15	26	21	29	21	19	25	23	23	22

Note: 1) Exceedance of the air quality criterion is shown in bold.
2) - indicates monitoring not established at this location in this year.

The majority of the annual average PM_{10} concentrations for each monitoring station were below the EPA criteria of 30 µg/m^3. There were four exceptions to this at PM10-3ii. In 2002, 2003, 2004 and 2012 the annual average PM_{10} concentration at monitor PM10-3ii was 31 µg/m^3, 38 µg/m^3, 36 µg/m^3 and 32 µg/m^3, respectively. Monitoring location PM10-3ii is located on a Glencore-owned property, approximately 200 metres from the nearest private residence (currently subject to acquisition rights from Glendell). The cause of the high PM_{10} concentrations at monitor PM10-3ii is unknown, however, given the location, there are a number of mines that may contribute to dust levels at this monitoring station in addition to the background concentration.

A summary of the annual average TSP monitoring results for each of the four TSP HVAS monitors is presented in **Table 5.2.6**.

Table 5.2.6 – Annual Average TSP Concentrations from 2002 to 2013 (All sources)[1]

Year	TSP-1	TSP-2[3]	TSP-3[4]	TSP-4[5]
2002	79	-	-	-
2003	70	-	28	-
2004	47	50	64	-
2005	50	45	60	-
2006	50	50	69	66
2007	64	69	79	64
2008	63	76	70	63
2009	80	84	**98**	73
2010	62	79	84	63
2011	62	72	85	65
2012	59	77	**102**	66
2013	47	85	**99**	65

Note: 1) Exceedance of the air quality criterion is shown in bold.
2) - indicates monitoring not established at this location in this year.
3) Monitoring commenced December 2003.
4) Monitoring commenced December 2003. Monitor located on mine owned land close to existing operations.
5) Monitoring commenced October 2006.

The annual average TSP concentrations have remained below the EPA criterion of 90 µg/m^3 for all years, except at monitor TSP-3 in 2009, 2012 and 2013. TSP-3 is located on mine owned land, west of the Project Area between Mount Owen and Liddell Coal Operations. The closest private residence is approximately 5 kilometres from the monitoring location. The highest 24 hour TSP concentration at monitor TSP-3 was 265 µg/m^3 on 8 December 2009. Concentrations at all four TSP monitors were elevated on this day. This day corresponds with severe weather conditions and dust storms experienced in the Hunter region from 8 to 13 December 2009. The high annual average in 2012 at TSP-3 is the result of elevated 24 hour levels between August and October, peaking at 327 µg/m^3 on 5 October 2012. Other monitors all recorded higher than normal TSP measurements on that day, indicating a possible regional event rather than just local factors.

5.2.3 Assessment Methodology

The Air Quality Impact Assessment follows a conventional approach commonly used for air quality assessment in Australia and outlined in the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (DEC 2005a). This modelling approach is accepted by the DP&E and the NSW EPA.

The TAPM and CALMET/CALPUFF modelling system was used in this assessment. TAPM is a prognostic meteorological model that generates gridded three dimensional meteorological data for each hour of the model run period. CALMET, the meteorological pre-processor for the dispersion model CALPUFF, calculates fine resolution three dimensional meteorological data based upon observed ground and upper level meteorological data, as well as observed or modelled upper air data generated by TAPM. CALPUFF then calculates the dispersion of dust within this three dimensional meteorological field.

Output from TAPM, plus local observational weather station data were entered into CALMET; from this, a 1 year representative meteorological dataset suitable for use in the 3 dimensional plume dispersion model, CALPUFF, was compiled.

In addition, a cumulative air quality assessment was undertaken to assess the combined effects of other mines operating concurrently with the Project. Emissions from other approved mines were derived from information provided in past publicly available air quality impact assessments. The following existing and proposed mines have been included, although not all are operational for all modelling years:

- Ashton South East Open Cut (SEOC) and Underground (UG);
- Glendell Mine;
- Hunter Valley Operations (HVO) North;
- Hunter Valley Operations (HVO) South;
- Integra Open Cut (OC) and Underground;
- Liddell Colliery (assumes approval of current modification application);
- Ravensworth Surface Operations;
- Ravensworth Underground; and
- Rixs Creek.

The mines that have been included in the cumulative model, as operating at particular Project stages, are shown in **Table 5.2.7** below. It is important to note that both Integra Coal Mine (including underground and open cut operations) has recently been placed on care and maintenance. Furthermore, Ravensworth Underground Mine is expected to enter a period of care and maintenance in November 2014. Given the uncertainty regarding the potential duration of the care and maintenance period, the Air Quality Impact Assessment assumes these mines will be operating as described in current approvals. The Air Quality Impact Assessment assumes mining operations within the Ashton SEOC will proceed as described in the Environmental Assessment (Pacific Environment 2014).

Table 5.2.7 - Operating Mines Included in Modelled Years

Mine	Year 1	Year 5	Year 10
Ashton SEOC and UG	Mine Operating	Mine Operating	Mining Completed
Glendell Mine	Mine Operating	Mine Operating	Mining Completed
HVO North	Mine Operating	Mine Operating	Mining Completed
HVO South	Mine Operating	Mine Operating	Mine Operating
Integra OC and UG	Mine Operating	Mine Operating	Mine Operating (Underground only)
Liddell Colliery	Mine Operating	Mine Operating	Mining Completed
Ravensworth Surface Operations	Mine Operating	Mine Operating	Mine Operating
Ravensworth UG	Mine Operating	Mine Operating	Mine Operating
Rixs Creek	Mine Operating	Mining Completed	Mining Completed

The assessment has considered three representative mining scenarios throughout the life of the Project (refer to **Section 2.3.5**), to ensure that the range and extent of proposed activities are considered. The three mining scenarios are as follows:

- Year 1 (approximately 2016);

- Year 5; and
- Year 10.

Year 1 represents the beginning of the Project including mining of BNP and the North Pit, while Year 5 represents the year of maximum combined overburden and ROM production. Year 10 represents the southernmost part of the proposed North Pit Continuation and the last year before a step-change decrease in production. The total material moved in Year 9 is slightly higher than in Year 10, but in Year 10 the pit has progressed to its southern most extent.

5.2.4 Air Quality Impact Assessment

5.2.4.1 Project Specific Emissions

With the exception of dust deposition, Project specific predictions are not compared to EPA criteria as these criteria are cumulative. The 24-hour PM_{10} Project specific predictions are also relevant to the DP&E acquisition criteria of 50 µg/m^3.

The results for each modelled year are included in **Appendix 6**. **Figure 5.4** considers all modelled years to produce the worst-case Project specific scenario for the entire Project life, for 24 hour PM_{10} predictions.

There are no privately owned residences that are predicted to exceed the 24 hour average PM_{10} criterion (50 µg/m^3) in Year 1 or Year 5 as a result of the incremental increase in impact from the Project specifically. One privately owned residence is predicted to exceed the 24 hour average PM_{10} criteria (50 µg/m^3) by 1 µg/m^3 in Year 10, refer to **Table 5.2.8**.

Table 5.2.8 - Worst Case Predicted Impacts at Residences

Resident ID	24 hr average	Applicable year
R023	51	10

There are seven properties (R018, R105, R114, R115, R116, R133, and R181) where greater than 25 per cent of the contiguous property area is predicted to be impacted greater than 50 µg/m^3 (refer to **Table 5.2.9**). Property R018, R115, R133, and R181 are vacant parcels of land, with property R018 currently holding acquisition rights from the existing Mount Owen approval. Residence R105 currently has acquisition rights with Integra.

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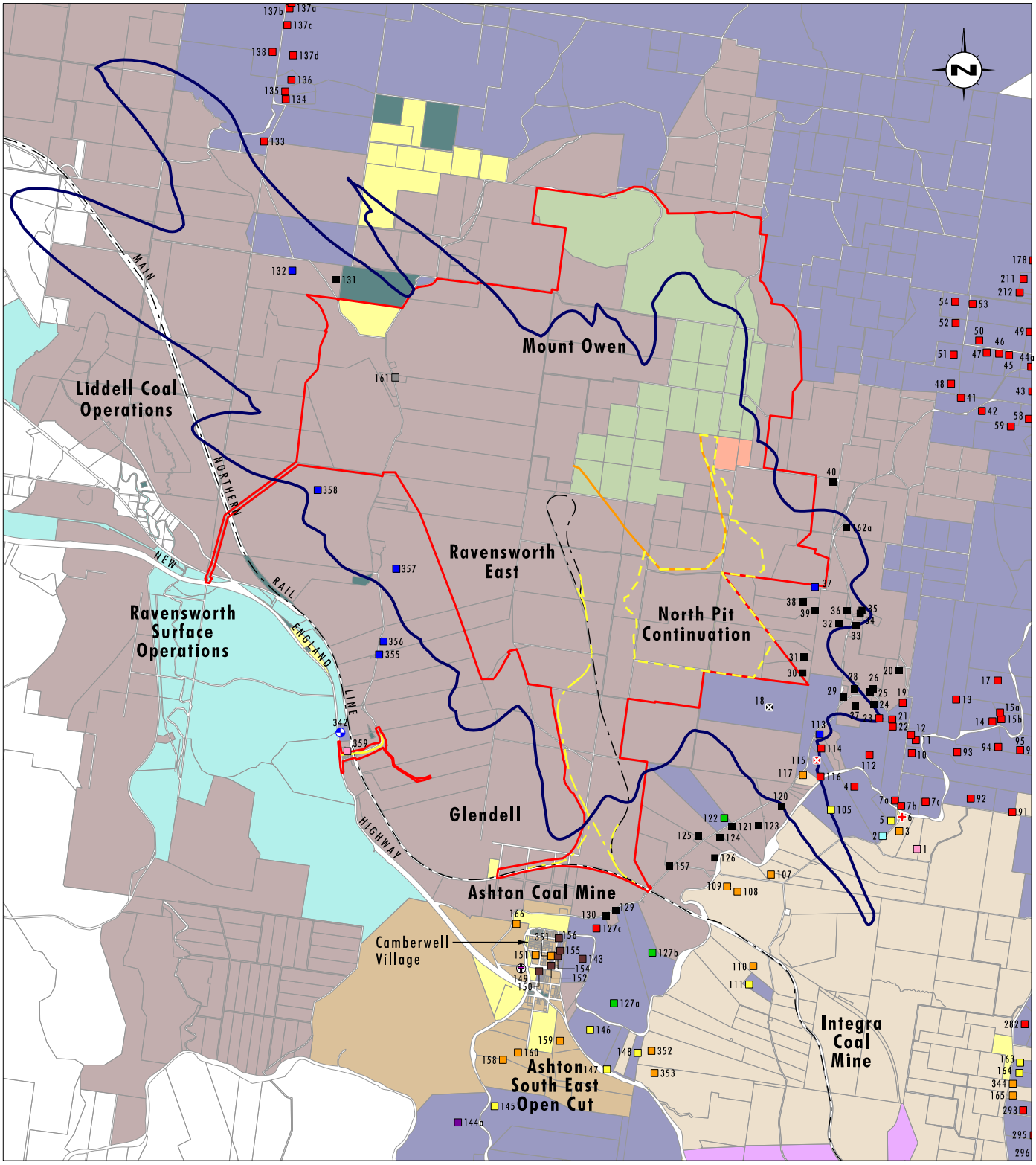

Data Source: Mount Owen (2014), Department of Lands (2009)

0 1 2 4 km

Scale 1:90 000

Legend

- Project Area
- Approved North Pit Mining Extent
- Proposed North Pit Continuation
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Ashton Coal
- Crown Land
- Crown Land TSR
- Government Authority
- Integra Coal
- Macquarie Generation
- Glencore
- Private
- Rixs Creek Mine
- State Forest
- Church
- Daracon Site Office
- Mine Owned Residence - Glencore
- Mine Owned Residence - Other Mine
- Mine Owned Residence - Derelict
- Mine Owned Residence - Vacant
- Subject to Acquisition Rights - Glencore No Dwelling
- Private No Dwelling
- Glennies Creek Fire Brigade
- Currently Subject to Acquisition Rights - Glencore
- Currently Subject to Acquisition Rights - Other Mines
- Private Residence
- Currently Subject to Acquisition Rights - Dairy
- SEOC Acquisition
- Community Hall
- Former Hebden Public School
- PM10 - 24 Hour 50μg/m^3 Contour

FIGURE 5.4

Worst Case Project Air Quality PM10
24 Hour 50μg/m^3 Contour

File Name (A4): R02/3109_899.dgn
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Table 5.2.9 – Property Impacts

Land Holding ID	Status	Area (ha)	Approximate Area impacted (ha)	% Impacted	Years above Criteria
R018	Vacant, currently has acquisition rights from existing Mount Owen development consent	184.9	184.9	100	Year 5 and Year 10
R105	Residence located on land holding. Currently has acquisition rights with Integra	62.8	19.9	32	Year 10
R114	Residence located on land holding.	5.7	1.7	30	Year 5
R115	Vacant	5.9	3.4	58	Year 5
R116	Residence located on land holding.	4.1	3.3	80	Year 5 and Year 10
R133	Vacant	107.5	84.9	79	Year 1 and Year 5
R181	Vacant	2.9	2.9	100	Year 5 and Year 10

Twelve mine owned residences (11 Glencore owned residences and 1 Integra owned residence) are predicted to have 24 hour PM_{10} levels in excess of the criterion in Year 1, Year 5 and Year 10.

The dust deposition levels are predicted to be well below the EPA incremental criterion of 2 g/m^2/month, at all private residences in Year 1, Year 5 and Year 10.

5.2.4.2 Cumulative Impacts

An assessment of the cumulative air quality impacts associated with the Project and neighbouring mines was undertaken as part of the air quality assessment.

There is one privately owned residence (R354), predicted to exceed the annual average cumulative PM_{10} criteria (30 $\mu g/m^3$) in Year 1. This residence is located in excess of 10 kilometres from the Proposed Disturbance Area and is likely to be heavily influenced from both Rixs Creek and Integra mines. The model indicates that this residence would exceed the applicable criteria irrespective of the Project. There are no privately owned residences, without current acquisition rights, predicted to exceed the annual average cumulative PM_{10} criterion (30 $\mu g/m^3$) for Years 5 and 10.

There are a further two residences that currently have acquisition rights from other mining operations that are predicted to exceed the annual average PM_{10} criterion. As identified in **Table 5.2.10** below, the contribution of the Project at these residences is very low. The primary driver for these properties exceeding the annual average criteria is their relative proximity to other approved mining operations and irrespective of the Project, air quality impacts at these residences are predicted to have exceeded the criteria.

Table 5.2.10 - Predicted Project Contribution to cumulative Annual Average

Exceeding Residence ID	Predicted Total Cumulative PM_{10}	Predicted contribution from Mount Owen ($\mu g/m^3$)
Year 1		
R111	36	3
R145	42	1
R354	35	<1
Year 5		
R111	36	3
R145	31	<1
Year 10		
No predicted exceedances at private residents		

To assess the predicted cumulative annual average impacts, each mine is allocated a set number of dust emission sources located at the points of major emission, as estimated from the locations of pits, overburden emplacement areas and other major dust sources shown in the Environmental Assessments for approved operations. Sources have been considered in three classes (wind erosion, loading, emplacement and all other sources where emissions are assumed to be independent of wind speed) covering all dust emission sources for which there are emission factor equations for open cut mines. Where data was not available for the modelled years of the Project, the closest modelling year was taken. This is considered a conservative approach (likely over-prediction) as it does not take into account the locations of individual activities at each site.

Given the inherent conservatism associated with the cumulative impact predictions, it is likely that the results are an over prediction.

Annual average cumulative TSP concentrations are not predicted to exceed 90 $\mu g/m^3$ at any private residences that do not already have acquisition rights for all modelled years. It is predicted that the TSP concentrations would exceed 90 $\mu g/m^3$ at one private residence (R145) and one mine owned residence in Year 1 of the Project only. Similarly, it is predicted that the maximum deposited dust criteria (4 g/m^2/month) would be exceeded at one private residence (R145) and two mine owned residences in Year 1 of the Project only. It is noted that R145 is a significant distance from the Project, which is estimated to contribute less than 2 $\mu g/m^3$. The cumulative prediction for this residence is well above 30 $\mu g/m^3$ and would exceed the relevant criteria without the contribution of the Project due to operations at the adjacent mines (i.e. Integra and Rixs Creek) as well as existing background levels.

Difficulties in predicting cumulative 24 hour impacts are compounded by the day-to-day variability in ambient dust levels and the spatial and temporal variation in any other anthropogenic activity and natural events (e.g. agricultural activity, dust storms, bushfires etc., and including mining in the future). Due to these variabilities, 24 hour cumulative air quality impacts have been evaluated using a statistical approach (Monte Carlo Simulation). This approach has been provided to meet the requirements of the DGRs to use an appropriate probabilistic methodology to assess 24 hour average cumulative PM_{10} and $PM_{2.5}$ and focuses on representative receptors in key areas in the vicinity of the mine.

A number of private receptors were selected for cumulative analysis based on their proximity to operations, prevailing wind directions and the magnitude of their Project only (i.e. non-cumulative) predictions. The location of these receptors is shown in **Figure 5.5** and include areas to the north west, Middle Falbrook and Camberwell Village.

The acquisition criterion for the cumulative PM_{10} 24 hour prediction is 150 µg/m^3. The probabilistic modelling undertaken indicates that no private residences are predicted to exceed 150 µg/m^3.

Although not an acquisition criteria, an assessment against the EPA cumulative PM_{10} 24 hour average of 50 µg/m^3 was also undertaken for the Project. Existing activities in the area already contribute to approximately two days per year where PM_{10} concentrations exceed 50 µg/m^3 at SX8 and SX9 and three days per year at SX14. Contributions from the Project are estimated to range from an additional exceedance of the EPA goal (50 µg/m^3) by two days at R093 to 12 days at R114.

There are not predicted to be any exceedances of the 25 µg/m^3 NEPM Advisory Reporting Standard for 24-hour average $PM_{2.5}$ concentrations, due to the Project.

5.2.4.3 Blast Fume Emissions

In order to estimate the potential NO_2 concentration at the nearby receptors, CALPUFF dispersion modelling was completed and predicted impacts assessed at the closest residences for Year 10. This year was selected as mine activities are closest to sensitive receptors. Two representative private residences (R114 and R116) and two mine owned residences closest to the site boundary (R030 and R031) were selected.

A summary of the number of hours predicted to exceed the 1 hour average NO_2 impact assessment criteria of 246 mg/m^3 is presented in **Table 5.2.11**. It is important to note that these results include background concentrations. There are a maximum of 12 hours in a year (from a possible 2,944 available blasting hours) when the 1 hour average criterion is predicted to be exceeded at two privately owned residences.

The approach taken to assess the impacts is considered to be conservative due to a number of assumptions, including:

- that every blast has a Rating 3 Fume Category; and
- that the background NO_2 and O_3 levels in the immediate vicinity of the blast are the same as Wallsend. This has a direct impact on the predicted conversion rate from NO to NO_2. The closest EPA monitoring station that collects NO_2 is in Singleton; however, the station does not collect O_3 data, and only started operating in November 2011. As both NO_2 and O_3 data are required, hourly data from the nearest EPA monitoring site that collects appropriate data (Wallsend, Newcastle) were used.

Table 5.2.11 – Summary of Number of Hours the 1 hour Average NO_2 Concentrations Predicted to Exceed Impact Assessment Criteria (including background NO_2) (Year 10)

Receiver	Number of Hours Predicted to Exceed the 1 hour NO_2 Assessment Criteria (246 µg/m^3)
Private	
R114	12
R116	10

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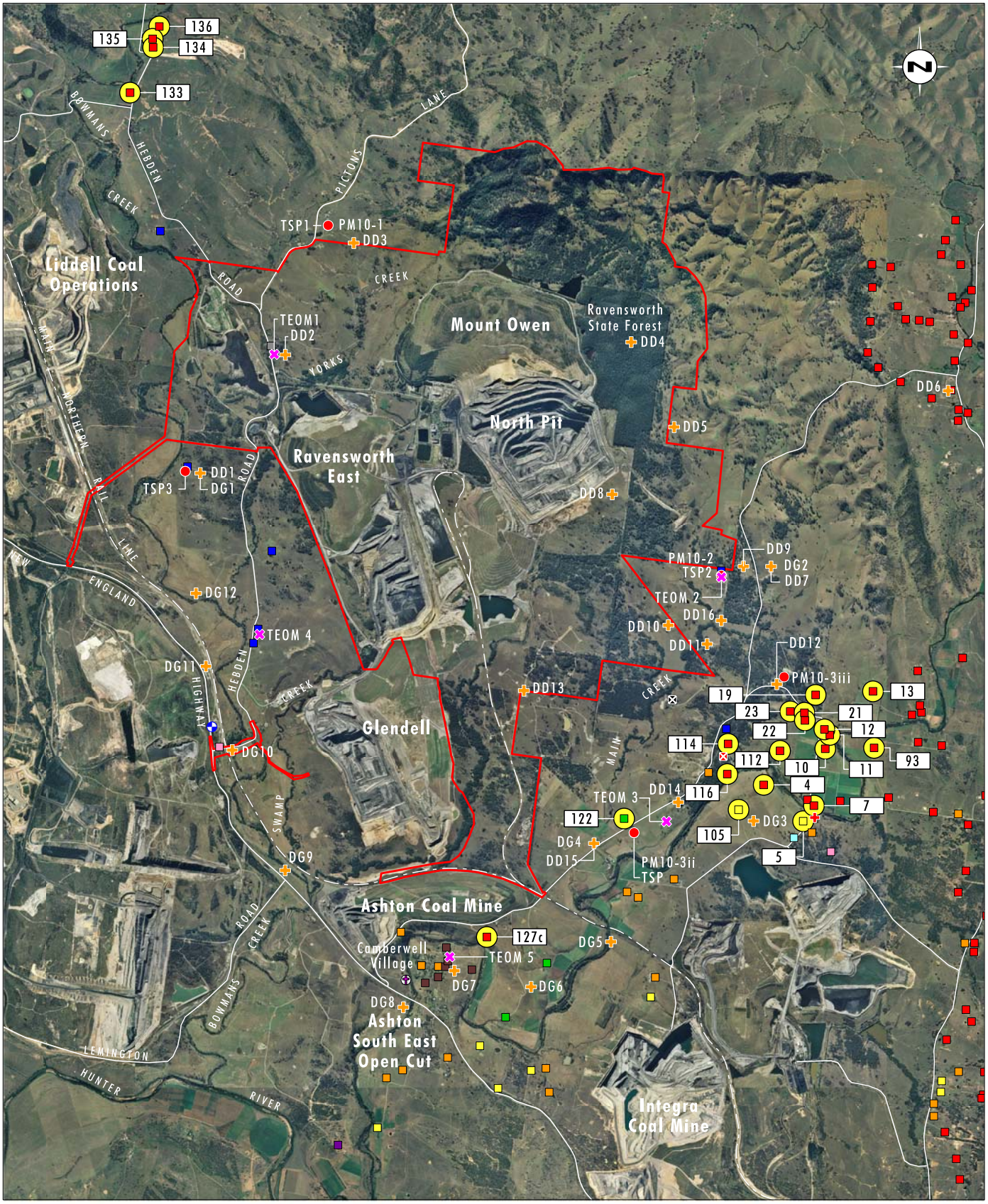

Image Source: Mount Owen (2012-2013)
Data Source: Mount Owen (2014)

0 1 2 4 km
1:80 000

Legend

- Project Area
- Depositional Dust Monitoring
- HVAS Location (dust)
- TEOM Monitoring Location
- Cumulative Analysis
- Church
- Mine Owned Residence - Mount Owen
- Mine Owned Residence - Other Mine
- Mine Owned Residence - Derelict
- Mine Owned Residence - Vacant
- Subject to Acquisition Rights - Mount Owen No Dwelling
- Private No Dwelling
- Glennies Creek Fire Brigade
- Currently Subject to Acquisition Rights - Mount Owen
- Currently Subject to Acquisition Rights - Other Mines
- Private Residence
- Currently Subject to Acquisition Rights - Dairy
- SEOC Acquisition
- Community Hall
- Former Hebden Public School
- Daracon Site Office

FIGURE 5.5

Mount Owen Complex
Cumulative Analysis Receivers

File Name (A4): R02/3109_900.dgn
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Table 5.2.11 – Summary of Number of Hours the 1 hour Average NO_2 Concentrations Predicted to Exceed Impact Assessment Criteria (including background NO_2) (Year 10) – cont.

Receiver	Number of Hours Predicted to Exceed the 1 hour NO_2 Assessment Criteria (246 µg/m^3)
Mine Owned	
R030	8
R031	3

A review of meteorological conditions when these exceedances are predicted to occur was completed. This analysis showed that all theoretical exceedances occurred when there was a rapid drop in the mixing height and the atmosphere becomes more stable, resulting in poor dispersion conditions.

As discussed above, the blast fume assessment was undertaken assuming a worst case scenario that a Rating 3 Fume Category could potentially occur at Mount Owen. Since July 2012, Mount Owen have been recording and reporting to DP&E post-blast fume to identify the range of blast categories actually occurring onsite. The two years of blast rating data recorded for the Mount Owen Mine (including the North Pit and West Pit) from July 2012 to June 2014 is presented in **Table 5.2.12** below.

Table 5.2.12 - Number and rating of Blasts at Mount Owen Mine from July 2012 to June 2014

Rating	Number of Blasts	Annual Percentage
0	147	77%
1	36	19%
2	9	4%
3	0	0.0%
4	0	0.0%
5	0	0.0%
Total Blasts	192	-

Further analysis of the two private residences identified above show that there is a potential for exceedance at R114 for rating fume categories one and two, and at R116 for rating fume category two. These theoretical exceedances are only predicted to occur under adverse weather conditions, during which blasting would not occur.

Table 5.2.13 - Summary of number of hours the 1-hour average NO_2 concentrations predicted to exceed 246 µg/m^3 (including background NO_2) (Year 10)

Receptor ID	Rating 2	Rating 1	Rating 0
Private Residences			
R114	9	3	0
R116	2	0	0

As discussed in **Section 5.2.5**, management measures will be implemented to firstly minimise the potential for the formation of NO_x emissions and in addition, Mount Owen will continue to limit blasting activity during adverse weather conditions, (i.e.: light winds from the

north-west and low mixing heights, combined with increasing atmospheric stability), and accordingly no exceedances of the criteria are anticipated.

5.2.4.4 Diesel Emissions

Table 5.2.14 presents the results of the dispersion modelling for each pollutant at the selected receptors for the Project alone. This shows that the predicted impacts for all pollutants at private residences are below their respective assessment criteria, with the exception of mine-owned residences R30 and R31 which may exceed the 1-hour average NO_2 criterion.

Predictions of CO and SO_2 are well below their respective criteria and were not considered further in the assessment.

Table 5.2.14 – Predicted NO_2, SO_2 and CO Concentrations due to Diesel Fumes (Year 10)

Receiver	Maximum 1-hour average NO_2 (µg/m^3)	Maximum 1-hour average CO (µg/m^3)	Maximum 1-hour average SO_2 (µg/m^3)
	Impact Assessment Criteria		
	246 µg/m^3	**30 µg/m^3**	**570 µg/m^3**
Private			
R114	161	0.53	0.79
R116	151	0.95	1.42
R127c	102	0.30	0.44
R133	96	0.23	0.35
Mine Owned			
R030	**252**	0.91	1.36
R031	**295**	1.08	1.61

5.2.4.5 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, but not so confined as to preclude the ingress of oxygen to the combustible material at a rate sufficient to promote the combustion and release of heat energy. 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 history of mining at Mount Owen, it is considered that there is a very low propensity for spontaneous combustion to occur within ROM and product coal, coal reject and overburden emplacement areas. However, the issue of spontaneous combustion and the potential liability for mine closure will continue to be evaluated and managed (if required) as part of the Project.

Material that is potentially susceptible will be placed at a suitable depth 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 bushfires in the

revegetated areas. Measures to minimise oxygen exposure pathways to potentially susceptible material will include the following:

- capping of tailings emplacement areas;
- co-disposal of coarse reject material with overburden and incorporated at a suitable depth into the final landform; and
- selectively handling and burying at depth, overburden material that is identified as being prone to spontaneous combustion to prevent exposure of this material.

5.2.5 Air Quality Management and Monitoring

In December 2011, the NSW EPA issued a notice of variation to the Mount Owen and Ravensworth East EPLs 4460 and 10860, respectively. This was part of an EPA initiative for Hunter wide mining operations. The notice required a site-specific review of Best Management Practice be conducted to identify the most practicable means to reduce particulate matter, as part of the Pollution Reduction Program (PRP). The Best Management Practice review for Mount Owen followed the process outlined in the OEH's *Coal Mine Particulate Matter Control Best Practice – Site Specific Determination Guideline* (OEH 2011a), referred to as the OEH Guideline.

The top four sources of PM_{10} emissions for the Mount Owen and Ravensworth East Mines were identified as:

1. Wheel generated dust from unpaved roads.
2. Wind erosion of overburden.
3. Loading overburden to trucks.
4. Loading coal to trucks.

The air quality impact assessment provides details of the applicable Best Management Practice measures recommended by the NSW EPA for the PRP process and identifies current measures and those to be implemented for this Project (refer to **Appendix 6**). These controls are drawn from recommendations of the *NSW Coal Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining* (Donnelly *et al*. 2010). As part of the Project, Mount Owen completed a detailed review of every measure identified in Donnelly *et al*. (2010) to enable a full account of all reasonable and feasible mitigation measures. This review identified a number of measures considered reasonable and feasible that have been included in the modelling and accordingly are part of the Project.

As part of the Project, Mount Owen will commit to a haul road emission control factor of 85 per cent. Although this is higher than the 80 per cent currently in the PRP, Mount Owen has undertaken testing of haul road control efficiencies which identified that the proposed haul road emission factor of 85 per cent used in the modelling is readily achievable. Further detail of this testing regime is provided in **Appendix 6**. Ongoing testing will continue as part of the air quality monitoring regime.

The air quality model has a number of management and mitigation measures 'built in' to reduce the potential impact of the Project. This includes an 85 per cent haul road emission control factor, progressive and temporary rehabilitation, product coal moisture, covered hoppers and the like.

The majority of the best practice measures are currently proactively implemented and will be maintained for the Project. A summary of the measures that are considered to be reasonable and feasible to minimise dust, diesel and blast fume emissions for the Project are presented in **Table 5.2.14**.

Table 5.2.14 – Proposed Mount Owen Air Quality Management Measures

Source	Management/Mitigation Measure
Wheel generated dust on unpaved haul roads	Continue to establish visual triggers and associated actions for wheel generated dust from unpaved haul roads and incorporate these within operational procedures and undertake operator training.
	Continue to implement an objective measurement method to demonstrate haul road dust control efficiency and target an overall dust control efficiency of 85%. This is over and above the target of 80% set by the EPA in their current PRP attached to the Mount Owen and Ravensworth East EPLs. Results from the monitoring program to date confirm that this is achievable.
	Continued implementation of the PRP to monitor and manage dust generation. As noted above, results from the monitoring program indicate that current practices are achieving more than the currently required 80 per cent control efficiency.
Bulldozer Operations	Continue to establish suitable visual triggers and associated actions for bulldozer operations at exposed locations and incorporate these within operational procedures and undertake operator training.
	Modify bulldozing operations at exposed locations to reduce the potential for dust impacts, in accordance with the Mount Owen Air Quality and Greenhouse Gas Management Plan (AQGG Management Plan).
Overburden Loading and Emplacement	Continue to establish suitable visual triggers and associated actions for overburden loading and emplacement operations and incorporate these within operational procedures and undertake operator training.
	Modify overburden loading and emplacement operations to reduce the potential for dust impacts, in accordance with the Mount Owen AQGG Management Plan.
Loading Coal to Trucks	Establish suitable visual triggers and associated actions for loading coal to trucks and incorporate these within operational procedures and undertake operator training.
	Modify coal loading operations to reduce the potential for dust impacts, in accordance with the Mount Owen AQGG Management Plan.
Wind Erosion of Overburden Emplacement and Exposed Areas	Temporarily treat disturbed areas if prompt rehabilitation is not feasible, for example on some topsoil stockpiles.

Table 5.2.14 – Proposed Mount Owen Air Quality Management Measures – cont.

Source	Management/Mitigation Measure
Across varying source types including bulldozing, overburden loading and emplacing, haulage on unsealed roads and loading coal to trucks.	Continue the use of the Mount Owen proactive air quality control system to inform operational dust management by undertaking the following: - Integrate short-term triggers and alarms into the real-time PM10 and meteorological monitoring system to integrate short-term triggers and alarms; - Develop a procedure linking triggers with associated actions; - Document within the procedure the use of dust risk forecast information for proactive dust management planning; and - Make provision for recording actions taken in response to alarms.

All reasonable and feasible measures will be undertaken and implemented to reduce dust generated from the Project (refer to Section 7 of the Air Quality report in **Appendix 6**). There are no other current measures that would be considered reasonable and feasible than those proposed.

Fumes from blasting are managed, and will continue to be managed, in accordance with Code of Good Practice: Prevention and Management of Blast Generated NOx Gases in Surface Blasting (Australian Explosives Industry and Safety Group Inc. 2011). Measures that are currently implemented are detailed in the Mount Owen Blast Management Plan. In summary they include measures to:

- restrict blasting to between 9.00 am and 5.00 pm (EST) (9.00 am and 6.00 pm (DST)) Monday to Saturday with an additional 12 blasts per year permitted between 7.00 am and 9.00 am (as per current approval conditions);
- restrict blast frequency to two blasts per day at both the Mount Owen and Ravensworth East Mines;
- assess meteorological conditions such as wind speed and direction immediately prior to each blast to identify the blast exclusion arc;
- restrict blasting to suitable atmospheric and meteorological conditions;
- advise nearby private landholders of blasting times (where requested); and
- document and video record each blast to determine fume generation for a minimum of one minute duration while following the blast until the fume has dissipated.

Although theoretically there is potential to exceed the 1 hour average NO_2 criterion under certain meteorological conditions, blasts will be designed not to cause exceedances of the relevant blast fume criteria.

The NSW *Protection of the Environment Operations* (POEO) *(Clean Air) Regulation 2010* prescribes requirements for motor vehicle emissions, which will be the main source of diesel fumes for the Project. Plant, equipment and motor vehicles will be maintained and operated in a proper and efficient manner.

Haul roads will also be constructed to minimise impact through measures such as reducing vehicle kilometres travelled (VKT) to a minimum distance, thereby reducing diesel usage and fume.

The risk of spontaneous combustion occurring at Mount Owen is very low. However, if it occurs, it would continue to be managed in accordance with the Mount Owen Spontaneous Combustion Procedure. Preventative measures include those related to managing delays in stockpiling and reclaiming, as well as information on recognising signs of spontaneous combustion and the potential level of risk (refer to **Section 5.2.4.5**). In the unlikely event that spontaneous combustion occurs, the control measures outlined in Mount Owen's Spontaneous Combustion Procedure identify the various options available depending on the level of risk associated with potential hazards to personnel and equipment.

As part of the ongoing management of these air quality control measures, long-term monitoring is required to ensure that any reductions in emissions are maintained over the lifetime of the Project, and will enable Mount Owen to check that progress is being made towards environmental targets. Mount Owen will continue to operate its dust monitoring network as detailed in **Section 5.2.2.3**, with refinement of the monitoring network as mining progresses.

5.3 Noise Assessment

The DGRs identify potential noise impacts as a key issue for the Project. To assess the potential impacts of the Project, a detailed Noise Impact Assessment (NIA) was completed by Umwelt. The DGRs in relation to noise are outlined in **Table 5.3.1** below.

Table 5.3.1 – Noise Impact Assessment Director-General's Requirements

Noise Impact Assessment Requirements	Section of Report
Detailed quantitative assessment of potential construction, operational and off-site road / rail noise impacts.	**Sections 5.3.3**, **5.3.6**, **5.3.7** and **5.3.8** and **Appendix 7**
Reasonable and feasible mitigation measures, including evidence that there are no such measures available other than those proposed.	**Section 5.3.10** and **Appendix 7**
Monitoring and management measures, in particular real-time, attended noise monitoring, and predictive meteorological forecasting.	**Section 5.3.10** and **Appendix 7**

In addition to the operational noise from the Project, the NIA also takes into consideration construction, road and rail noise impacts associated with the Project. The NIA also assesses the cumulative impact of all industrial noise sources in the area, considering the combined impacts of the Project and the surrounding existing and approved mining operations. The NIA for the Project is included as **Appendix 7**.

As discussed in **Section 4.2.4**, noise is a key issue for the local community. Mount Owen has actively managed noise impacts from its operations through the implementation of a performance based adaptive management approach that has focussed on implementing appropriate operational controls and management strategies to proactively manage potential noise impacts. The management of noise at Mount Owen includes the design and operation of mining activities to proactively mitigate noise, the implementation of a range of operational controls and also implementation of mitigation measures at surrounding receivers.

Central to the ongoing noise management process has been the implementation of an extensive continuous noise monitoring system to enable proactive and real time management of operations during noise propagating conditions. The use of a continuous noise monitoring system to proactively inform operational noise management has been in place at Mount Owen since 2003.

This approach to management of noise impacts is a proven and effective tool for minimising noise impacts from operations and has formed the basis for the detailed design process for the Project (refer to **Section 5.3.1**) and the identification of reasonable and feasible noise mitigation measures for the Project (refer to **Section 5.3.10**).

Notwithstanding, the noise environment surrounding the Project Area has undergone a range of changes since the existing Mount Owen Mine approval in 2004, in relation to both land ownership and also the cessation and commencement of a number of mining operations. Accordingly, a comprehensive assessment of the existing noise environment and identification of current noise impact assessment goals has been undertaken as part of the NIA in order to assess the Project in accordance with contemporary requirements and expectations. The NIA has been independently peer reviewed by an appropriately qualified and recognised acoustician.

5.3.1 Project Design Process

Potential noise impacts associated with the Project were a key consideration in the design of the Project. Comprehensive noise modelling was completed on an iterative basis throughout the design of the Project to develop a mine plan that would minimise noise impacts associated with the Project as far as practicable. This detailed assessment included the assessment of a number of Project alternatives (refer to **Section 2.5**) to incorporate the consideration of potential noise impacts as a central aspect of Project design.

Prior to the finalisation of the Project design, production schedule and fleet requirements, a range of options were investigated to minimise, control or manage the noise impacts from the Project. In establishing the feasible and reasonable noise control measures that could be incorporated into the Project, a broad range of specific noise control measures were considered, as detailed in **Appendix 7**.

Those controls that were found to be reasonable and feasible in relation to providing an effective control of potential impacts have been incorporated into the Project design and included as part of the noise model for the Project. These reasonable and feasible noise controls include:

- management of the operation of the RERR Mining Area during periods when the weather conditions enhance the noise impacts, such as inversion conditions, during some winter night times. Consequently, the results for Year 10 in **Section 5.3.3** do not include operations in the RERR Mining Area under adverse weather conditions during winter night times, (estimated to be approximately 20 to 30 nights during the June-August winter period), but include the operation's contribution within the RERR Mining Area during non-winter nights, non-winter evenings and all season day time predicted noise levels;

- the management of mobile machines during adverse weather conditions when wind conditions or inversion conditions enhance noise propagation towards sensitive receiver locations. In order to control / eliminate noise impacts this would likely include:

    - providing alternative overburden emplacement locations; and

  - moving parts of the fleet to locations deeper in the pit.

- managing a number of activities during adverse meteorological conditions, such as those which may occur during winter night-times, including:
  - limiting a portion of the coaling fleet during the later stages of the mine life;
  - reducing bulldozer activity on exposed rehabilitation areas; and
  - managing top-soil and pre-strip during the later stage of the mine life.
- the inclusion of bunds in strategic locations along some haul roads, where practicable, along the side of the ramps in the North Pit Continuation shielding trucks and equipment on exposed sections of the ramps;
- locating key haul roads within the North Pit below ground surface to maximise topographical shielding to surrounding receiver areas;
- in the later years of the Project, locating the primary coal haul road to the Mount Owen CHPP on the western side of the North Pit Continuation;
- location and orientation of haul roads to be not aligned with prevailing source to receiver winds where practicable;
- inclusion of bunds in strategic locations to shield trucks and equipment operating on exposed overburden emplacement areas in the BNP and RERR Mining Area; and
- incorporation of reasonable and feasible noise attenuation on key plant and equipment as detailed in **Appendix 7**.

In addition to the identification of appropriate noise controls incorporated into Project design, this assessment process also reinforced the effectiveness of the performance based adaptive management approach that has focussed on implementing appropriate operational controls and management strategies to proactively manage potential noise impacts associated with mining operations. As outlined in **Section 5.3.10**, Mount Owen commit to the ongoing implementation of this system as an effective and proactive management tool to minimise potential noise impacts over the life of the Project.

5.3.2 Existing Environment

5.3.2.1 Existing Acoustic Environment

An assessment of the existing noise environment in the area surrounding the Project Area was undertaken using monitoring data from the Mount Owen Complex continuous monitoring network and two mobile continuous noise monitors, specifically for the Project. An attended noise monitoring program was used to provide supplementary data in areas not covered by the continuous noise monitors and to confirm source identification at the continuous noise monitor locations. The noise monitoring data is taken from a complete data set over a period of 12 months, which includes data from all seasons.

The continuous and attended noise monitoring results include noise contributions from a number of mining, road and rail noise sources as well as Mount Owen and Ravensworth East Mines. In accordance with the Section 3 of the Industrial Noise Policy (INP), the assessment of the background noise environment has, where practical, excluded the noise impact from Mount Owen and Ravensworth East Mines from the analysis.

The assessment of the existing noise environment using the continuous noise monitoring results, reported as the underlying Rated Background Level (RBL) and the measured Mean $L_{Aeq, period}$ (where 'period' equals day, evening or night) are presented in **Appendix 7**.

The assessed RBL formed the basis of the definition of Project Specific Noise Levels (PSNL) for surrounding land uses (refer to **Section 5.3.3.2**). As outlined above, given the changes in the receiving environment in relation to changed land ownership, cessation and commencement of surrounding mining operations, the proposed continuation of the North Pit and the proposed mining in the BNP and RERR Mining Area, the NIA has assessed an extensive area surrounding the Project Area.

Residences in the surrounding area have been 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) for the purposes of this assessment. The location of surrounding properties and residences and the defined receiver areas are shown on **Figure 5.6**, and detailed in **Appendix 7**.

The results from the background noise monitoring program presented in **Appendix 7** show that the RBL in the rural areas surrounding the Project Area are generally between 30 to 35 dB(A) during the day-time, 30 to 36 dB(A) during the evening and less than 30 to 35 dB(A) during the night-time. The RBLs within these areas are generally affected by industrial noise associated with existing mining operations within the surrounding area.

Monitoring in Camberwell Village and in proximity to the New England Highway shows the influence of road traffic noise on the New England Highway with the RBLs ranging from 36 to 45 dB(A) depending on the time of day and proximity to the highway (refer to **Appendix 7**).

5.3.2.2 Existing Meteorological Conditions

Atmospheric conditions that most affect noise propagation are temperature and wind velocity gradients. They can both enhance or reduce noise propagation from source to receiver due to refraction of sound propagating through the atmosphere.

Noise levels are increased when the wind blows from 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.

Meteorological data was sourced from the Mount Owen Complex continuous monitoring network weather stations to produce a composite data set representative of the region surrounding the Project Area. The data used for modelling consists of the 12 month period from 1 September 2011 to 21 August 2012 which was found to be consistent with meteorological monitoring records from January 2009 to August 2012 (refer to **Appendix 7**).

This data has been analysed to determine the frequency of temperature inversions and wind conditions (speed and direction) in order to assess the regional variability of wind patterns within the area surrounding the Project Area. The analysis of the meteorological data from the Mount Owen Complex continuous monitoring network weather stations is presented in **Appendix 7**.

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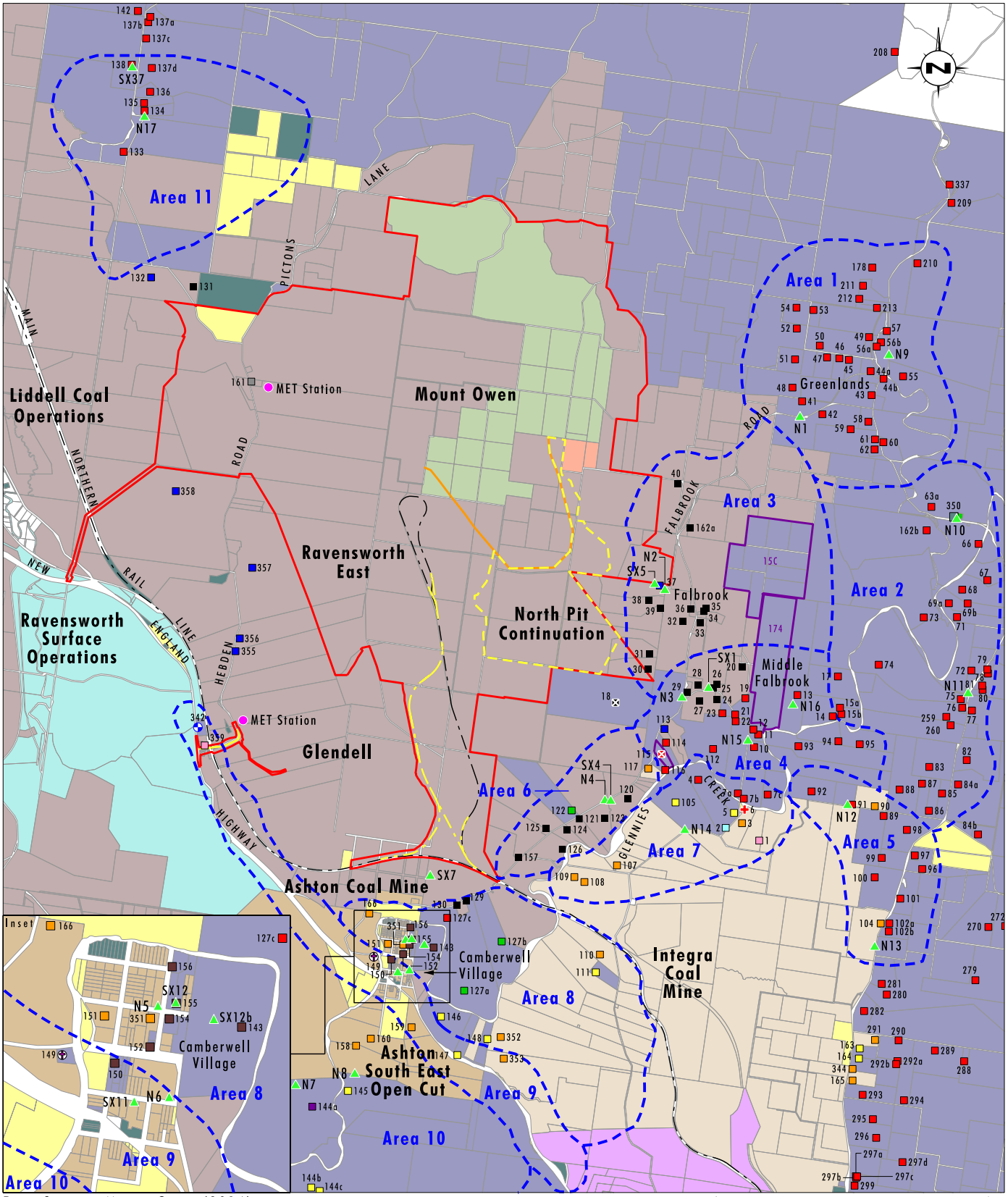

Data Source: Mount Owen (2014), Department of Lands (2009)

0 0.5 1.0 1.5km — Inset Scale 1:30 000

0 1 2 4km — Main Scale 1:90 000

Legend

- Project Area
- Approved North Pit Mining Extent
- Proposed North Pit Continuation
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Defined Receiver Areas (Project-specific Noise Level)
- Vacant Land
- Ashton Coal
- Crown Land
- Crown Land TSR
- Government Authority
- Macquarie Generation
- Integra Coal
- Glencore
- Private
- Rixs Creek Mine
- State Forest
- Minister for Education
- Noise Monitoring Location
- MET Station Location
- Church
- Daracon Site Office
- Glennies Creek Fire Brigade
- Mt Pleasant Primary School
- Former Hebden Public School
- Private Residence - Currently Subject to Acquisition Rights - Glencore
- Private Residence - Currently Subject to Acquisition Rights - Other Mines
- Subject to Acquisition Rights - Glencore No Dwelling
- Currently Subject to Acquisition Rights - Dairy
- SEOC Acquisition
- Private No Dwelling
- Private Residence
- Mine Owned Residence - Glencore
- Mine Owned Residence - Other Mine
- Mine Owned Residence - Derelict
- Mine Owned Residence - Vacant
- Community Hall

FIGURE 5.6

Sensitive Receivers and Allocation of PSNL

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5.3.2.3 Existing Noise Monitoring

The existing noise monitoring program at Mount Owen is a combination of unattended continuous noise monitoring and attended noise monitoring. The continuous monitoring network consists of four fixed and two mobile continuous noise monitoring units (refer to **Figure 5.7**). The monitoring units:

- specifically assess operational performance against the intrusiveness criteria using a $L_{Aeq, 15\ minute}$ descriptor;
- measure and assess the environmental noise levels due to industrial noise sources using the amenity assessment descriptor of $L_{Aeq, Period}$; and
- measure and assess the transient noise levels due to industrial noise sources using the $L_{A1, 1\ minute}$ sleep disturbance criteria descriptor.

The continuous monitoring network also includes two 10 metre tower weather stations.

As part of the NIA, the analysis of monitoring data from the continuous monitoring network from autumn 2013 through to autumn 2014 has provided a broad range of meteorological conditions including periods where the increased occurrence of noise propagating meteorological conditions are present.

In addition, two mobile continuous noise monitors were used to provide background noise monitoring data within the Middle Falbrook locality and Greenlands locality over the corresponding period.

During the attended noise monitoring program completed for the NIA, the contribution from Mount Owen Mine was quantified. The observations from the attended noise monitoring program have been used to establish the measured $L_{Aeq,15\ minute}$ noise levels excluding the contribution from Mount Owen and Ravensworth East Mines, and other industrial sources as part of the assessment of background noise levels (refer to **Section 5.3.3**).

The observations from the attended noise monitoring program have also been used to validate the measured Mean $L_{Aeq,15\ minute}$ noise levels recorded by the continuous noise monitoring units excluding the contribution from Mount Owen and Ravensworth East Mines.

5.3.3 Operational Noise Assessment

5.3.3.1 Methodology and Approach

As part of the NIA, noise levels were predicted using RTA Technology's Environmental Noise Model (ENM) to determine the acoustic impact of mining operations. Results were determined using the cumulative distribution of results methodology which uses a full set of meteorological conditions to identify the likely noise impacts experienced by residences surrounding the Project Area.

Results provided for assessment against intrusive criteria are 10th percentile L_{Aeq} values; that is, the noise level that is likely to be exceeded 10 per cent of the time in the worst-case season. This approach takes account of the influence of local meteorological conditions on the propagation of the noise from the Project to the entire region surrounding the Project Area. The ENM includes predicted noise levels at each of the residences surrounding the Project Area. The assessment of intrusive criteria has included the assessment of intrusive

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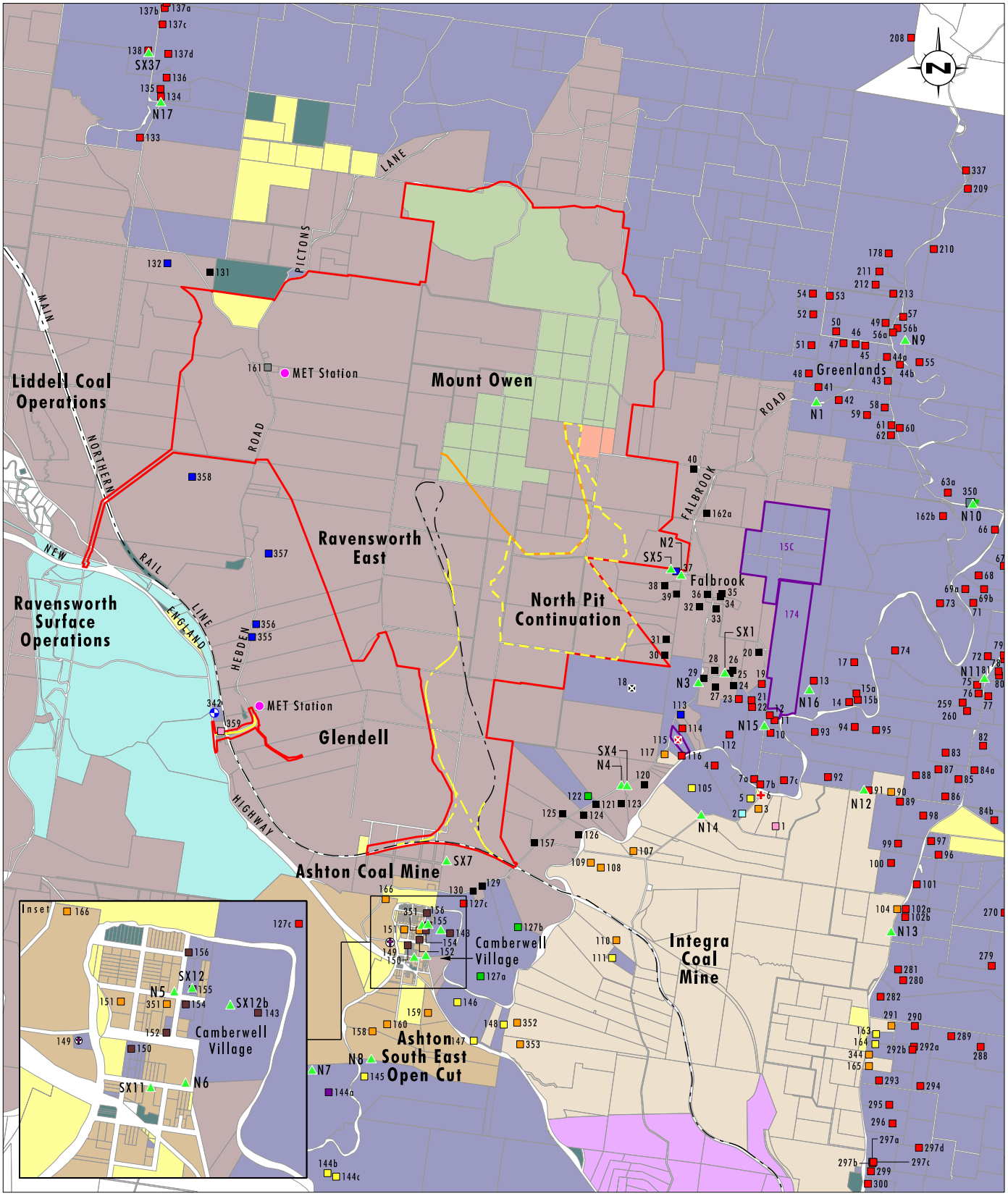

Data Source: Mount Owen (2014), Department of Lands (2009)

Legend

- Project Area
- Approved North Pit Mining Extent
- Proposed North Pit Continuation
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Vacant Land
- Ashton Coal
- Crown Land
- Crown Land TSR
- Government Authority
- Macquarie Generation
- Integra Coal
- Glencore
- Private
- Rixs Creek Mine
- State Forest
- Minister for Education
- Noise Monitoring Location
- MET Station Location
- Church
- Community Hall
- Daracon Site Office
- Glennies Creek Fire Brigade
- Mt Pleasant Primary School
- Former Hebden Public School
- Private Residence - Currently Subject to Acquisition Rights - Glencore
- Private Residence - Currently Subject to Acquisition Rights - Other Mines
- Subject to Acquisition Rights - Glencore No Dwelling
- Currently Subject to Acquisition Rights - Dairy
- SEOC Acquisition
- Private Residence
- Mine Owned Residence - Glencore
- Mine Owned Residence - Other Mine
- Mine Owned Residence - Derelict
- Mine Owned Residence - Vacant
- Private No Dwelling

FIGURE 5.7

Sensitive Receivers and Noise Monitoring Locations

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noise effects (sleep disturbance) and INP modifying factors, including low frequency noise effects.

Modelling Scenarios

Three conceptual mine plan stages were selected for modelling which were considered to be representative of the key stages of the Project and include scenarios predicted to represent the reasonable worst case operating conditions for the Project from a noise perspective. The plans modelled were representative of operating conditions for the indicative mine plans for Years 1, 5, and 10 (refer to **Figures 2.9** to **2.11**). The rationale for the selection of these representative stages of the Project is outlined in **Table 5.3.2**.

Table 5.3.2 - Mine Plan Stages for NIA

Mine Plan Stage	Key Features
Year 1	• mining activities (primarily pre strip operations) would be undertaken south of the currently approved North Pit mining limit during Year 1; and • mining activity within the BNP.
Year 5	• continued mining activity within the BNP; • mining progressed in the North Pit Continuation in a southerly direction; and • North Pit Continuation - maximum production rate (up to 10 Mtpa ROM) and maximum equipment numbers for the Project.
Year 10	• mining activity within the RERR Mining Area; southernmost extent of the North Pit Continuation mining limit; and • longest haul distances to the ROM stockpiles and the Mount Owen CHPP.

The number of plant modelled was based on indicative mining schedules developed for the conceptual mine plan years. Further information regarding sound power levels (SWL) and the location and number of plant modelled is provided in the NIA in **Appendix 7**.

The modelling incorporated representative meteorological data for the locality surrounding the Project Area based on the assessed percentage of occurrence of inversions and / or wind effects. The noise impacts of the Project were modelled for each set of significant meteorological conditions identified based on the extensive meteorological monitoring of the surrounding area (refer to **Section 5.3.2.2**). This approach comprehensively takes into account the influence of local meteorological conditions on the propagation of the noise from the Project to the surrounding locality.

5.3.3.2 Noise Criteria

The PSNLs, noise management level and noise affection level have been determined in accordance with the requirements of the INP and associated practice notes for each defined area in the region surrounding the Project Area as discussed below.

Noise Management Zones

It is important to note an exceedance of the Project-specific criteria does not automatically follow that all people exposed to the noise would find the noise noticeable or unacceptable. In subjective terms, exceedances of the relevant PSNL can be generally described as follows:

- minor noise level increase of up to and including 2 dB above relevant PSNL (not noticeable by most people);
- moderate noise level increase of greater than 2 dB and up to and including 5 dB above relevant PSNL (not noticeable by some people and may be noticeable by others); and
- appreciable noise level increase of greater than 5 dB above relevant PSNL (noticeable by most people).

This is reflected within the current Mount Owen Operations Project Approval (DA 14-1-2004) which defines the noise management zone as private residences which have predicted noise levels above 37 dB(A), that is, greater than 2 dB above the applicable noise impact assessment criteria. On this basis, it is proposed to maintain a Noise Management Zone that relates to residences that are predicted to exceed the relevant PSNL by greater than 2 dB and up to and including 5 dB throughout the life of the Project.

As outlined further in **Section 5.3.10**, Mount Owen will actively engage with landholders within the Noise Management Zone to identify a range of reasonable and feasible noise mitigation and management measures at these residences. In addition, residences within the Noise Management Zone are expected to have entitlements to additional reasonable and feasible noise mitigation measures upon written request to Mount Owen from the landowner as part of the development consent. Additionally, Mount Owen expect that for those residences where noise levels are predicted to exceed PSNLs by up to and including 2 dB, noise monitoring at the property would be undertaken at the request of the resident.

Noise Affectation Zone

The INP defines Noise Affectation Zone as being an exceedance of greater than 5 dB above the relevant PSNL. In essence, privately owned residences where the noise level is predicted to be greater than 5 dB(A) are expected to be significantly affected and would be expected to be granted acquisition rights under any Project Approval. Currently, due to operations at Mount Owen, there is one non-mine owned property (R018 vacant land) located in the Noise Affectation Zone that is entitled to be purchased by Mount Owen on request from the landholder.

Table 5.3.3 provides a summary of the relevant PSNL, Noise Management Zone and Noise Affectation Zone criteria for areas surrounding the Project Area.

Table 5.3.3 – Residential Receiver Areas (refer to Figure 5.6) PSNL, dB(A)

Receiver Description	Time Period	PSNL	Noise Management Zone	Noise Affectation Zone
Area 1 - Falbrook Road and Goorangoola	Day	35 $L_{Aeq,15min}$	> 37 $L_{Aeq,15min}$	> 40 $L_{Aeq,15min}$
	Evening	35 $L_{Aeq,15min}$	> 37 $L_{Aeq,15min}$	> 40 $L_{Aeq,15min}$
	Night	35 $L_{Aeq,15min}$	> 37 $L_{Aeq,15min}$	> 40 $L_{Aeq,15min}$
Area 2 – Bridgman Road	Day	35 $L_{Aeq,15min}$	> 37 $L_{Aeq,15min}$	> 40 $L_{Aeq,15min}$
	Evening	35 $L_{Aeq,15min}$	> 37 $L_{Aeq,15min}$	> 40 $L_{Aeq,15min}$
	Night	35 $L_{Aeq,15min}$	> 37 $L_{Aeq,15min}$	> 40 $L_{Aeq,15min}$
Area 3 – Falbrook	Day	35 $L_{Aeq,15min}$	> 37 $L_{Aeq,15min}$	> 40 $L_{Aeq,15min}$
	Evening	35 $L_{Aeq,15min}$	> 37 $L_{Aeq,15min}$	> 40 $L_{Aeq,15min}$
	Night	35 $L_{Aeq,15min}$	> 37 $L_{Aeq,15min}$	> 40 $L_{Aeq,15min}$
Area 4 – Middle Falbrook [1]	Day	35 $L_{Aeq,15min}$	> 37 $L_{Aeq,15min}$	> 40 $L_{Aeq,15min}$
	Evening	35 $L_{Aeq,15min}$	> 37 $L_{Aeq,15min}$	> 40 $L_{Aeq,15min}$
	Night	35 $L_{Aeq,15min}$	> 37 $L_{Aeq,15min}$	> 40 $L_{Aeq,15min}$
Area 5 – Thomas Lane/Bridgman Road	Day	35 $L_{Aeq,15min}$	> 37 $L_{Aeq,15min}$	> 40 $L_{Aeq,15min}$
	Evening	35 $L_{Aeq,15min}$	> 37 $L_{Aeq,15min}$	> 40 $L_{Aeq,15min}$
	Night	35 $L_{Aeq,15min}$	> 37 $L_{Aeq,15min}$	> 40 $L_{Aeq,15min}$
Area 6 – Glennies Creek Road	Day	39 $L_{Aeq,15min}$	> 41 $L_{Aeq,15min}$	> 44 $L_{Aeq,15min}$
	Evening	39 $L_{Aeq,15min}$	> 41 $L_{Aeq,15min}$	> 44 $L_{Aeq,15min}$
	Night	39 $L_{Aeq,15min}$ 37 $L_{Aeq, night}$	> 41 $L_{Aeq,15min}$ 39 $L_{Aeq, night}$	> 44 $L_{Aeq,15min}$ 42 $L_{Aeq, night}$
Area 7 – Middle Falbrook Road /Stoney Creek Road	Day	37 $L_{Aeq,15min}$	> 39 $L_{Aeq,15min}$	> 42 $L_{Aeq,15min}$
	Evening	37 $L_{Aeq,15min}$	> 39 $L_{Aeq,15min}$	> 42 $L_{Aeq,15min}$
	Night	37 $L_{Aeq,15min}$	> 39 $L_{Aeq,15min}$	> 42 $L_{Aeq,15min}$
Area 8 – Northern Camberwell Village	Day	36 $L_{Aeq,15min}$	> 38 $L_{Aeq,15min}$	> 41 $L_{Aeq,15min}$
	Evening	36 $L_{Aeq,15min}$	> 38 $L_{Aeq,15min}$	> 41 $L_{Aeq,15min}$
	Night	35 $L_{Aeq,15min}$	> 37 $L_{Aeq,15min}$	> 40 $L_{Aeq,15min}$
Area 9 – Central Camberwell Village	Day	50 $L_{Aeq,15min}$	> 52 $L_{Aeq,15min}$	> 55 $L_{Aeq,15min}$
	Evening	48 $L_{Aeq,15min}$ 45 $L_{Aeq, evening}$	> 50 $L_{Aeq,15min}$ 47 $L_{Aeq, evening}$	> 53 $L_{Aeq,15min}$ 50 $L_{Aeq, evening}$
	Night	43 $L_{Aeq,15min}$ 38 $L_{Aeq, night}$	> 45 $L_{Aeq,15min}$ 40 $L_{Aeq ,night}$	> 48 $L_{Aeq,15min}$ 43 $L_{Aeq, night}$
Area 10 – South of New England Highway	Day	35 $L_{Aeq,15min}$	> 37 $L_{Aeq,15min}$	> 40 $L_{Aeq,15min}$
	Evening	35 $L_{Aeq,15min}$	> 37 $L_{Aeq,15min}$	> 40 $L_{Aeq,15min}$
	Night	35 $L_{Aeq,15min}$	> 37 $L_{Aeq,15min}$	> 40 $L_{Aeq,15min}$
Area 11 – Hebden	Day	35 $L_{Aeq,15min}$	> 37 $L_{Aeq,15min}$	> 40 $L_{Aeq,15min}$
	Evening	35 $L_{Aeq,15min}$	> 37 $L_{Aeq,15min}$	> 40 $L_{Aeq,15min}$
	Night	35 $L_{Aeq,15min}$	> 37 $L_{Aeq,15min}$	> 40 $L_{Aeq,15min}$

Note: 1) PSNL is set in accordance with the relevant Application Note (refer to Appendix B of **Appendix 7**).

5.3.3.3 Noise Assessment Findings

The NIA includes the prediction of noise levels from the Project at nearest residential receiver locations identified on **Figure 5.6** under the meteorological conditions described in **Appendix 7**. The predicted operational noise levels for the three operational years modelled, Years 1, 5 and 10 are presented in detail in **Appendix 7**.

The predicted noise levels for Year 1 of the Project are consistent with the noise levels predicted for Year 10 of the currently approved Mount Owen Operations (DA 14-1-2004). This is because the mine plans and the machine SWL for Year 1 of the Project are similar to the approved mine plans for Mount Owen Operations.

Table 5.3.4 presents a summary of the 10th percentile predicted operational noise levels for Years 1, 5 and 10 where the predicted noise levels exceed the relevant PSNL. In general, the noise assessment results indicate that the predicted worse case noise levels are likely to occur in Year 10 of the Project and are primarily focussed in areas to the south-east of the North Pit Continuation. The Project proposes to continue to operate continuously 7 days per week 24 hours per day. As a result, the most stringent noise criteria the mining operation will need to achieve is the night-time PSNL (refer to **Table 5.3.3**).

Table 5.3.4 – Summary of 10th Percentile Predicted Operational Noise Level, dB(A) for predicted levels above 35dB (A) (for receiver locations refer to Figure 5.6)

Receiver Location	Period	PSNL[1]	Year 1				Year 5				Year 10			
			Winter Night	Non-winter Nights	Non-winter Evening	All Seasons Day	Winter Night	Non-winter Nights	Non-winter Evening	All Seasons Day	Winter Night	Non-winter Nights	Non-winter Evening	All Seasons Day
Area 1 - R041	Day	35	-	-	-	36	-	-	-	-	-	-	-	-
Area 1 - R048	Day	35	-	-	-	36	-	-	-	-	-	-	-	-
Area 3 - R015c (vacant land)	Day	35	-	-	-	44	-	-	-	43	-	-	-	43
	Evening	35	-	-	38	-	-	-	37	-	-	-	-	-
	Night	35	44	41	-	-	43	40	-	-	41	38	-	-
Area 3 - R018 (vacant land)	Day	35	-	-	-	44	-	-	-	44	-	-	-	47
	Evening	35	-	-	40	-	-	-	39	-	-	-	40	-
	Night	35	46	41	-	-	46	41	-	-	44	42	-	-
Area 3 – R174 (vacant land)	Day	35	-	-	-	42	-	-	-	42	-	-	-	43
	Evening	35	-	-	38	-	-	-	37	-	-	-	36	-
	Night	35	44	41	-	-	44	41	-	-	43	39	-	-
Area 4 - R010	Night	35	-	-	-	-	-	-	-	-	-	37	-	-
Area 4 - R011	Day	35	-	-	-	36	-	-	-	36	-	-	-	37
	Night	35	37	-	-	-	36	-	-	-	37	37	-	-
Area 4 - R012	Day	35	-	-	-	-	-	-	-	36	-	-	-	36
	Evening	35	-	-	-	-	-	-	-	-	-	-	36	-
	Night	35	36	-	-	-	36	-	-	-	-	38	-	-
Area 4 - R013	Day	35	-	-	-	36	-	-	-	36	-	-	-	38
	Night	35	37	-	-	-	37	-	-	-	38	37	-	-
Area 4 - R014	Day	35	-	-	-	36	-	-	-	-	-	-	-	37
	Night	35	37	-	-	-	36	-	-	-	37	-	-	-

Table 5.3.4 – Summary of 10th Percentile Predicted Operational Noise Level, dB(A) for predicted levels above 35dB (A) (for receiver locations refer to Figure 5.6) (cont.)

Receiver Location	Period	PSNL[1]	Year 1				Year 5				Year 10			
			Winter Night	Non-winter Nights	Non-winter Evening	All Seasons Day	Winter Night	Non-winter Nights	Non-winter Evening	All Seasons Day	Winter Night	Non-winter Nights	Non-winter Evening	All Seasons Day
Area 4 - R019	Day	35	-	-	-	36	-	-	-	36	-	-	-	38
	Night	35	37	-	-	-	37	-	-	-	39	38	-	-
Area 4 - R021	Day	35	-	-	-	36	-	-	-	36	-	-	-	39
	Evening	35	-	-	-	-	-	-	-	-	-	-	37	-
	Night	35	37	-	-	-	37	-	-	-	41	39	-	-
Area 4 - R022	Day	35	-	-	-	37	-	-	-	38	-	-	-	40
	Evening	35	-	-	-	-	-	-	-	-	-	-	37	-
	Night	35	38	-	-	-	38	-	-	-	41	39	-	-
Area 4 - R023	Day	35	-	-	-	36	-	-	-	36	-	-	-	38
	Evening	35	-	-	-	-	-	-	-	-	-	-	38	-
	Night	35	36	-	-	-	36	-	-	-	41	39	-	-
Area 4 - R093	Day	35	-	-	-	-	-	-	-	-	-	-	-	38
	Night	35	36	-	-	-	-	-	-	-	40	36	-	-
Area 4 - R094	Day	35	-	-	-	-	-	-	-	-	-	-	-	37
	Night	35	-	-	-	-	-	-	-	-	38	36	-	-
Area 4 - R095	Day	35	-	-	-	38	-	-	-	-	-	-	-	37
	Night	35	38	36	-	-	36	-	-	-	37	-	-	-
Area 4 - R112	Night	35	-	-	-	-	-	-	-	-	-	38	-	-
Area 4 - R114	Day	35	-	-	-	-	-	-	-	-	-	-	-	37
	Night	35	-	-	-	-	36	-	-	-	36	-	-	-
Area 4 - R115 (vacant land)	Day	35	-	-	-	36	-	-	-	36	-	-	-	37
	Night	35	37	-	-	-	37	-	-	-	37	36	-	-

Table 5.3.4 – Summary of 10th Percentile Predicted Operational Noise Level, dB(A) for predicted levels above 35dB (A) (for receiver locations refer to Figure 5.6) (cont.)

Receiver Location	Period	PSNL[1]	Year 1				Year 5				Year 10			
			Winter Night	Non-winter Nights	Non-winter Evening	All Seasons Day	Winter Night	Non-winter Nights	Non-winter Evening	All Seasons Day	Winter Night	Non-winter Nights	Non-winter Evening	All Seasons Day
Area 5 - R091	Day	35	-	-	-	-	-	-	-	-	-	-	-	36
	Night	35	-	-	-	-	-	-	-	-	36	-	-	-
Area 5 - R092	Day	35	-	-	-	-	-	-	-	-	-	-	-	37
	Night	35	-	-	-	-	-	-	-	-	37	36	-	-
Area 6 - R122[2]	Day	39	-	-	-	40	-	-	-	-	-	-	-	42
	Evening	39	-	-	-	-	-	-	-	-	-	-	42	-
	Night	39/37[3]	42	39	-	-	41	-	-	-	42	42	-	-
Area 7 - R004	Day	37	-	-	-	-	-	-	-	-	-	-	-	38
Area 8 – R111	Night	35	36	-	-	-	-	-	-	-	-	36	-	-

Note: 1) PSNL based on intrusiveness $L_{Aeq,15minute}$ criteria unless otherwise noted.
2) Predicted noise levels are at the residence.
3) Criteria 39 dB(A) $L_{Aeq,15minute}$ and 37 dB(A) $L_{Aeq,night}$.

The results summarised in **Table 5.3.4** include predicted noise levels over the range of representative seasons, including during the likely worst case season / period of winter night-time. The NIA (refer to **Appendix 7**) presents the 10th percentile predicted operational noise levels at all the residential receiver locations surrounding the Project for Year 1, 5 and 10 for winter night-time, non-winter night-time, non-winter evenings and all seasons day-time.

Figure 5.8 present the 10th percentile noise level contours predicted under the likely worst case season / period of winter night-time for Year 10.

The number of potential exceedances of the relevant PSNL for the Project (refer to **Table 5.3.4**) are summarised in relation to the noise management zone and noise acquisition zone (refer to **Section 5.3.3.2**) in **Table 5.3.5**. The potential exceedances identified in **Table 5.3.5** are inclusive of the control measures identified in **Section 5.3.10**.

Table 5.3.5 – Summary of Predicted Noise Impacts

Noise Prediction Outcome	No. of Residences	Residences
Residences where noise levels are predicted to exceed PSNL's by up to and including 2 dBL	10	R004, R041, R048, R010, R011, R014, R091, R092, R111[1], R114
Residences within Noise Management Zone (exceedance of greater than 2 dBL and up to and including 5 dBL above relevant PSNL)	8	R012, R013, R019, R093, R094, R095, R112, R122[2]
Residences within Noise Affectation Zone (exceedance of greater-than 5 dBL above relevant PSNL)	3	R021, R022, R023,

Note: 1) R111 is subject to acquisition rights from Integra Mine (Open Cut).
2) R122 is subject to acquisition under Glencore's Glendell Mine.

Section 8 of the INP requires, amongst other things, the consideration of equity issues associated with predicted noise impacts from a Project. The NIA has identified that the PSNLs could be exceeded at a number of private residences. As discussed above, eight properties are predicted to have noise impacts greater than 2 dB above the relevant PSNL and are expected to have noise management / mitigation rights under the development consent, should the Project be approved. Three additional residences are predicted to have noise impacts greater than 5 dB above the relevant PSNL and are expected have acquisition rights upon request under the development consent, should the Project be approved.

In addition to the properties identified within the Noise Management Zone and Noise Affection Zone, the NIA indicates that the relevant PSNL may be exceeded by up to 2 dB at 10 private residences and that noise monitoring at the property would be undertaken at the request of the resident. As outlined in **Section 5.3.10**, Mount Owen will implement operational controls to seek to minimise noise impacts above the relevant PSNL.

As part of the ongoing noise monitoring program (refer to **Section 5.3.10**), targeted monitoring will be undertaken to assess the effectiveness of the control measures that will be implemented to mitigate predicted noise impacts.

Vacant Land Assessment

Vacant land where the predicted 10th percentile noise level exceeds the PSNL by more than 5 dB are:

- Area 3 - R018: A vacant parcel of land to the west of Falbrook Road where the noise levels are predicted to exceed 40 dB(A) over greater than 25 per cent of the land area.

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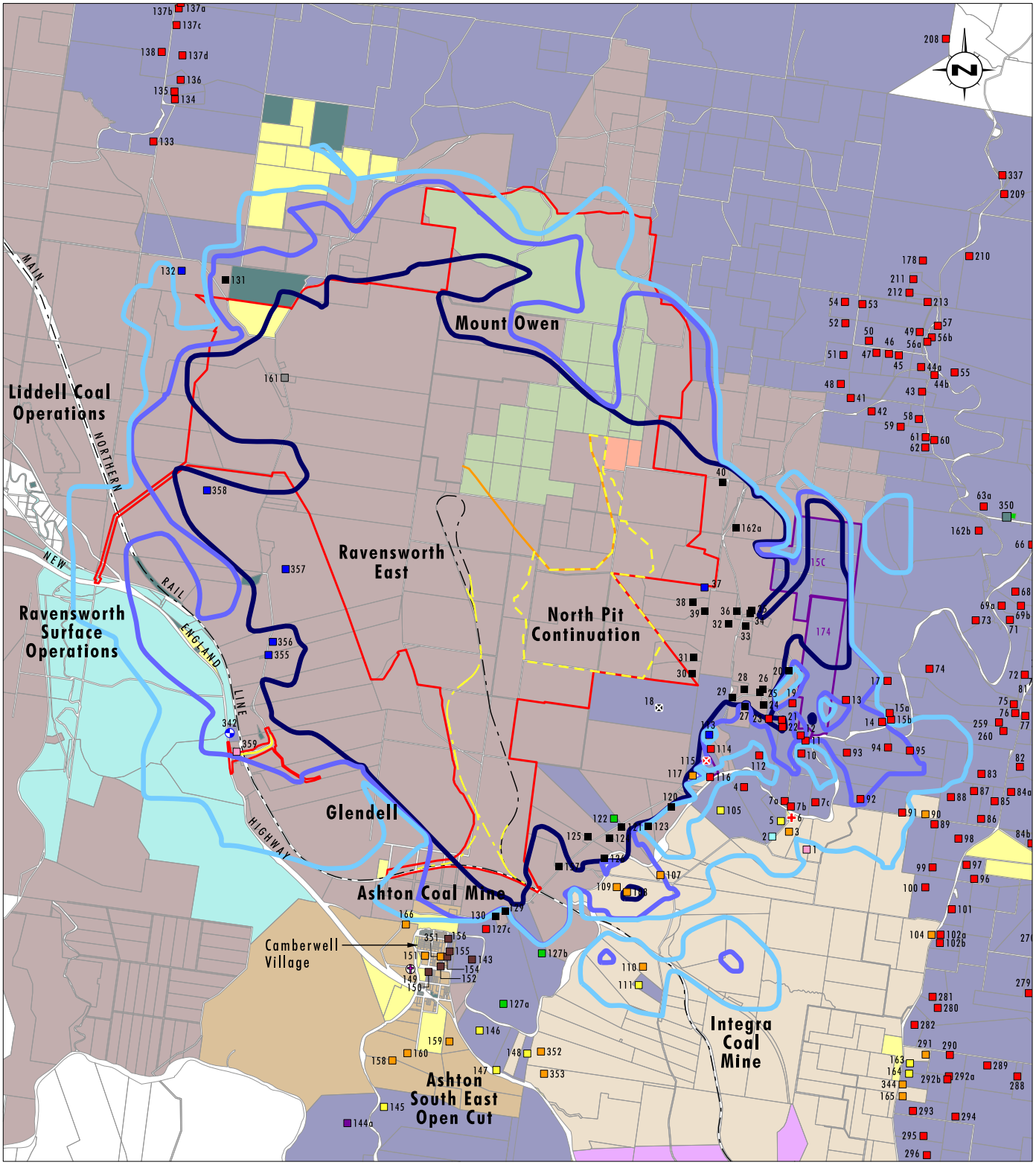

Data Source: Mount Owen (2014), Department of Lands (2009)

0 1 2 4 km

Scale 1:90 000

Legend

- Project Area
- Approved North Pit Mining Extent
- Proposed North Pit Continuation
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Vacant Land
- Ashton Coal
- Crown Land
- Crown Land TSR
- Government Authority
- Integra Coal
- Macquarie Generation
- Glencore
- Private
- Rixs Creek Mine
- State Forest
- Minister for Education
- 35 dB(A) 10th Percentile Exceedence
- 37 dB(A) 10th Percentile Exceedence
- 40 dB(A) 10th Percentile Exceedence
- Mt Pleasant Primary School
- Currently Subject to Acquisition Rights - Dairy
- SEOC Acquisition
- Private Residence
- Private Residence - Currently Subject to Acquisition Rights - Glencore
- Private Residence - Currently Subject to Acquisition Rights - Other Mines
- Subject to Acquisition Rights - Glencore No Dwelling
- Mine Owned Residence - Glencore
- Mine Owned Residence - Other Mine
- Mine Owned Residence - Derelict
- Mine Owned Residence - Vacant
- Community Hall
- Private No Dwelling
- Church
- Daracon Site Office
- Glennies Creek Fire Brigade
- Former Hebden Public School

FIGURE 5.8

Year 10 Winter Nights Noise Contours

File Name (A4): R02/3109_903.dgn
20141008 11.14

This vacant parcel of land is subject to acquisition under the current Mount Owen Operations project approval.

- Area 4 - R015c: Currently a vacant parcel of land east of Falbrook Road and is the western allotment linked to property R015a. The noise levels are predicted to exceed 40 dB(A) over greater than 25 per cent of the land area.

- Area 3/4 - R174: Currently a vacant parcel of land north of Middle Falbrook Road where the noise levels are predicted to exceed 40 dB(A) over greater than 25 per cent of the land area.

Vacant land where the predicted 10th percentile noise levels exceed the PSNL by up to and including 2 dB is:

- Area 4: R115 (a vacant parcel of land to the east of Falbrook Road).

5.3.4 Low Frequency Noise

An analysis of the predicted noise level results for the inclusion of 'modifying factors' was completed as part of the NIA in accordance with Section 4 of the INP (EPA 2000), the INP application notes and the low frequency noise criteria suggested by DP&I (2013) and Broner (2011). Tonal noise, impulsive noise, intermittent noise during the night time and single event duration noise were found to not require the application of modifying factors to the predicted noise levels.

The NIA found that the predicted low frequency noise levels for the Project were below the DP&E 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.

5.3.5 Sleep Disturbance

Noise sources that could lead to sleep disturbance are typically transient noises and often have tonal characteristics. Examples of mining activities occurring within the night-time that could lead to sleep disturbance include:

- an excavator bucket striking the ground;

- heavy objects (rocks) being dropped into a truck tray;

- air horns used to control truck movement;

- reversing beepers; and

- track clatter from bulldozers.

Sleep Disturbance Criteria are based on the criteria from the INP Application Notes (refer to **Appendix 7**), which reference the review of research on sleep disturbance published in the NSW Road Noise Policy (DECCW 2011). The INP Application Notes suggests that to prevent sleep disturbance, the $L_{A1,1\ minute}$ or $L_{A\ max}$ level of a noise source should not exceed the L_{A90} background noise level by more than 15 dB when measured outside the bedroom window.

The Sleep Disturbance Criteria for all the representative noise sensitive locations is presented in **Table 5.3.6**. The INP Application Notes state 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 Area are shift workers, the assessment of sleep disturbance for the Project has also considered the day and evening assessment periods, as outlined in **Table 5.3.6**.

Table 5.3.6 – Sleep Disturbance Criteria, dB(A)

Receiver Description	Sleep Disturbance Criteria, $L_{A1,1\ minute}$		
	Day	Evening	Night
Area 1 - Falbrook Road and Goorangoola	45	45	45
Area 2 – Bridgman Road	45	45	45
Area 3 – Falbrook	45	45	45
Area 4 – Middle Falbrook	45	45	45
Area 5 – Thomas Lane /Bridgman Road	45	45	45
Area 6 – Glennies Creek Road	49	49	49
Area 7 – Middle Falbrook Road/ Stoney Creek Road	47	47	47
Area 8 – Northern Camberwell Village	46	46	45
Area 9 – Central Camberwell Village	60	58	53
Area 10 – South of New England Highway	45	45	45
Area 11 – Hebden	45	45	45

The NIA predicted noise levels at the nearest residential receiver locations under three meteorological conditions: calm neutral, F Class Stability with accompanying drainage flow from the north to north-west and a north-west at 3m/s (refer to **Appendix 7**). The predicted received $L_{A1,\ 1\ minute}$ noise levels associated with these activities that could result in sleep disturbance are summarised in **Table 5.3.7**.

Table 5.3.7 – Summary of Predicted Noise Impacts

Season/Period	Year 1	Year 5	Year 10
Calm Neutral			
No. Properties greater-than Criteria	-	-	-
Maximum Noise Level	<30	<30	<30
F-Class Stability and 2m/s NW Drainage Flow (Night Only)			
No. Properties greater-than Criteria	-	-	1
Maximum Noise Level	37	36	46
3 m/s NW Wind			
No. Properties greater-than Criteria	-	-	1
Maximum Noise Level	35	37	47

The property where the predicted $L_{A1,\ 1\ minute}$ noise levels associated with the Project could result in sleep disturbance impacts is R018 which is currently vacant land and subject to acquisition under the current Mount Owen development consent.

5.3.6 Construction Noise

As outlined in **Section 2.3.17**, the construction phase of the Project includes the construction of a new dual lane bridge over Bowmans Creek and rail crossing on Hebden Road, and the construction of an additional rail line and northern turn-out west of the existing Mount Owen rail line. Other construction activities such as upgrades and modifications to the MIA, CHPP, including product coal stockpile and Water Management System (WMS) are considered to generate minor noise impacts that are consistent with general activities considered in the operational noise assessment.

The EPA recognises that construction activities could potentially generate higher noise levels than those of an industrial operation. The Interim Construction Noise Guideline (ICNG) (DECC 2009) provides noise management criteria for construction activities. The criteria, presented in **Table 5.3.8**, are intended to guide the need for and the selection of feasible and reasonable work practices to minimise construction noise impacts.

Table 5.3.8 – Construction Noise Criteria, dB(A)

Receiver Description	**Management Level LAeq, 15 minute**	
	Standard hours (based on day-time RBL)	**Outside Standard Hours** (based on night-time RBL)
Area 1 - Falbrook Road and Goorangoola	40	35
Area 2 – Bridgman Road	40	35
Area 3 – Falbrook	40	35
Area 4 – Middle Falbrook	40	35
Area 5 – Thomas Lane / Bridgman Road	40	35
Area 6 – Glennies Creek Road	44	39
Area 7 – Middle Falbrook Road/ Stoney Creek Road	42	37
Area 8 – Northern Camberwell Village	41	35
Area 9 – Central Camberwell Village	55	43
Area 10 – South of New England Highway	40	35
Area 11 – Hebden	40	35

The construction noise management levels for the non-sensitive receivers such as other industrial operations is 75 dB(A).

The activities required to construct a new road bridge over Bowmans Creek, construct the Hebden Road rail overpass and construct a northern rail turn-out and additional Mount Owen rail line will occur mostly during recommended standard hours as defined by the ICNG. Limited activities (such as track work involving the Main Northern Rail Line) will be undertaken when required outside of the ICNG recommended standard hours.

The NIA included the prediction of construction noise levels at the nearest residential receiver locations under worst-case meteorological conditions of source to receiver winds of 3 m/s (refer to **Appendix 7**). The predicted noise levels in relation to the relevant criteria at private properties in the vicinity of the construction activities associated with the Project are summarised in **Table 5.3.9**.

Table 5.3.9 – Summary of Predicted Noise Impacts – Construction Activities

Season/Period	Calm Neutral	3 m/s NW Wind	3 m/s SE Wind
Dual lane bridge over Bowmans Creek, Hebden Road			
No. Properties greater-than Criteria	-	-	-
Maximum Noise Level	<30	31	<30
Additional rail line and northern turn-out			
No. Properties greater-than Criteria	-	1	-
Maximum Noise Level	41	44	39

5.3.7 Road Noise

Road traffic volumes for the operational stage of the Project will remain unchanged from present operational road traffic volumes. Road traffic volumes will increase during the construction phase of the Project.

The former Department of Environment, Climate Change and Water (DECCW) (now EPA) NSW Road Noise Policy (RNP) (DECCW 2011) sets out criteria for road traffic noise through the provision of a framework that addresses traffic noise issues associated with new developments, new or upgraded road developments or planned building developments.

The primary access route to the Project Area will be from the south along Hebden Road and the New England Highway. Some traffic may travel north along Hebden Road and access the New England Highway to the west of Lake Liddell, however traffic volumes and associated impacts are likely to be minimal. Glennies Creek Road will be utilised for a limited time by construction related traffic during activities associated with the construction of a new northern turn-out and rail line. Hebden Road and Glennies Creek Road are defined as sub-arterial roads as these roads support non-local traffic serving major traffic-generating developments. The relevant road noise impact assessment criteria are outlined in **Table 5.3.10**.

Table 5.3.10 – 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)

The predicted road traffic noise impacts at closest receivers and the relevant assessment criteria are presented in **Table 5.3.11**.

Table 5.3.11 – Predicted Noise Impacts, dB(A)

Receiver Location	Existing		Construction Phase		Criteria	
	Peak AM	Peak PM	Peak AM	Peak PM	AM [1]	PM [2]
St Clement's Anglican Church	50.9	50.4	51.0	50.6	50 [3]	50 [3]
R146	48.5	48.1	48.7	48.2	55	60
R147	61.2	60.7	61.4	60.9	55	60
R150	47.6	47.1	47.7	47.3	55	60
R127c	38.4	38.6	41.8	41.9	55	60
R133	35.6	34.3	38.3	37.7	55	60
Lake Liddell Recreation Park	48.1	46.8	50.9	50.2	55	55[4]

Note: 1) Night time criteria, NSW Road Noise Policy, DECCW 2011.
2) Day time criteria, NSW Road Noise Policy, DECCW 2011.
3) Internal noise criteria of 40 dB(A) (DECCW 2011), assume 10 dB(A) drop from external noise level (NSW Industrial Noise Policy, EPA 2000).
4) Open space (passive use) criteria, NSW Road Noise Policy, DECCW 2011.

The predicted existing and construction phase road traffic noise impacts presented in **Table 5.3.11** for properties R146, R150, R127c, R133 and the Lake Liddell Recreation Park are below the relevant road traffic noise criteria. The predicted existing and construction phase road traffic noise impacts for the St Clement's Anglican Church and property R147 are both above the relevant road traffic noise criteria. Relative increases in the road traffic noise levels associated with the construction phase of the Project at St Clement's Anglican Church and property R147 are negligible at 0.2 dB and 0.3 dB respectively.

5.3.8 Rail Noise

Anticipated train movements associated with the Project will not increase beyond the number of train movements currently approved (refer to **Section 2.3.9**). The operation of the Mount Owen Complex Rail Line and the proposed additional rail line and northern turn-out, including Glencore train park up, were assessed as part of the Project's operational noise sources in **Section 5.3.2.3**. In addition, there will be no increase in the L_{Amax} pass-by noise levels on the Main Northern Rail Line as a result of the Project.

The ARTC 2013-2022 Hunter Valley Corridor Capacity Strategy, indicates the contract coal tonnage in 2013 on the Main Northern Rail Line between Mount Owen and Camberwell is 110 Mtpa. The predicted contract coal tonnage in 2022 on the Main Northern Rail Line between Mount Owen and Camberwell is 200 Mtpa. The planned tonnages from the Project are considered in this overall increase in coal train movements on the Main Northern Rail Line. This total increase represents a 2.6 dB increase in the noise level associated with contracted coal train movements on the Main Northern Rail Line between Mount Owen and Camberwell Junction.

Mount Owen's current coal train movements on the Main Northern Rail Line contribute 0.5 dB to the noise levels generated by coal train movements on the Main Northern Rail Line between Mount Owen junction and Camberwell junction. At ARTC's proposed contracted coal train movement rate of 200 Mtpa by 2022, Mount Owen's coal train movements on the Main Northern Rail Line would contribute 0.2 dB to the noise levels generated by coal train movements on the Main Northern Rail Line between Mount Owen junction and Camberwell junction. Based on the guidelines in the RING, Mount Owen'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 train noise setback distances.

5.3.9 Cumulative Noise Assessment

Cumulative noise impacts that may arise from the Project operating in conjunction with other existing developments in the area have been considered as part of the NIA, in accordance with the INP (refer to **Appendix 7**). The cumulative noise assessment considered noise generated by the simultaneous operation of other nearby existing and approved mines in accordance with current approvals.

Cumulative Impact Assessment Criteria

In relation to industrial noise sources, the acceptable cumulative industrial noise criteria applying to the combined operation of the Project and the open cut and underground mines in the rural areas surrounding the Project Area are outlined in **Table 5.3.12**.

Table 5.3.12 – Cumulative Noise Goals based on Amenity Level, dB(A)

Period	Acceptable Cumulative Noise Level LAeq period	Maximum Cumulative Noise Level LAeq period
Day	50	55
Evening	45	50
Night	40	45

Within the rural areas to the east and south-east of the Project Area, the most stringent of the criteria is 40 dB(A) $L_{Aeq, night}$. This reflects the need to protect the night-time amenity noise levels as this is the primary period when cumulative noise levels from industrial operations have the potential to impact on the amenity noise level of the surrounding region.

Industrial Noise Sources

A number of the surrounding industrial activities, including Ravensworth Surface Operations, Ravensworth Underground Mine, Ravensworth Coal Terminal, Ashton Underground Mine, Ashton CHPP, Integra Underground Mine, Integra CHPP, Glennies Creek Power Station and Liddell Colliery are 24 hour per day operations. It is noted that two of the surrounding industrial activities operate during the day time only: activities at Ashton SEOC and the Integra North Pit (currently on care and maintenance). Glendell will have completed mining by Year 10 of the Project and not included in the Year 10 model.

Achieving the night-time PSNL would ensure day-time and evening criteria are achieved. In addition to this, during the day-time and evening periods, noise from sources such as local traffic, domestic activities, the natural environment and road noise from the New England Highway, mask the noise from the surrounding mining operations. Therefore, the assessment of cumulative noise levels focuses on the night-time period.

In addition, the Project forms part of the Mount Owen Complex which includes the continued operation of the approved Glendell Mine (Year 1 and Year 5), and this has been considered in the cumulative noise assessment.

Results

The NIA provides the cumulative noise predictions for the Mount Owen Complex for Year 1 and Year 5 of the Project. The results are presented as 10th percentile 40 dB(A) and 45 dB(A) probability contours (refer to **Figure 5.9** and **5.10**). Year 1 of the Project coincides approximately with Year 9 of the approved Glendell operation. Year 5 of the Project coincides approximately with Year 12 of the approved Glendell operation.

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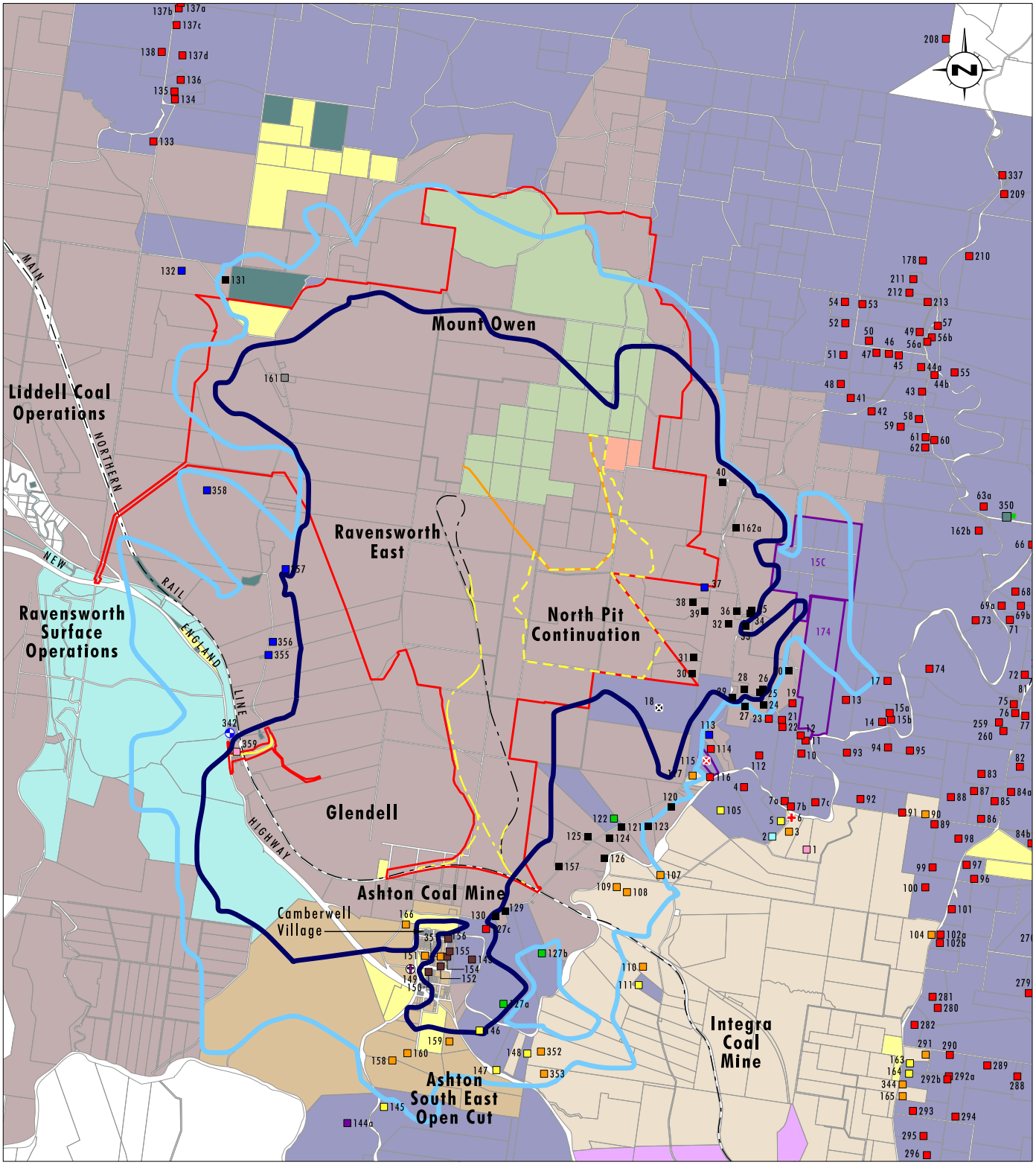


Data Source: Mount Owen (2014), Department of Lands (2009)

0 1 2 4 km
Scale 1:90 000

Legend

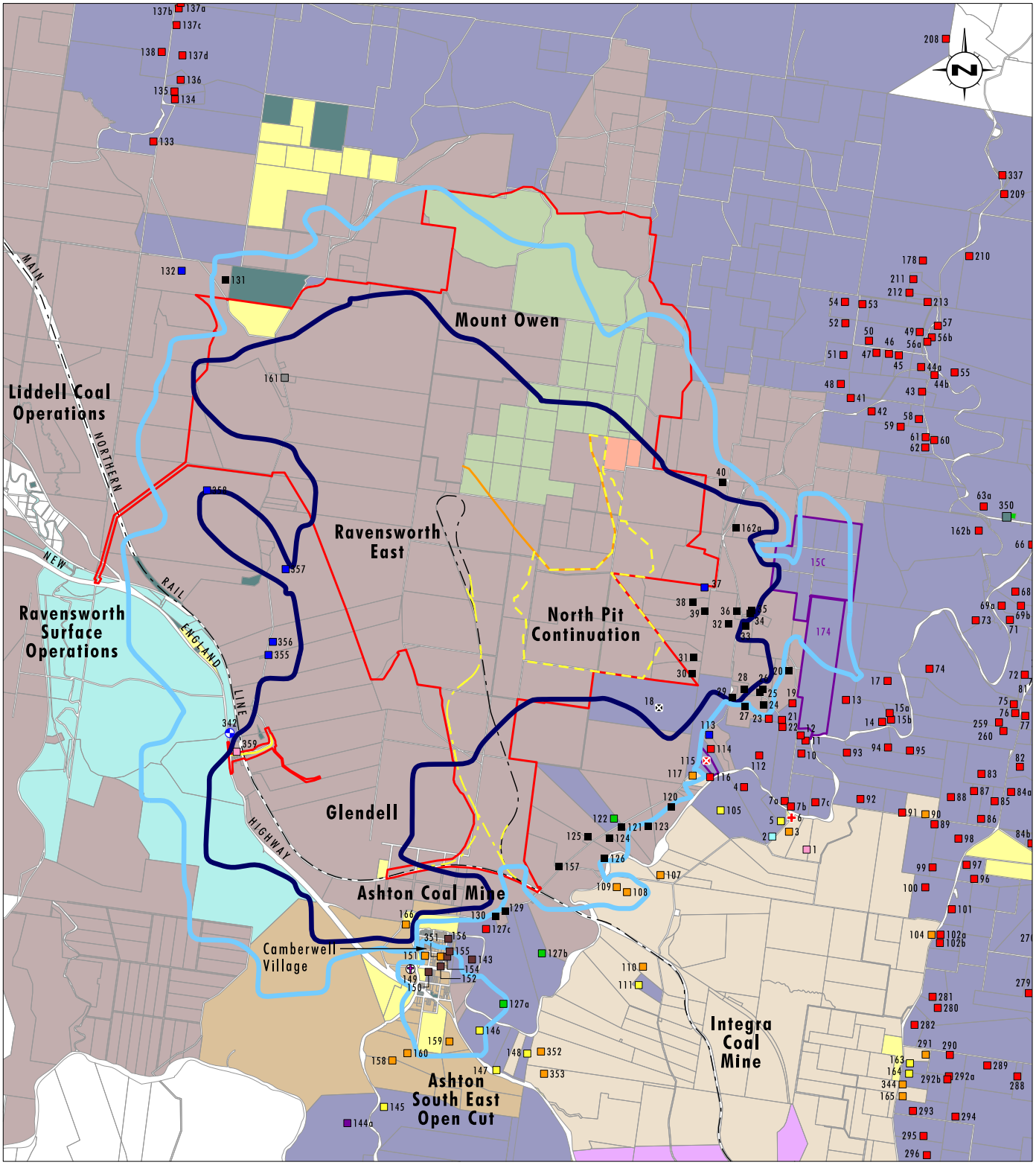
- Project Area
- Approved North Pit Mining Extent
- Proposed North Pit Continuation
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Vacant Land
- Ashton Coal
- Crown Land
- Crown Land TSR
- Government Authority
- Integra Coal
- Macquarie Generation
- Glencore
- Private
- Rixs Creek Mine
- State Forest
- Minister for Education
- 40 dB(A) 10th Percentile Exceedence
- 45 dB(A) 10th Percentile Exceedence
- Mt Pleasant Primary School
- Currently Subject to Acquisition Rights - Dairy
- SEOC Acquisition
- Private Residence
- Private Residence - Currently Subject to Acquisition Rights - Glencore
- Private Residence - Currently Subject to Acquisition Rights - Other Mines
- Subject to Acquisition Rights - Glencore No Dwelling
- Private No Dwelling
- Mine Owned Residence - Glencore
- Mine Owned Residence - Other Mine
- Mine Owned Residence - Derelict
- Mine Owned Residence - Vacant
- Community Hall
- Church
- Daracon Site Office
- Glennies Creek Fire Brigade
- Former Hebden Public School

FIGURE 5.9

Year 1 Cumulative Mount Owen Complex Winter Nights Noise Contours

File Name (A4): R02/3109_904.dgn
20141008 11.15

umwelt



Data Source: Mount Owen (2014), Department of Lands (2009)

0 1 2 4 km

Scale 1:90 000

Legend

- Project Area
- Approved North Pit Mining Extent
- Proposed North Pit Continuation
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Vacant Land
- Ashton Coal
- Crown Land
- Crown Land TSR
- Government Authority
- Integra Coal
- Macquarie Generation
- Glencore
- Private
- Rixs Creek Mine
- State Forest
- Minister for Education
- 40 dB(A) 10th Percentile Exceedence
- 45 dB(A) 10th Percentile Exceedence
- Mt Pleasant Primary School
- Currently Subject to Acquisition Rights - Dairy
- SEOC Acquisition
- Private Residence
- Private Residence - Currently Subject to Acquisition Rights - Glencore
- Private Residence - Currently Subject to Acquisition Rights - Other Mines
- Subject to Acquisition Rights - Glencore No Dwelling
- Private No Dwelling
- Mine Owned Residence - Glencore
- Mine Owned Residence - Other Mine
- Mine Owned Residence - Derelict
- Mine Owned Residence - Vacant
- Community Hall
- Church
- Daracon Site Office
- Glennies Creek Fire Brigade
- Former Hebden Public School

FIGURE 5.10

Year 5 Cumulative Mount Owen Complex Winter Nights Noise Contours

File Name (A4): R02/3109_905.dgn
20141008 11.15

The results presented in the NIA for the Mount Owen Complex indicate that in the region around Camberwell village, the noise models predict that noise levels from the Project will be typically 5 to 10 dB less than the predicted noise levels from the approved Glendell operation. For the areas surrounding the Project Area outside of Camberwell village, the cumulative noise assessment indicates that the cumulative noise impact assessment criteria will not be exceeded based on the Project and the relevant surrounding mining operations. Mount Owen proposes to maintain a continuous noise monitoring unit between the Project and potentially affected privately owned residential receivers to discern the contribution the Project makes to the cumulative noise level. Noise levels that are recorded above the cumulative noise impact assessment criteria by the continuous noise monitoring system will be investigated on a case-by-case basis. When required, attended noise monitoring will be undertaken to confirm the noise source(s) contributing to the cumulative noise levels. This approach to noise performance management of the cumulative noise impacts has been successfully implemented at Mount Owen since 2004. The use of the continuous noise monitoring system to assess the noise impact of the Project is outlined further in **Section 5.3.10**.

5.3.10 Noise Management and Monitoring

As outlined in **Section 5.3.1**, the identification and assessment of reasonable and feasible noise controls have been considered through the Project design process and incorporated into detailed noise modelling (refer to **Appendix 7**). The incorporation of these reasonable and feasible controls has reduced the Noise Affectation Zone and related noise impacts associated with the Project as far as practicable. Mount Owen commits to the implementation of the following reasonable and feasible controls over the life of the Project

- management of the operation of the RERR Mining Area during periods when the weather conditions enhance the noise impacts, such as inversion conditions, during some winter night times. Consequently, the results for Year 10 in **Section 5.3.3** do not include operations in the RERR Mining Area under adverse weather conditions during winter night times, (estimated to be approximately 20 to 30 nights during the June-August winter period), but include the operation's contribution within the RERR Mining Area during non-winter nights, non-winter evenings and all season day time predicted noise levels;

- the management of mobile machines during adverse weather conditions when wind conditions or inversion conditions enhance noise propagation towards sensitive receiver locations. In order to control / eliminate noise impacts this would likely include:

  - providing alternative overburden emplacement locations; and
  - moving parts of the fleet to locations deeper in the pit;

- managing a number of activities during adverse meteorological conditions, such as those which may occur during winter night-times, including:

  - limiting a portion of the coaling fleet during the later stages of the mine life;
  - reducing bulldozer activity on exposed rehabilitation areas;
  - managing topsoil and pre-strip during the later stage of the mine life;

- the inclusion of bunds in strategic locations along some haul roads, where practicable, along the side of the ramps in the North Pit Continuation shielding trucks and equipment on exposed sections of the ramps;

- locating key haul roads within the North Pit below ground surface to maximise topographical shielding to surrounding receiver areas;

- in the later years of the Project, locating the primary coal haul road to the Mount Owen CHPP on the western side of the North Pit Continuation;
- location and orientation of haul roads to be not aligned with prevailing source to receiver winds where practicable;
- inclusion of bunds in strategic locations to shield trucks and equipment operating on exposed overburden emplacement areas in the BNP and RERR Mining Area; and
- incorporation of reasonable and feasible noise attenuation on key plant and equipment as detailed in **Appendix 7**.

In addition to measures discussed in **Section 5.3.1** and above, Mount Owen intends to achieve the predicted noise levels associated with the Project presented in the NIA through the continued 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 considering evolving technology and associated equipment noise levels. A range of controls and strategies may be adopted as required to meet noise performance requirements for the Project include:

- dozer operations:
  - using a low gear when reversing;
  - remaining in gear when reversing down the stockpiles;
  - moving track dozer operations off elevated locations during adverse weather conditions;
  - using rubber tyred dozers on elevated or exposed overburden emplacement areas during adverse weather conditions;
  - rescheduling topsoil pre-strip activities outside of adverse weather conditions;
- waste haulage:
  - the use of high overburden emplacement areas will be restricted during periods when the weather conditions can potentially enhance the noise impacts;
  - creating sheltered or less exposed overburden emplacement areas that can be used during adverse weather conditions, where practicable;
- excavator operations:
  - using ‘silent horns’ to communicate with trucks;
  - managing the drop of the first load into truck bodies to minimise impact noise from the material;
- drilling operations:
  - rescheduling drilling in exposed locations for periods when the weather conditions do not enhance the noise impacts;

In addition to the implementation of noise mitigation strategies during periods of potential adverse weather conditions, Mount Owen will implement the following general noise mitigation measures as part of the Project:

- use smart broadband 'Quacker' reversing alarms;
- regular inspection and maintenance of noise attenuation systems;
- implement a process for periodic review of noise performance of the equipment fleet;
- implement work area specific controls for high risk areas; and
- offer reasonable and feasible noise mitigation measures such as double glazing, insulation and / or air conditioning to landowners with predicted noise levels greater than 2 dB above relevant PSNLs;

- Mount Owen will develop and implement a Noise Management Plan (NMP) (to update the current Noise Monitoring Program for both Mount Owen and Ravensworth East Mines) in accordance with the Project Approval and EPL. The NMP will detail the continued management controls to be utilised to manage potential noise impacts associated with operations;

- As a central component of the management of noise impacts, Mount Owen will continue to implement the extensive continuous noise monitoring system to enable proactive and real time management of operations during noise propagating conditions. The noise monitoring system will comprise:

  - continued use of predictive forecasting of adverse weather conditions to identify when and where management measures are likely to be required as a result of an adverse weather event;
  - continuous monitoring network consisting of fixed and mobile continuous noise monitoring units and two weather stations. Where the noise impacts are predicted based on stability class rather than lapse rate, a 10 metre tower is suitable for measuring stability class based on sigma theta. As a result, the current weather stations used by Mount Owen are suitable for assessing the presence of inversion conditions that could lead to the enhancement of noise impacts.
  - by Year 5, continuous noise monitoring will be conducted in the region of Middle Falbrook at one of the residences in Area 4;
  - by Year 10, continuous noise monitoring will be conducted in the region of Middle Falbrook and Stoney Creek Roads at one of the residences in Area 7;
  - retain the existing attended noise locations N1 to N8, and additional attended noise monitoring locations in order to assess ongoing compliance with relevant noise impact assessment criteria and to validate the information obtained from the continuous noise monitoring units. The location and frequency of the additional attended noise monitoring will be determined on an ongoing risk assessment basis; and
  - use of the continuous noise monitoring system to identify when noise levels are approaching relevant noise limits in the surrounding area to actively manage operations to minimise potential noise impacts as far as practicable.

5.4 Blasting Assessment

To assess the potential blasting impacts associated with the Project, a detailed Blast Impact Assessment was undertaken by Enviro Strata Consulting Pty Ltd (ESC) (refer to **Appendix 8**). The requirements of the DGRs relating to blasting and the sections where these requirements are addressed in this report are set out in **Table 5.4.1**.

Table 5.4.1 – Blast Impact Assessment Director-General's Requirements

Blast Impact Assessment Requirements	Section of Report
Blasting impacts on nearby mining operations.	**Section 5.4.6.3** and **Appendix 8**
Blasting impacts on people, livestock and property.	**Section 5.4.6** and **Appendix 8**
Reasonable and feasible mitigation measures, including evidence that there are no such measures available other than those proposed.	**Section 5.4.7** and **Appendix 8**

The potential impacts associated with blast fume is considered as part of the Air Quality Impact Assessment outlined in **Section 5.2** and contained in full in **Appendix 6**.

Blasting is currently undertaken in accordance with the Mount Owen Complex Blast Management Plan. The Blast Management Plan details the relevant management and mitigation measures associated with blasting, and provides a protocol for monitoring and evaluating blast impacts.

Blasting at Mount Owen Mine is currently limited to between 9.00 am and 5.00 pm (EST) and 9.00 am and 6.00 pm (EDST) Monday to Saturday inclusive with an additional 12 blasts per year permitted between 7.00 am and 9.00 am Monday to Saturday, allowing for up to 2 blasts per day in accordance with the current Mount Owen development consent (DA 14-1-2004). The Ravensworth East development consent (DA 52-03-99) allows for blasting between 9.00 am and 5.00 pm (EST) and 9.00 am 6.00 pm (EDST) Monday to Saturday inclusive, allowing for up to 2 blasts per day. The frequency of blasting is proposed to continue for the Project. The Blast Management Plan provides for the detailed design of each blast to minimise dust, fumes, ground vibration and airblast overpressure, to maximise blast efficiency and ensure compliance with site specific blasting conditions.

5.4.1 Blast Sensitive Locations

Potential blast impacts associated with the Project have been assessed in relation to the surrounding private residences located within a 5 kilometre radius of the North Pit Continuation, BNP and RERR Mining Area, respectively (refer to **Figure 5.11**). The majority of land within a 1 kilometre radius surrounding each of the proposed mining areas is owned by Mount Owen, with the exception of one privately owned vacant lot (property R018). R018 adjoins the Project Area to the south of the North Pit Continuation. The surrounding area owned by Mount Owen is currently utilised for cattle grazing or as ungrazed land, while a number of mine owned rural residential properties are leased from Mount Owen.

The closest private residences to the North Pit Continuation Area are located to the south-east in the Falbrook and Middle Falbrook areas, with the closest privately owned residence located approximately 1.8 kilometres from the proposed North Pit Continuation mining limit. The closest privately owned residences to the BNP and RERR Mining Area are located approximately 5.2 kilometres north-west and 3.4 kilometres south-east, respectively.

The identified infrastructure and historical items (excluding existing mine owned infrastructure) included in the Blast Impact Assessment are shown on **Figure 5.11** and relevant criteria for assessment is provided in **Section 5.4.5**.

As discussed in **Section 2.3.3**, based on the current conceptual mine plans, mining in the North Pit Continuation and RERR Mining Area will result in Mount Owen mining within the strata above a portion of the current approved Integra underground workings (refer to **Figure 2.7**). Based on the production schedules for both Mount Owen and Integra, mining

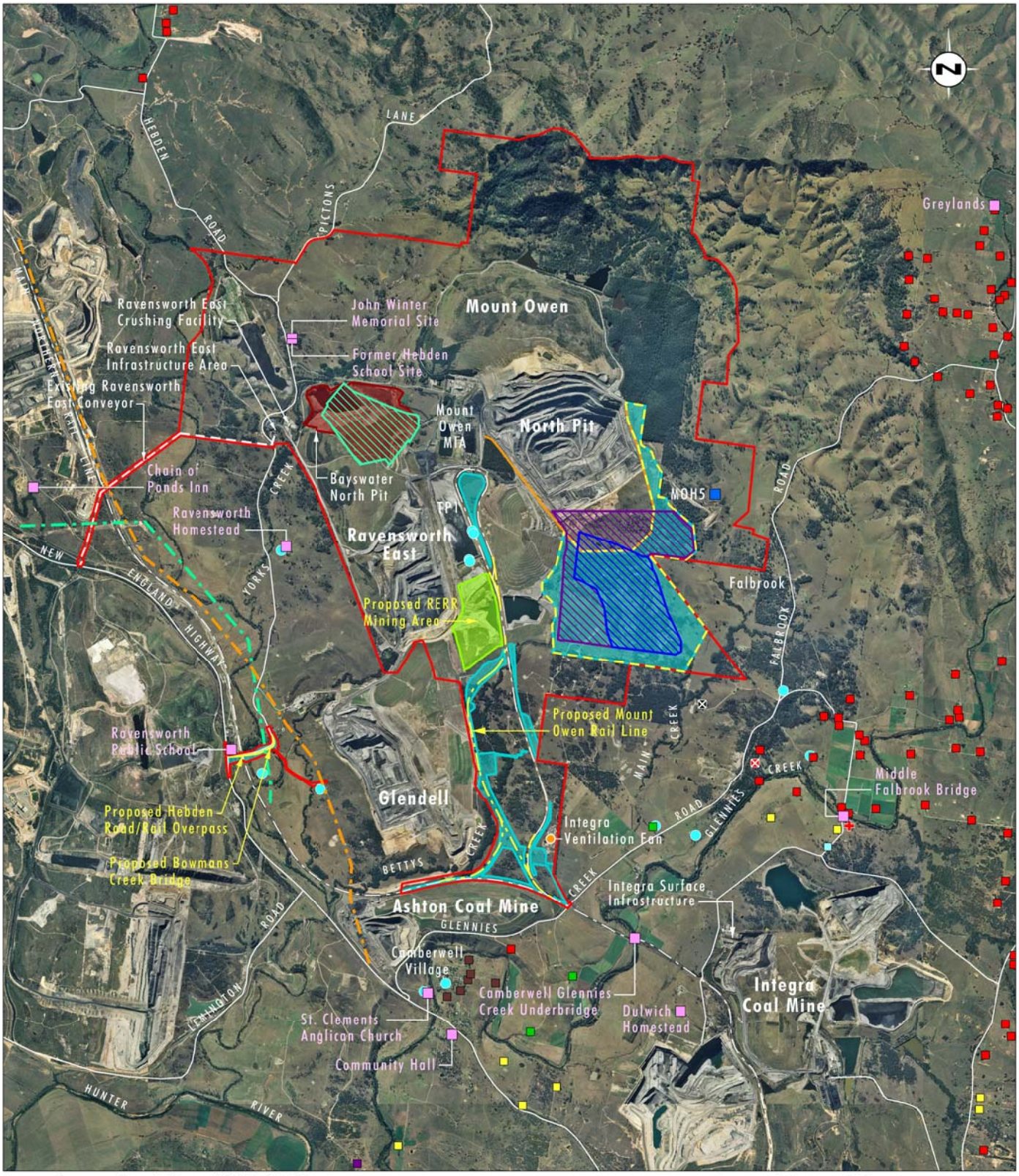


Image Source: Mount Owen (2012-2013)
Data Source: Mount Owen (2014)

0 1.0 2.0 4.0km
1:80 000

Legend

- Project Area
- Proposed Disturbance Area
- Bayswater North Pit
- Proposed RERR Mining Area
- Approved North Pit Mining Extent
- Proposed North Pit Continuation
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- 132kV Powerlines
- 330kV Powerlines
- Western Blast Area
- Eastern Blast Area
- Proposed Bayswater North Pit - Active Mining Area
- Private No Dwelling
- Subject to Acquisition Rights - Glencore No Dwelling
- Private Residence - Currently Subject to Acquisition Rights - Glencore
- Private Residence - Currently Subject to Acquisition Rights - Other Mines
- Private Residence
- Currently Subject to Acquisition Rights - Dairy
- SEOC Acquisition
- Community Hall
- Church
- Glennies Creek Fire Brigade
- Blast Monitoring Location
- Identified Heritage Site
- Listed Heritage Item

FIGURE 5.11

Indicative Blast Areas and Nearby Receivers

File Name (A4): R02/3109_906.dgn
20141024 9.33

within the North Pit Continuation and RERR Mining Area, and the Integra Underground Mine are not expected to overlap. It should be noted that Integra Underground is currently on care and maintenance which will likely alter timing associated with longwall mining. Notwithstanding, the potential impact of blasting within the North Pit Continuation and RERR Mining Area on the Integra Underground Mine has been assessed.

5.4.2 Existing Blast Monitoring Network

The existing Mount Owen Complex Blast Monitoring Network includes 13 blast monitoring stations, refer to **Figure 5.11**.

The stations are as follows:

- Residence R029 – (mine owned);
- Residence R123 – (mine owned);
- Residence R112 – (Private);
- Green Acres;
- Camberwell Village;
- St Clement's Church (Camberwell);
- Ravensworth Homestead;
- Tailings Pit 1 (TP1) Monitors (x 4);
- Railway; and
- Powerlines.

Properties R029, R123 and R112 in addition to Green Acres and Camberwell Village, provide monitoring representative of blast impacts on private residences in accordance with the current Blast Management Plan. These blast monitors are placed in strategic locations to monitor blast levels associated with the existing Mount Owen and Ravensworth East Mines.

5.4.3 Conceptual Blast Design

Mount Owen currently undertakes detailed design for all blasts. In order to maximise blast efficiency, minimise potential vibration and overpressure impacts and to ensure compliance with the relevant consent criteria, it is proposed that these established blast design practices will continue for blasting activities associated with the Project.

As discussed in **Section 2.3.2**, coal is currently extracted from the North Pit down to the Hebden seam. The target coal seams for extraction within the North Pit Continuation will vary. Coal will continue to be extracted down to the Hebden seam where the coal seams dip, however as the North Pit Continuation progresses to the south, the coal seams flatten and coal extraction will be undertaken down to the Bayswater seam. Mining depths will vary between 180 and 300 metres. Mining in the BNP and RERR Mining Area will target the Ravensworth and Bayswater seams and will involve extraction from these coal seams down to a depth of approximately 200 metres.

The proposed depth of mining within the North Pit Continuation and RERR Mining Area is restricted by the interaction with the approved Integra Underground Mine operations (stratified mining lease). Based on the current conceptual mine plans, the North Pit Continuation and RERR Mining Area could result in Mount Owen mining over a portion of the current approved Integra underground workings (refer to **Figure 2.7**). The vertical separation between the projected North Pit Continuation and RERR Mining Area pit floors and the currently approved Integra Underground Mine will be a minimum of approximately 250 metres (refer to **Figure 2.8**).

A range of blast sizes (measured as Maximum Instantaneous Charge (MIC)) have been modelled for the North Pit Continuation, BNP and RERR Mining Area; with the modelling accounting for the potential worst case scenario. The modelled blast sizes are representative of blasting practices which enable compliance with the relevant criteria based on the varying distance to the surrounding sensitive receivers. Due to the variable thickness of interburden material between the coal seams in the North Pit Continuation, BNP and RERR Mining Area; various bench heights will be required. The projected charge masses required are based on these varying bench heights.

5.4.4 Ground Vibration and Airblast Predictive Models

The ground vibration predictive model is based on vibration and airblast monitoring data collected from blast monitoring stations located to the south and south-west of the Project Area. The analysed sample of data was collected over a one year period (2011-2012) and includes more than 170 blasts. This data was utilised to inform the development of the ground vibration predictive model and the airblast overpressure predictive model for the Project.

Mining operations within the North Pit Continuation and BNP are anticipated to occur concurrently in the early years of the Project; while in the later years of the Project, mining operations within the North Pit Continuation and RERR Mining Area are anticipated to occur concurrently. However, as discussed in **Section 5.4.7**, blasting within the North Pit Continuation, BNP and RERR Mining Area will not occur simultaneously.

The assessment also utilised the ground vibration predictive model for underground workings previously developed from underground monitoring data from Integra Underground Mine, associated with blasting within the Mount Owen Eastern Rail Pit (ERP) in 2005-2006. This ground vibration predictive model is considered to be representative of blasting for the Project and suitable for the prediction of the potential impacts on the Integra Underground Mine.

5.4.5 Blast Assessment Criteria

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 5.4.2**.

Table 5.4.2 – Residential Blast Impact Criteria

Receiver	Peak Particle Velocity (mm/s)	Allowable Exceedance	Overpressure (dBL)	Allowable Exceedance
Residence on Privately owned land	5	5% of the total number of blasts over a 12 month period	115	5% of the total number of blasts over a 12 month period
	10	0%	120	0%

The relevant blast assessment criteria associated with property damage are provided in **Table 5.4.3**.

Table 5.4.3 – Infrastructure Blast Impact Criteria

Receiver	Minimum Distance from Proposed Mining Areas (km)	Peak Particle Velocity (mm/s)	Allowable Exceedance	Overpressure (dBL)	Allowable Exceedance
St Clements Church	4.7	2	5% of the total number of blasts over a 12 month period	115	5% of the total number of blasts over a 12 month period
		5	0%	120	0%
Ravensworth Homestead	1.6	5	0%	126	No limit specified
Former Chain of Ponds Inn	4.2	10	No limit specified	133	No limit specified
Former Dulwich Homestead (Kangory Homestead)[1]	5.1	5	0%	126	No limit specified
Power Transmission Lines	2.6	50	0%	No limit specified	No limit specified
Prescribed dams (TP1 Tailings Dam wall and Ashton Coal Clean Water Dam 1)[2]	0.6	50	0%	No limit specified	No limit specified
Surface Mine Infrastructure (non-sensitive sites)	4.0	25	0%	No limit specified	No limit specified
Surface Mine Infrastructure (non Mount Owen) – unoccupied structures (reinforced concrete or steel)	2.7	100	0%	No limit specified	No limit specified
Main Northern Rail Line[2]	3.0	25	0%	No limit specified	No limit specified
Public Roads[2]	0.45	100	0%	No limit specified	No limit specified

Table 5.4.3 – Infrastructure Blast Impact Criteria – cont.

Receiver	Minimum Distance from Proposed Mining Areas (km)	Peak Particle Velocity (mm/s)	Allowable Exceedance	Overpressure (dBL)	Allowable Exceedance
Concrete Bridges (existing and proposed road/rail bridges)[2]	3.0	100	0%	No limit specified	No limit specified

Note: 1) Criteria adopted from Ravensworth Homestead.
2) If further studies indicate that increased vibration limits can be achieved, an application to modify the approved limits will be made in consultation with the relevant authority.

Two separate criteria are relevant to underground mining including a safe vibration limit and a vibration limit for personnel withdrawal, as specified in **Table 5.4.4**. Safe vibration limits in relation to underground mining are site specific. The criteria adopted for the assessment is based on previous studies undertaken in relation to blasting interactions between the ERP and the Integra Underground Mine, as discussed in **Section 2.3.3**.

Table 5.4.4 – Criteria for Safe Vibration Limits and Vibration Limits for Personnel Withdrawal – Integra Underground Mine

Criteria	Peak Particle Velocity (mm/s)
Safe Vibration Limit	250
Vibration Limit for Personnel Withdrawal	10

The safe vibration limit for an underground mine is a unique number mainly dependent upon rock strength characteristics. The safe vibration limit is specified as 'the level at which there is a high probability of rock strata damage'. To avoid any potential damage issues, blasting should be designed below the safe vibration limit using a target vibration level (that is, specified below the safe vibration limit). The vibration limit for personnel withdrawal has been based on extensive previous studies (Lewandowski *et al*. 2006 and 2007). A 10 mm/s vibration level is recommended and used across a number of underground mines for personnel withdrawal and is specified as a human comfort level, and not as a safe vibration limit (which is higher). It is expected that the mine sections exposed to predicted vibration levels of less than 10 mm/s can be manned if notification to all personnel of the predicted vibration levels is given. In such circumstances, personnel must also be informed of excluded sections (that is, where vibrations exceed 10 mm/s).

5.4.6 Predicted Blast Impacts

5.4.6.1 Surrounding Private Residences

The predicted ground vibration levels that will be experienced at the private residences have been modelled for each of the mining areas. Each mining area has been modelled separately, as Mount Owen will not undertake any blasts simultaneously in either the North Pit and BNP or North Pit and RERR Mining Area.

As outlined in **Section 5.4.3**, Mount Owen proposes to use variable charge masses (MIC) at different locations within the North Pit Continuation, BNP and RERR Mining Area in order to manage ground vibration and airblast levels. The predicted ground vibration levels for the nearest private residences using variable charge masses within the eastern blast area of the North Pit Continuation (refer to **Figure 5.11**) is in the order of 0.1 mm/s to 2.5 mm/s. The predicted ground vibration levels for private residences using variable charge masses within the western blast area of the North Pit Continuation (refer to **Figure 5.11**) is in the order of 0.1 mm/s to 1.9 mm/s. The predicted ground vibration levels in the BNP indicate the estimated vibration levels for all residences are no higher than 0.5 mm/s. In the RERR Mining Area, the expected vibration levels for the majority of blasting are below 0.7 mm/s, with the vibration levels not predicted to exceed 1.6 mm/s at the closest residence. These levels in the North Pit Continuation, BNP and RERR Mining Area are below the applicable ground vibration criteria of 5 mm/s (for 95 per cent of blasts) as outlined in **Table 5.4.2**.

The predicted airblast levels from the North Pit Continuation will also gradually increase as mining operations move closer to the nearest private residences, with the lowest levels predicted for Year 1 and highest levels for Year 10 of the Project. In the eastern blast area of the North Pit Continuation, the predicted airblast levels for the private residences for the variable charge masses will be in the order of 95 dBL to 119 dBL; while the predicted airblast levels for blasts in the western blast area are in the order of 95 dBL to 116 dBL. Predicted airblast levels from the BNP and RERR Mining Area indicate that no exceedance of the required limit of 115 dBL is predicted at surrounding private residences. Through the implementation of appropriate charge mass design, blasts in the North Pit Continuation can be managed to ensure the predicted airblast levels are below the required limit of 115 dBL (for 95 per cent of blasts), as outlined in **Table 5.4.2**. Predicted airblast levels at each identified private residence (within a 5 kilometre radius of the North Pit Continuation, BNP and RERR Mining Area, respectively) are provided in **Appendix 8**. Further detail regarding the proposed blast management measures and charge mass design is provided in **Section 5.4.7**.

The Blast Impact Assessment also states that as mining within the North Pit Continuation, BNP and RERR Mining Area progresses to greater depths, some topographical shielding will be created due to a change in the contours of the area. This will assist with controlling the impacts associated with airblast and subsequently lessen the impact on the surrounding private residences.

5.4.6.2 Existing and Proposed Infrastructure

The potential impact of blasting activities within the North Pit Continuation, BNP and RERR Mining Area has been assessed in relation to the infrastructure identified in **Section 5.4.1** and illustrated in **Figure 5.11**.

The ground vibration modelling undertaken included seven different simulations involving the application of various potential charge masses which are representative of the design for blasting activities within each of the proposed mining areas.

The closest infrastructure to the North Pit Continuation (TP1) and BNP (Hebden Road) will be exposed to vibration levels no higher than 8 mm/s and 24 mm/s, respectively; these levels are well below the relevant vibration criteria of 50 mm/s. The closest infrastructure to the RERR Mining Area (TP1) will not be functional by the time blasting commences in this area and, therefore, the applicable vibration limit criteria for this infrastructure does not apply. The predicted ground vibration levels at Glennies Creek and Falbrook Roads, associated with blasting in the North Pit Continuation, BNP and RERR Mining Area will be no higher than 7 mm/s which is also below the vibration criteria for roadways of 100 mm/s. The predicted ground vibration levels associated with blasting in the North Pit Continuation, BNP and RERR Mining Area at all other identified infrastructure are below 17 mm/s; this is well below

the vibration criteria of 50 mm/s. The predicted ground vibration levels associated with blasting in the North Pit Continuation, BNP and RERR Mining Area at all listed historical items are below any of the applicable vibration criteria. Predicted ground vibration and airblast levels at all infrastructure identified in **Section 5.4.1** are provided in **Appendix 8**.

Generally, infrastructure is not assessed in terms of airblast exposure as levels required to inflict damage to infrastructure are not applicable and/or could not be achieved. Two of the identified listed heritage items, the Chain of Ponds Inn (approximately 4.2 kilometres to the west of the BNP) and Ravensworth Homestead (approximately 1.6 kilometres to the south-west of the BNP), have applicable airblast criteria limits of 133 dBL and 126 dBL, respectively. For all proposed mining areas, the predicted airblast exposure for the Chain of Ponds Inn is in the order of 90 to 108 dBL, while for the Ravensworth Homestead the predicted airblast exposure is in the order of 98 to 120 dBL. These predicted airblast levels are below the applicable airblast criteria.

5.4.6.3 Integra Underground Mine

Based on the anticipated production schedules for the Project and Integra Underground Mine, it is unlikely that direct interaction of operational activities will occur. As previously noted, Integra Underground is currently on care and maintenance which will likely alter timing associated with longwall mining. Notwithstanding, the Blast Impact Assessment has predicted vibration impacts in relation to the Integra Underground Mine that are based on seven different simulations involving a range of charge masses which represent the reasonable worst case design for blasting activities within the North Pit Continuation, BNP and RERR Mining Area. Two representative boreholes were examined from the Proposed Disturbance Area which indicated vertical separation distances of 254 and 257 metres, between the North Pit Continuation pit floor and the Middle Liddell seam (Integra Underground target seam) which is considered adequate to enable the management of safety and operational issues (refer to **Figure 2.7**). It is noted that if Integra extracts all resources from the Middle Liddell seam, it is likely to then commence within the lower coal seams, increasing this separation distance.

The modelling results for the potential vibration exposures for various sections of the underground mine vary, dependent on the distance between the blasting area within the North Pit Continuation, BNP and RERR Mining Area and the different sections of the Integra Underground Mine (refer to **Figures 2.7** and **2.8**), as discussed below:

- North Pit Continuation:
  - In areas immediately beneath the blasting zone within the North Pit Continuation the predicted vibration is in the range of 2 to 26 mm/s. As the predicted vibration levels are in excess of 10 mm/s, personnel withdrawal from the affected longwall areas will be required prior to blasting within the North Pit Continuation should this scenario occur.
  - For a separation distance of 300 metres to 500 metres from the blast zone, predicted vibration is in the range of 1.5 to 19 mm/s. As the predicted vibration levels are in excess of 10 mm/s, personnel withdrawal from the affected longwall areas will be required prior to blasting within the North Pit Continuation should this scenario occur.
  - In the remaining sections of the Integra Underground Mine (separation distances in excess of 500 metres,), the predicted vibration levels associated with blasting in the North Pit Continuation will be 8 mm/s or less. As the predicted vibration levels are below 10 mm/s, personnel management during blasting is not considered to be required.

  - Predicted vibration levels for the main headings area in the North Pit Continuation (used as a transport road, located in excess of 1,300 metres), will be in the order of 2 mm/s or less. As the predicted vibration levels will be below 10 mm/s, personnel withdrawal from the main headings will not be required prior to blasting.

- BNP:
  - Within the BNP, all sections of the underground mine are at distances in excess of 1,000 metres from the blast zone. The maximum predicted ground vibration exposure is 0.5mm/s, resulting in a negligible impact. As vibration levels are predicted to be below 10 mm/s, the need for personnel management during blasting is not considered to be required.

- RERR Mining Area:
  - In areas immediately beneath the blasting zone within the RERR Mining Area the predicted vibration is in the range of 2 to 32 mm/s. As the predicted vibration levels are in excess of 10 mm/s, personnel withdrawal from the affected longwall areas will be required prior to blasting within the RERR Mining Area should this scenario occur.
  - For a separation distance of 300 metres to 500 metres from the blast zone, predicted vibration is in the range of 1.5 to 24 mm/s. As the predicted vibration levels are in excess of 10 mm/s, personnel withdrawal from the affected longwall areas will be required prior to blasting within the RERR Mining Area, should this scenario occur.
  - In the remaining sections of the Integra Underground Mine (separation distances in excess of 500 metres,), the predicted vibration levels associated with blasting in the RERR Mining Area will be 11 mm/s or less. For sections with vibration predictions in excess of 10 mm/s personnel withdrawal will be necessary, while for sections below 10 mm/s there is no need for personnel management during blasting.

Existing surface infrastructure associated with the Integra Underground Mine include surface facilities (office buildings, staff facilities and a power plant), ventilation fans and conveyors. This surface infrastructure is located in excess of 2.6 kilometres from the North Pit Continuation, 5 kilometres from the BNP and 2.7 kilometres from the RERR Mining Area boundaries (refer to **Figure 5.11**).

Vibration exposure to the identified Integra surface infrastructure is predicted to be no higher than 2 mm/s, 1 mm/s and 3 mm/s for the North Pit Continuation, BNP and RERR Mining Area, respectively. These predicted ground vibration levels are well below the applicable vibration criteria (25 mm/s and 100 mm/s) and are considered negligible.

Although it is unlikely that mining within the North Pit Continuation and RERR Mining Area, and the Integra Underground Mine will overlap, consultation between Mount Owen and Integra has been undertaken in relation to a possible interaction scenario. This consultation has identified the need for a blast management protocol and it is proposed that this protocol be developed and agreed with Integra Underground Mine prior to any blasting occurring within 500 metres of currently approved, active underground workings. A similar protocol was implemented when blasting was conducted within the ERP at Mount Owen Mine.

5.4.6.4 Flyrock

The current Blast Management Plan includes the application of an exclusion zone associated with blasting activities to manage any potential impacts associated with flyrock. The blast impact assessment confirms that an appropriate blast exclusion zone commensurate with that used across the mining industry will continue to be implemented at Mount Owen to manage the impact of flyrock.

Mount Owen currently owns all land surrounding the North Pit Continuation, BNP and RERR Mining Area; with the closest private residence being located in excess of 1.8 kilometres from the North Pit Continuation boundary.

Some operational activities in the BNP will be undertaken within 500 metres of Hebden Road as well as the Mount Owen Mine access road. This will require the formulation of appropriate management measures and consultation with relevant stakeholders. Mount Owen will implement an appropriate protocol, including preventative measures to ensure that the 500 metre exclusion zone is maintained during blasting.

The existing and proposed infrastructure and historical buildings identified in **Section 5.4.1** are located outside of the blast exclusion zone, with the exception of the existing TP1 which is located within the 500 metre radius of the RERR Mining Area; however, this dam will be capped prior to commencement of mining in the RERR Mining Area.

5.4.6.5 Livestock

The DGRs for the Project (refer to **Section 3.2.1**) require an assessment of potential blasting impacts on people, livestock and property. The majority of the land surrounding the Project Area is used for cattle grazing. Previous investigations of potential blasting impacts have been completed within the area surrounding the Project. Investigations undertaken by Neil Nelson Advice Pty Limited (Agriculture Consultancy Service) in 2011 included observations made at a Colinta Holdings feedlot, located on Falbrook Road approximately 2 kilometres south of the Project Area.

Observations were made during four separate blasts with no disturbance of the livestock observed within the feedlot or within the paddocks adjoining the feedlot during blasting activities. The report concludes that while blasting can result in immediate noise disruption, so does that of passing traffic and general farming equipment. Given the history of mining activities within the Project Area and surrounding mining operations, blast noise associated with the Project will not be an additional noise source to the area and livestock and other animals are likely to be accustomed to blast noise.

Potential impacts to livestock related to flyrock will be managed as part of pre-blast inspection activities, with the clearing of all livestock from within the blast exclusion zone if required.

5.4.7 Blast Management and Monitoring Commitments

The results of the Blast Impact Assessment indicate that the potential impacts resulting from blasting activities for the Project can be managed effectively to ensure no exceedance of relevant criteria. Blasting activities at the Mount Owen and Ravensworth East Mines is currently undertaken in accordance with the Blast Management Plan, which includes protocols for detailed blast design and monitoring, to ensure compliance with relevant criteria. As a result of the detailed Blast Impact Assessment undertaken for the Project, the Blast Management Plan will be updated to include the following management and monitoring measures which are considered to be reasonable and feasible to minimise the potential impacts of blasting activities:

- Blasting will be undertaken between 9.00 am and 5.00 pm (EST) and 9.00 am and 6.00 pm (EDST) Monday to Saturday inclusive with an additional 12 blasts per year permitted between 7.00 am and 9.00 am Monday to Saturday.

- No more than 2 blasts per day at Mount Owen and 2 blasts per day at Ravensworth East Mine will be undertaken.

- Mount Owen will continue to notify the landowner / occupier of all residences (who register to be notified) within a 3 kilometre radius of the Mount Owen Complex of the blasting schedule.

- Mount Owen will continue to operate the blasting hotline and provide up to date information relating to the blasting schedule for the Mount Owen Complex.

- Mount Owen will notify all landowners within 3 kilometres of the proposed mining limit that they are entitled to a structural property inspection (to be carried out by a suitably qualified, experienced and independent person).

- Blasting activities will continue to be undertaken in accordance with the Blast Management Plan which includes controls to ensure safety to people, property and livestock, control vibration and airblast emissions, minimise dust and fume emissions and minimise the cumulative effects of blasting.

The Blast Management Plan will also be revised to include the following controls identified by the Blast Impact Assessment for the Project:

- application of charge mass and initiation design appropriate to control ground vibration and airblast overpressure levels;

- use of a ground vibration predictive model (based on collated monitoring data) to estimate potential vibration levels to aid with the design of future blasts;

- continued refinement of the understanding of the geology of the blast area and adjustment to the blast design as required for adverse geological conditions;

- application of quality stemming material and stemming height to enable appropriate confinement of explosive charges to minimise airblast emission;

- application of an appropriate burden specification for the front row holes (to avoid face burst);

- application of airblast predictive model (based on collated monitoring data) to estimate potential overpressure levels to aid with the design of future blasts;

- undertake pre-blast meteorological condition review to avoid blasting in unfavourable weather conditions;

- modification of the existing Mount Owen blast monitoring system to include monitoring stations to the east and south-east of the North Pit Continuation;

- annual review of the preblast check protocol to give appropriate consideration of the distance to surrounding residences as mining within the North Pit Continuation progresses to the south;

- a meteorological station will be relocated with consideration of the requirements for air quality and noise monitoring to an appropriate position (see **Section 5.3.4**) to enable accurate monitoring of weather conditions in relation to the location of the North Pit Continuation, BNP and RERR Mining Area;

- should mining operations within the North Pit Continuation and RERR Mining Area, and the Integra Underground Mine overlap, a Blast Management Protocol will be developed prior to any blasting within 500 metres of the currently approved, active underground workings in consultation with Integra Underground Mine to manage any potential impacts

associated with blasting activities within the North Pit Continuation. As previously noted, Integra announced in mid-2014 that both its underground and open cut operations were entering a period of care and maintenance, impacting upon the extraction schedule for Integra Underground Mine. Mount Owen will continue to liaise with Integra to clarify the planned extent of the mining progression at that time and to establish the Blast Management Protocol prior to any blasting within 500 metres of underground workings;

- blasting activities within the North Pit Continuation, BNP and RERR Mining Area will not occur simultaneously;
- Mount Owen will implement an appropriate protocol, including preventative measures to ensure that the 500 metre exclusion zone is maintained during blasting; and
- Mount Owen will coordinate blasting with Liddell Colliery to ensure there is no simultaneous blasting likely to impact beyond relevant criteria at the historic Chain of Ponds Inn.

5.5 Surface Water

The DGRs for the Project require a detailed assessment of potential impacts on the quality and quantity of existing surface water resources. A detailed surface water assessment has been completed by Umwelt and is included in **Appendix 9**. The requirements of the DGRs relating to surface water and the sections where these requirements are addressed in this report are set out in **Table 5.5.1**.

Table 5.5.1 – Surface Water Assessment Director-General's Requirements

Surface Water Assessment Requirements	Section of Report
Detailed assessment of potential impacts (including cumulative impacts) on the quality and quantity of existing surface water resources, including: • impacts on affected licensed water users and basic landholder rights; • impacts on riparian, ecological, geomorphological and hydrological values of watercourses, including environmental flows; and • a flood assessment including identification of any necessary flood impact mitigation measures.	**Section 5.5.6** and **Appendix 9**
A detailed site water balance, including a description of site water demands, water disposal methods (inclusive of volume, salinity and frequency of any water discharges), water supply infrastructure and water storage structures.	**Section 5.5.5** and **Appendix 9**
An assessment of proposed water discharge quantities and quality/ies against receiving water quality and flow objectives.	**Section 5.5.5** and **Appendix 9**
Assessment of impacts of salinity from mining operations, including disposal and management of coal rejects and modified hydrogeology, a salinity budget and the evaluation of salt migration to surface and groundwater sources.	**Section 5.5.4** and Groundwater Assessment (refer to **Section 5.6**) and **Appendix 9**
Identification of any licensing requirements or other approvals under the *Water Act 1912* and / or *Water Management Act 2000*.	**Appendix 9**
Demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP).	**Section 5.5.6** and **Appendix 9**
A description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant WSP or water source embargo.	**Section 5.5.7** and **Appendix 9**

Table 5.5.1 – Surface Water Assessment Director-General's Requirements – cont.

Surface Water Assessment Requirements	Section of Report
A detailed description of the proposed water management system (including sewage), water monitoring program and other measures to mitigate surface and groundwater impacts.	**Section 5.5.4** and **5.5.7** and **Appendix 9**
Compliance with the Hunter River Salinity Trading Scheme.	**Section 5.5.3** and **Appendix 9**

5.5.1 Key Project Features with Potential to Impact Surface Water

As the Project is a continuation of an existing mining operation, potential impacts are minimised within the context of a well established water management system.

Key features of the Project that have the potential to impact on surface water resources include:

- landform changes as a result of the North Pit Continuation and continued mining operations within Ravensworth East Mine, including:
  - continued mining using open cut methods;
  - ROM coal and product coal stockpiles;
  - overburden emplacement areas;
  - clean water diversions;
  - the emplacement of tailings within the West Pit and RERR Mining Area at Ravensworth East Mine, and in-pit tailings cells in the North Pit Continuation;
- infrastructure upgrades including:
  - CHPP upgrades, including product coal stockpile extension;
  - MIA upgrades;
  - Hebden Road upgrades;
  - Mount Owen Complex rail line upgrades;
- changes to the Mount Owen Complex water balance associated with the Project; and
- 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 are discussed further in the following sections.

5.5.2 Existing Surface Water Environment

The Mount Owen Complex has an extensive existing water management system (WMS), which includes mine dewatering systems, water storages, sedimentation and retention basins, settling and tailings ponds, diversion drains, levee banks and earth bunding around the main stockpile, laydown hardstand areas and fuelling areas.

The WMS at the Mount Owen Complex is an integrated system, that is, the water from the Mount Owen, Ravensworth East and Glendell Mines are managed together within the integrated WMS. In addition, the Mount Owen Complex is an integral part of the Greater Ravensworth Water Sharing Scheme (GRWSS) with the Cumnock, Ravensworth Surface Operations, Narama, Ravensworth Underground and Liddell mining operations. The GRWSS allows greater flexibility in the water management by the Mount Owen Complex.

The use and management of water within the Glendell Mine does not form part of the Project and will continue to be managed pursuant to the existing Glendell development consent. Notwithstanding, the WMS proposed for the Project allows for the continued integration of water management across the Mount Owen Complex (refer to **Figure 5.12**).

5.5.2.1 Catchment Areas and Watercourses

The Project Area is located within the catchments of Bowmans Creek and Glennies Creek, both of which flow into the Hunter River to the south of the Project Area. Bowmans Creek catchment is located to the north and west of the Project Area, while Glennies Creek is located to the east and south (refer to **Figure 5.13**).

The Bowmans Creek catchment includes the sub catchments of Stringybark Creek, Yorks Creek, Swamp Creek and Bettys Creek (refer to **Figure 5.12**); while the Glennies Creek catchment includes the sub catchment of Main Creek. The existing Mount Owen Complex WMS is located within the Project Area, the extent of which is illustrated on **Figure 5.12**. Bettys Creek has been the subject of three approved diversions known as the upper, middle and lower Bettys Creek diversions (refer to **Figure 5.12**). Both Yorks Creek and Swamp Creek have also been the subject of approved diversions (refer to **Figure 5.12**).

Land uses within and immediately surrounding the Project Area include other mining operations, State Forest, biodiversity offset areas and rural and rural residential land holdings. Downstream water users are discussed further in **Section 5.5.2.3**. Previous mining operations within the Project Area have modified local catchments through the capture of runoff from mining areas within the mine WMS and diversion of upslope runoff around the mining operations.

Further details on both Bowmans Creek and Glennies Creek catchments and their sub catchments are provided in the Surface Water Assessment (refer to **Appendix 9**).

5.5.2.2 Surface Water Quality

Surface water monitoring at the Mount Owen Complex is documented in the *Mount Owen Complex Surface Water Monitoring Program*. Existing surface water quality monitoring locations for the Mount Owen Complex and monitoring locations that are shared with Ashton and Liddell Operations are illustrated on **Figure 5.14**.

The relevant default ANZECC trigger values and site specific trigger values for the key water quality indicators monitored by Mount Owen are presented in **Table 5.5.2**. These include pH, electrical conductivity (EC), total suspended solids (TSS) and total dissolved solids (TDS). The site specific trigger values for Bowmans Creek and for flow conditions in the ephemeral creeks are the same as the ANZECC default trigger values for pH, EC and TSS. The trigger value for TDS for Bowmans Creek and for flow conditions in the ephemeral creeks is based on historical data and is lower than the default ANZECC trigger values.

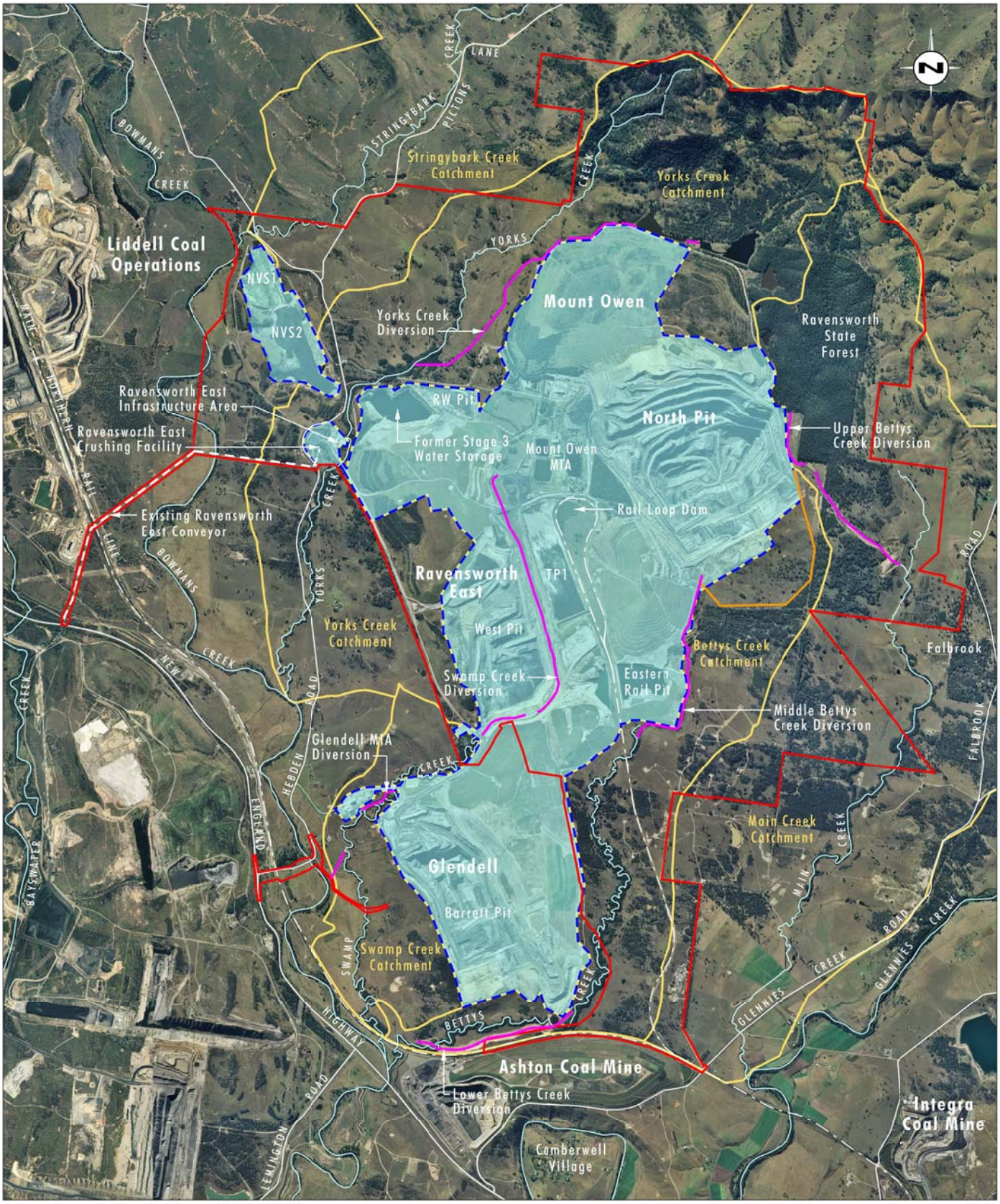


Image Source: Mount Owen (2012-2013)
Data Source: Mount Owen (2014)

0 1 2 3km
1:60 000

Legend

- Project Area
- Approved North Pit Mining Extent
- Mount Owen Complex Water Management System Catchment
- Catchment Boundary
- Existing Diversion Channel

FIGURE 5.12

Project Area Surface Water Catchment Context

File Name (A4): R02/3109_907.dgn
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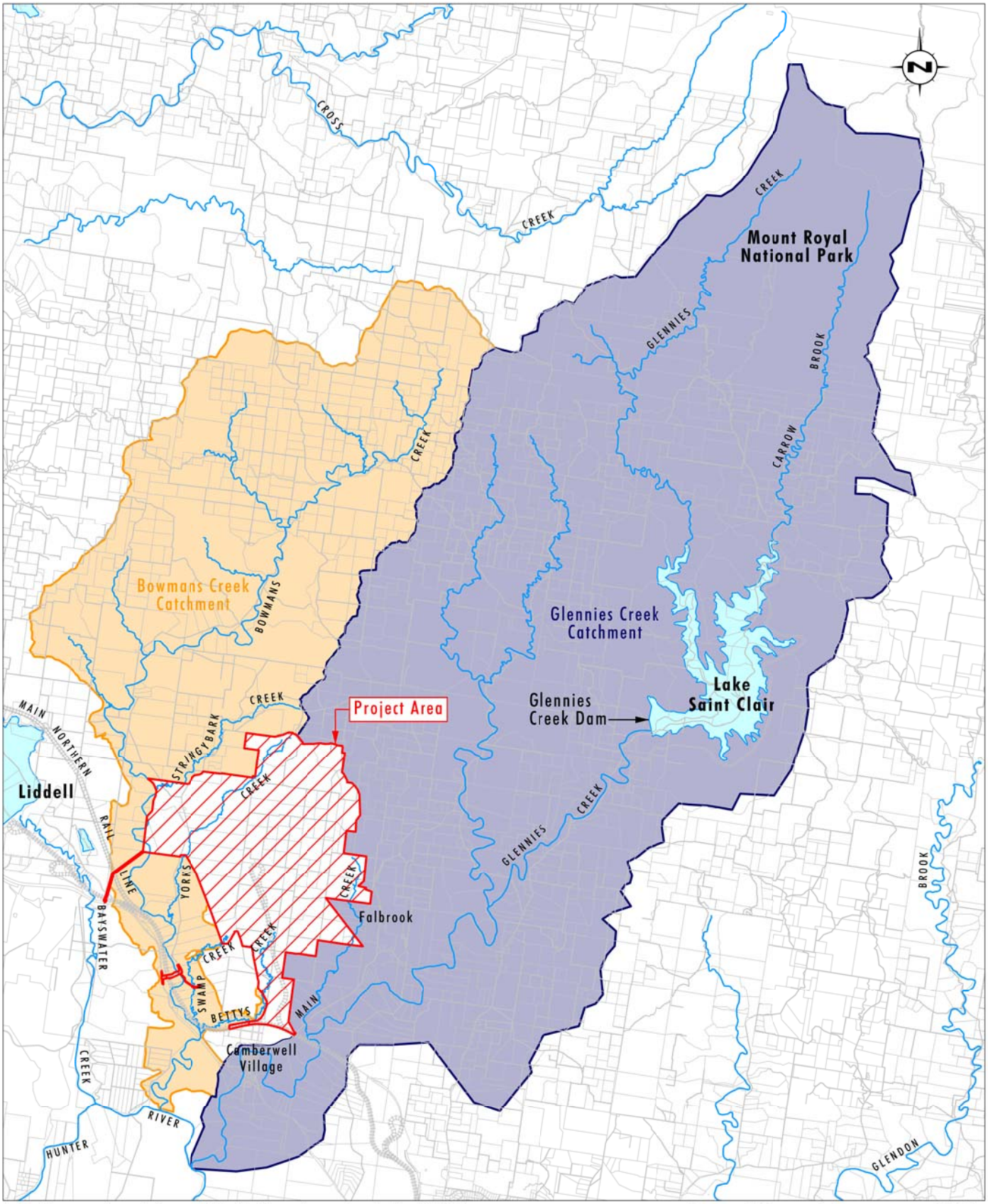

Data Source: Mount Owen (2014), Geoscience Australia (2006), Department of Lands (2009)

0 2.5 5.0 10.0km
1:200 000

Legend

- Project Area
- Glennies Creek Catchment Area
- Bowmans Creek Catchment Area
- Cadastre
- Railway
- Drainage Line

FIGURE 5.13

Catchment Context

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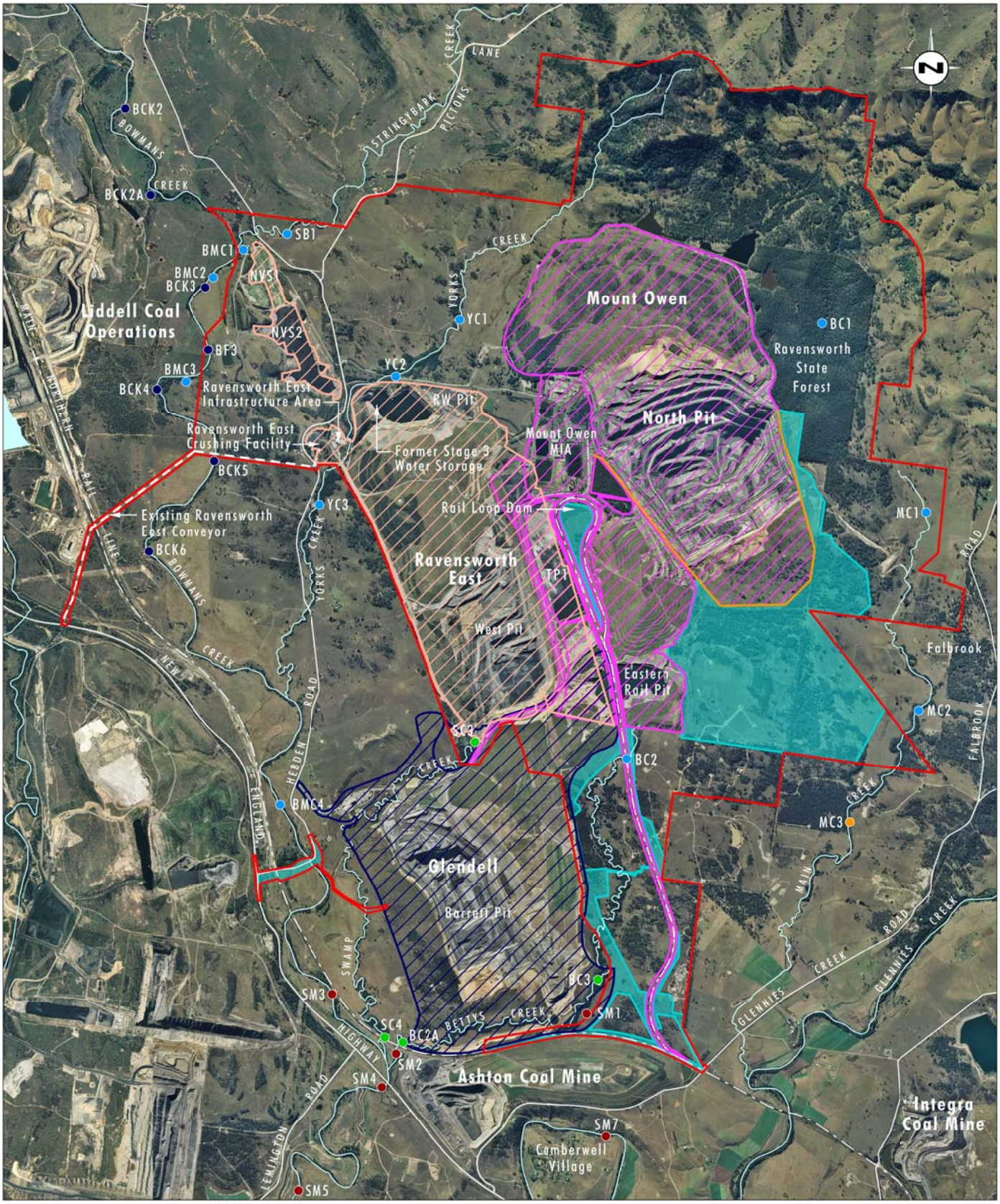

Image Source: Mount Owen (2012-2013)
Data Source: Mount Owen (2014), Department of Lands (2006)

0 1 2 3 km
1:60 000

Legend

- Project Area
- Proposed Disturbance Area
- Approved North Pit Mining Extent
- Mount Owen Surface Water Monitoring Location
- Ashton Surface Water Monitoring Location
- Liddell Surface Water Monitoring Location
- Glendell Surface Water Monitoring Location
- Proposed Future Water Monitoring Location
- Mount Owen Operational Area
- Glendell Operational Area
- Ravensworth East Operational Area

FIGURE 5.14

Surface Water Quality Monitoring Locations

File Name (A4): R02/3109_909.dgn
20141023 11.44

Table 5.5.2 - Water Quality Parameters and Trigger Levels

Parameter Monitored	ANZECC default trigger	Site Specific Trigger Values[1]		
		Bowmans Creek	Ephemeral Creek Systems	
			Flow Conditions	No Flow Conditions
pH	6.5 to 8.0	6.5 to 8.0	6.5 to 8.0	6.5 to 8.6
EC (µs/cm)	2,200	2,200	2,200	5,400
TSS (mg/L)	50	50	50	50
TDS (mg/L)	4,000 to 5,000[2]	1,480	1,480	4,700

Note: 1) Source: Mount Owen Complex Surface Water Monitoring Program (XMO 2012c).
2) Source: ANZECC guidelines (2000) - recommended concentration of TDS in drinking water for beef cattle as no default trigger value is provided by the ANZECC guidelines (2000) for ecosystem protection.

Background water quality data indicates that Bowmans Creek historically has elevated pH, while EC and TDS are typically within site specific trigger values. Tributaries of Bowmans Creek, including Yorks Creek and Swamp Creek historically have elevated concentrations of EC and TDS during periods of reduced flow, and elevated TSS concentrations during rainfall events. Swamp Creek occasionally shows elevated pH levels during periods of low flow. Bettys Creek typically has consistent EC and TDS, with elevated TSS concentrations during rainfall events. The historic water quality in Main Creek occasionally displays elevated EC and elevated TSS concentrations during high rainfall events. The full record of available water quality results from August 2008 to March 2014 for pH, EC, TSS and TDS is included in **Appendix 9**.

Mount Owen also monitors water quality within the WMS for operational purposes, on an as needs basis to assist in the day to day management of operations.

The water quality monitoring indicates that the pH within the WMS for mine water dams typically has a 6 month rolling average of approximately 8.6, with minimum and maximum readings of 6.0 and 10.4 respectively. EC results of mine water dams within the WMS show a wide variance with a 6 month rolling average of approximately 3,000 µs/cm. Further water quality details are provided in **Appendix 9**.

Surface water monitoring at Mount Owen and Ravensworth East Mines is also undertaken in accordance with current EPLs 4460 and 10860 respectively (refer to **Figure 5.14**).

5.5.2.3 Downstream Water Users

Water is extracted from Glennies Creek and the Hunter River downstream of Mount Owen Mine by Ashton Coal. Ashton also holds irrigation, domestic and stock licences for Bowmans Creek.

There are no known licensed water users on waterways directly downstream of the Project Area along Yorks Creek, Swamp Creek, Bettys Creek or Main Creek; however, there are known licensed water users on Bowmans Creek and Glennies Creek downstream of the Project Area. There are private landholders downstream of the Project Area of Main Creek, Glennies Creek and Bowmans Creek that retain landholder rights to water in these creeks for domestic and stock use.

The majority of land adjacent to Yorks Creek, Swamp Creek and Bettys Creek downstream of the Project Area to the New England Highway is owned by Glencore. There is one lot on Yorks Creek owned by a government authority and one lot on Bettys Creek owned by the

Crown. As such, there are no private landholders located immediately downstream of the Project Area on Yorks Creek, Swamp Creek or Bettys Creek. There are two private landholders with access to Main Creek, located downstream of the Project Area.

5.5.3 Existing Surface Water Management

Key objectives and functions of the Mount Owen Complex WMS include:

- diversion of clean water around mining operations to minimise capture of upslope runoff and separate clean water runoff from mining activities;
- segregating mine impacted water and runoff from undisturbed and revegetated areas with better water quality to minimise the volume of water that requires reuse;
- reuse of mine impacted water within the WMS and within the GRWSS to reduce reliance on raw / clean water (e.g. extraction from Glennies Creek);
- minimising adverse effects on downstream waterways (i.e. hydraulic and water quality impacts);
- reducing the discharge of pollutants from the mine to the environment; and
- managing approved water discharges to meet licence conditions.

The aim of the WMS is to manage the potential impacts of mining operations on water resources. The approach to existing water management includes measures to convey clean water away from the areas disturbed by mining activities and associated infrastructure areas, and contain and reuse water that has been affected by mining related activities.

The key features of the existing WMS are illustrated in **Figure 5.15**. The existing WMS is used to control runoff and all mine water managed within the WMS as the mining progresses.

Diversions of the upper catchments of Yorks Creek, Swamp Creek and Bettys Creek have been undertaken as part of currently approved operations to reduce the volume of clean water entering and requiring management within the WMS.

Water is supplied to the Mount Owen Complex from both the GRWSS and Glennies Creek. Raw water extracted from Glennies Creek is treated for use as potable water at the administration building and bath houses. Raw water is also used at the workshop and as the water supply for the fire fighting systems.

Dirty water and mine water is shared between mines as part of the GRWSS to assist in minimising the demand for raw / clean water across the GRWSS. Discharges also occur from the GRWSS in accordance with Ravensworth Operations and Liddell Coal Mines EPLs.

Wastewater from on-site facilities, including sewage, is collected and treated on site by a number of aerated wastewater treatment plants, which are licensed by Singleton Council. The effluent from the wastewater treatment plants at Mount Owen and Ravensworth East Mines is used to irrigate tree-lots.

The full details of the existing WMS are provided in **Appendix 9**.

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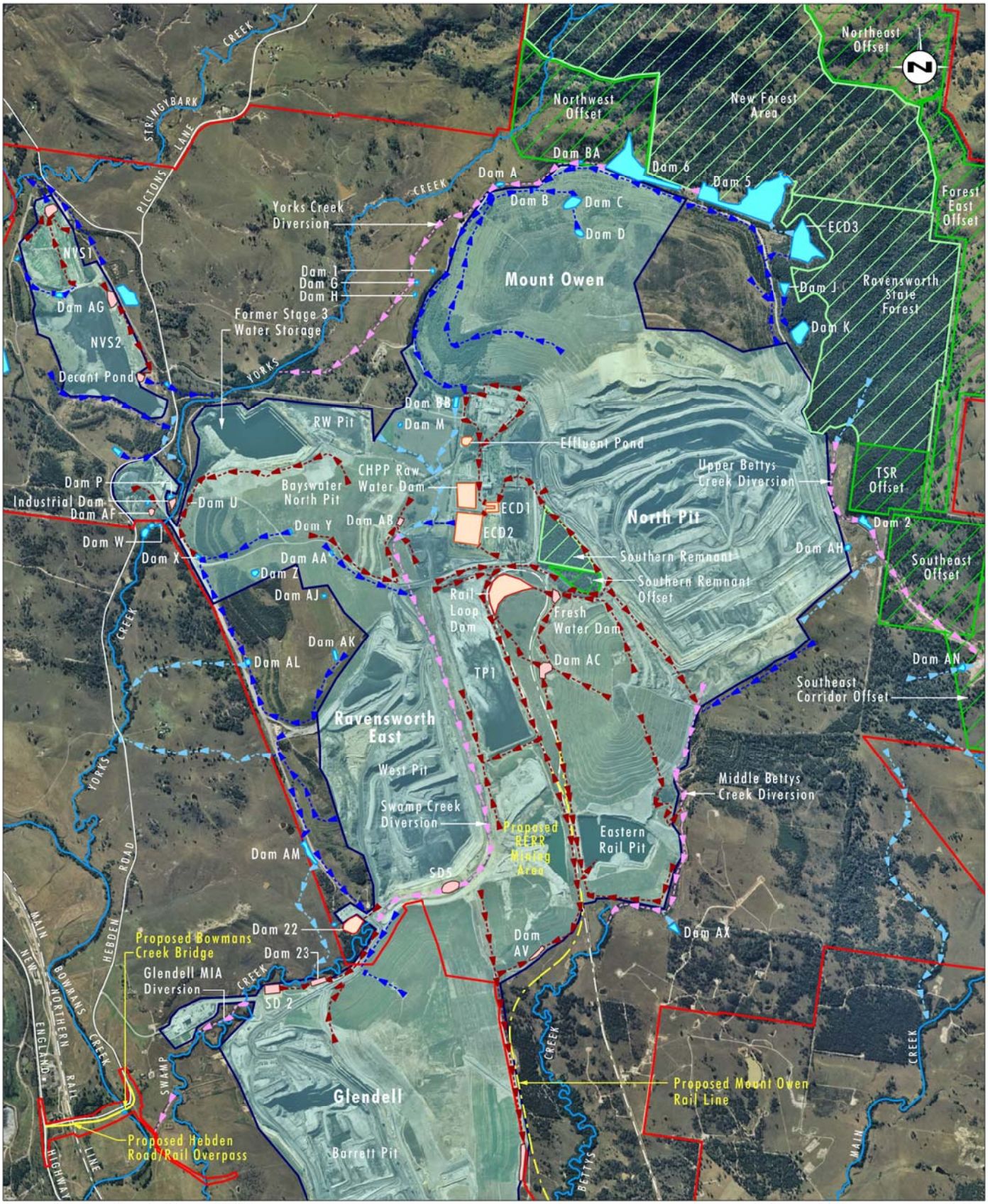

Image Source: Mount Owen (2013)
Data Source: Mount Owen (2014)

0 0.5 1.0 2.0km
1:40 000

Legend

- Project Area
- Existing Biodiversity Offset Areas
- Ravensworth State Forest
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Clean Water Dam
- Sediment Dam
- Mine Water Dam
- Existing Flow Path
- Clean Water Diversion Drain
- Dirty Water Drain
- Existing Diversion Channel
- Drainage Line
- Existing Railway
- Mount Owen Complex Water Management System Catchment

FIGURE 5.15

Existing Surface Water Management

File Name (A4): R02/3109_911.dgn
20141023 11.47

5.5.4 Proposed Water Management

5.5.4.1 Water Management Strategy

The water management strategy for the Project has been designed to integrate water management requirements of the Project with the existing WMS for the Mount Owen and Ravensworth East Mines. The strategy includes the separation of clean and dirty water, preventing the contamination of clean water by mining activities and managing compliance with statutory obligations.

A detailed description of the proposed conceptual WMS is provided in **Appendix 9**.

For the Project, three categories of water have been identified to be managed, each with different potential to cause environmental harm, namely:

- Clean water – Runoff from undisturbed or rehabilitated areas where vegetation is fully established, and the water quality is suitable for release / discharge. Clean water includes raw water imported from Glennies Creek under existing licences.

- Dirty 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 MIAs. This water quality is typically of a higher level of salinity.

Each type of water requires different management measures to minimise the risk of contamination of downstream drainage systems. The target design criteria for the three categories of water are summarised in **Table 5.5.3**.

Table 5.5.3 – Design Criteria for Components of the WMS

Water Category	Water Description	Target Design Criteria
Clean	Runoff from undisturbed or rehabilitated areas	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 or water used in coal processing or from coal stockpile areas	Contained for events up to and including the 1% annual exceedance probability (AEP) 24 hour storm event.

Dirty water and mine water is shared between Glencore's mining operations as part of the GRWSS to assist in minimising the demand for raw / clean water across the GRWSS. Excess water that cannot be shared in the GRWSS may be discharged in accordance with the HRSTS and relevant EPL.

Raw water supply and wastewater treatment and disposal for the Project will be the same as for the existing operations.

The WMS for the Project will make provision for ongoing evaluation of all existing and proposed components of the WMS using additional data obtained through ongoing water quality sampling together with risk assessments, where required, to ensure the objectives of the WMS are achieved.

5.5.4.2 Proposed Water Management System

While changes are proposed to the WMS as described above, the objectives of the WMS remain as set out in **Section 5.5.3**.

Figures 5.16 to **5.20** illustrate the conceptual WMS for key stages during the life of the Project. It is important to note that stage plans indicate only the components of the WMS which are required for the particular stage of the mine and does not preclude construction of some components throughout the Project.

The water management requirements for the Project will be integrated with the existing WMS. Mine water and dirty water runoff will continue to be directed to the WMS. Clean water diversions will continue to divert runoff off the upper catchments of Yorks Creek, Swamp Creek and Bettys Creek around the WMS.

Full details on the proposed staged WMS are provided in **Appendix 9**.

5.5.5 Site Water Balance

A detailed site water balance has been completed for the Project (refer to **Appendix 9**). Inflows to the water balance include site rainfall runoff, tailings decant water, groundwater inflows to open cut pits, transfers from other mines within the GRWSS and water extracted under licence from Glennies Creek.

Water is supplied to the Mount Owen Complex from both the GRWSS and Glennies Creek. Mount Owen currently holds 1,056 units per year of High Security Entitlement and 861 units per year of General Security Entitlement Water Access Licences under the *Hunter Regulated River Water Sharing Plan 2004*, for extraction of water from Glennies Creek.

Surplus water at the Mount Owen Complex is able to be managed by either transfers to the GRWSS or discharge via the HRSTS via either Ravensworth Operations and Liddell Coal Mines or from the Mount Owen Complex.

Table 5.5.4 presents a summary of the gross water balance for the complex in isolation from the GRWSS, and corresponding annual import and export volumes to and from the GRWSS for the conceptual mine plans for Year 1, Year 5 and Year 10 of the Project.

As there is limited excess water storage capacity at the Mount Owen Complex, the GRWSS will be used to transfer water to the complex to meet water demands during dry periods and transferred from the Mount Owen Complex to manage water surplus during wet periods. For example, over the course of a single year, during periods of high or prolonged rainfall, the Mount Owen Complex may have a surplus of water at one time during the year while a prolonged dry period may result in a water deficit at another time. This is likely to result in water transfers to and from the Mount Owen Complex that will be greater than the stated gross water balance.

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Image Source: Mount Owen (2013)
Data Source: Mount Owen (2014)

0 100 200 400m
1:7 500

Legend

- Clean Water Dam
- Sediment Dam
- Mine Water Dam
- Existing Flow Path
- Clean Water Diversion Drain
- Dirty Water Drain

FIGURE 5.16

Conceptual Water Management System for the Mine Infrastructure Area and Product Stockpile Extension Area

File Name (A4): R02/3109_910.dgn
20141023 11.48

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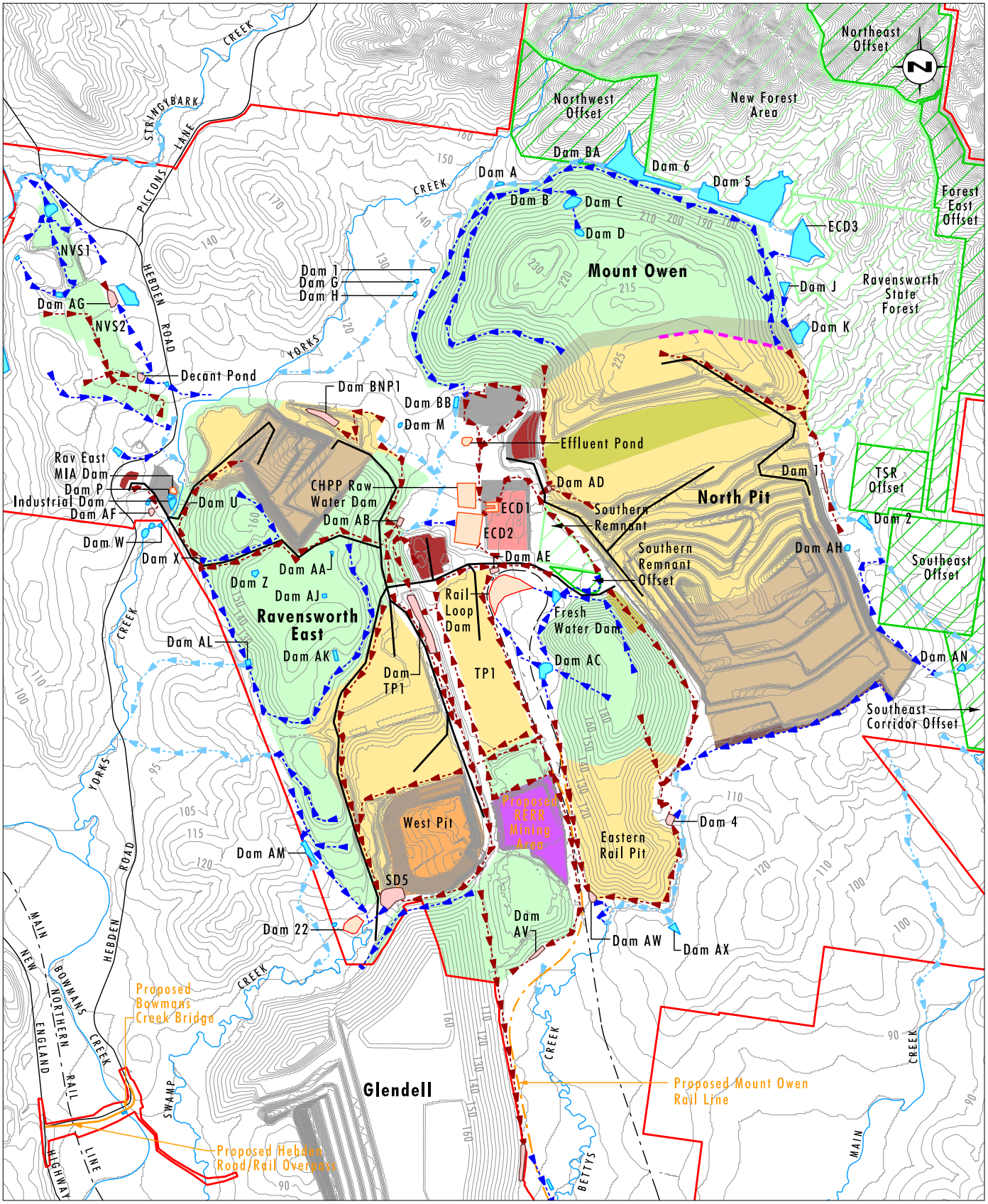


Data Source: Mount Owen (2014)
Note: Contour Interval 5m(AHD). Subject to refinement as part of WMP process

0 0.5 1.0 2.0km
1:40 000

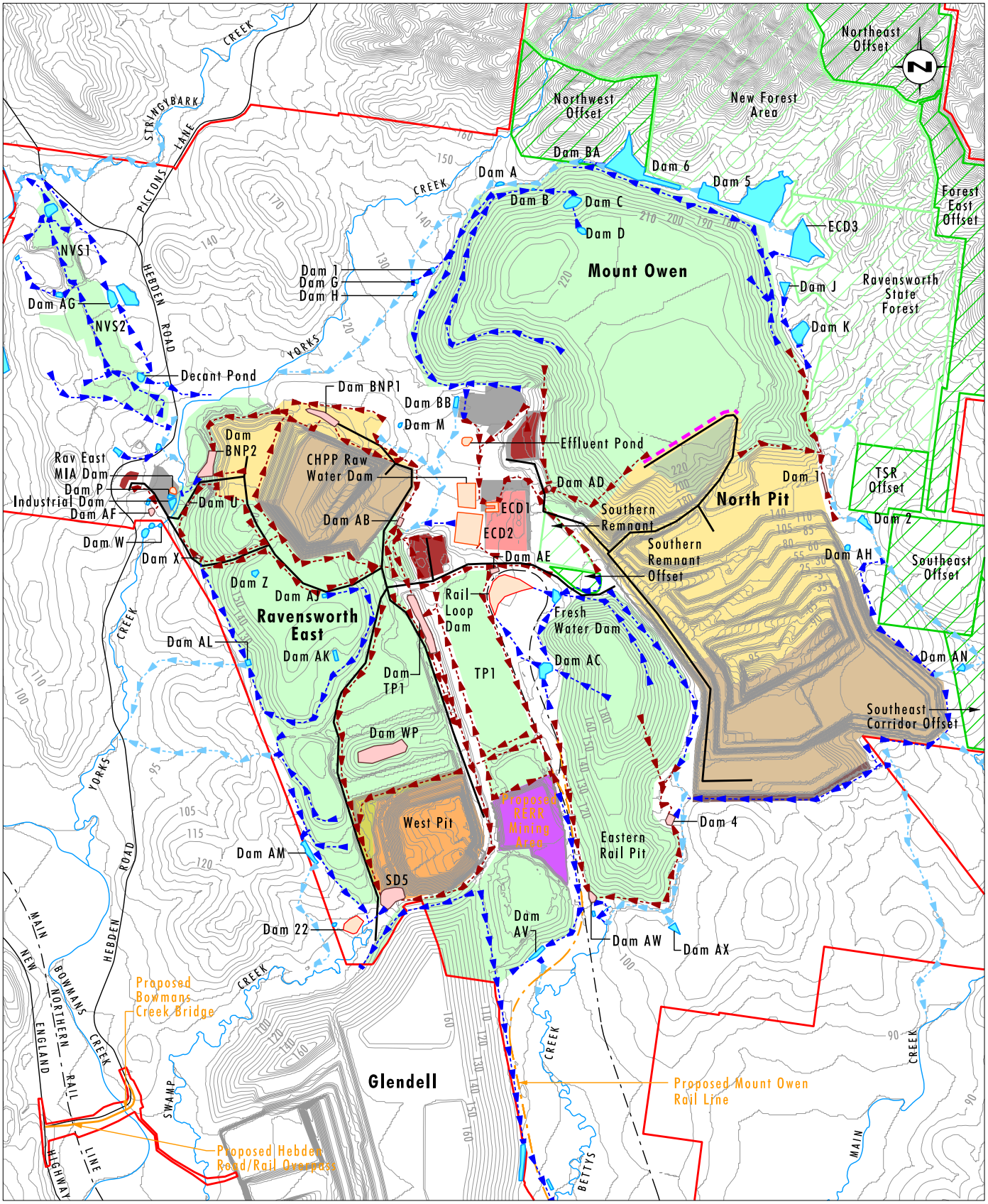
Legend

- Project Area
- Existing Biodiversity Offset Areas
- Ravensworth State Forest
- Existing Railway
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Clean Water Dam
- Sediment Dam
- Mine Water Dam
- Existing Flow Path
- Clean Water Diversion Drain
- Dirty Water Drain
- Windrow
- Drainage Line
- Haul Road
- Active Mining Area
- Active Overburden Emplacement Area
- Topsoil Removal
- Coal Stockpile - Product
- Coal Stockpile - ROM
- Infrastructure
- Proposed RERR Mining Area
- Rehabilitation - Complete
- Rehabilitation - Temporary
- Shaped Not Seeded
- Tailings Placement

FIGURE 5.17

Conceptual Surface Water Management Year 1

File Name (A4): R02/3109_912.dgn
20141023 11.49



Data Source: Mount Owen (2014)
Note: Contour Interval 5m(AHD). Subject to refinement as part of WMP process

0 0.5 1.0 2.0km
1:40 000

Legend

- Project Area
- Existing Biodiversity Offset Areas
- Ravensworth State Forest
- Existing Railway
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Clean Water Dam
- Sediment Dam
- Mine Water Dam
- Existing Flow Path
- Clean Water Diversion Drain
- Dirty Water Drain
- Windrow
- Drainage Line
- Haul Road
- Active Mining Area
- Active Overburden Emplacement Area
- Topsoil Removal
- Coal Stockpile - Product
- Coal Stockpile - ROM
- Infrastructure
- Proposed RERR Mining Area
- Rehabilitation - Complete
- Rehabilitation - Temporary
- Shaped Not Seeded
- Tailings Placement

FIGURE 5.18

Conceptual Surface Water Management Year 5

File Name (A4): R02/3109_913.dgn
20141023 11.50

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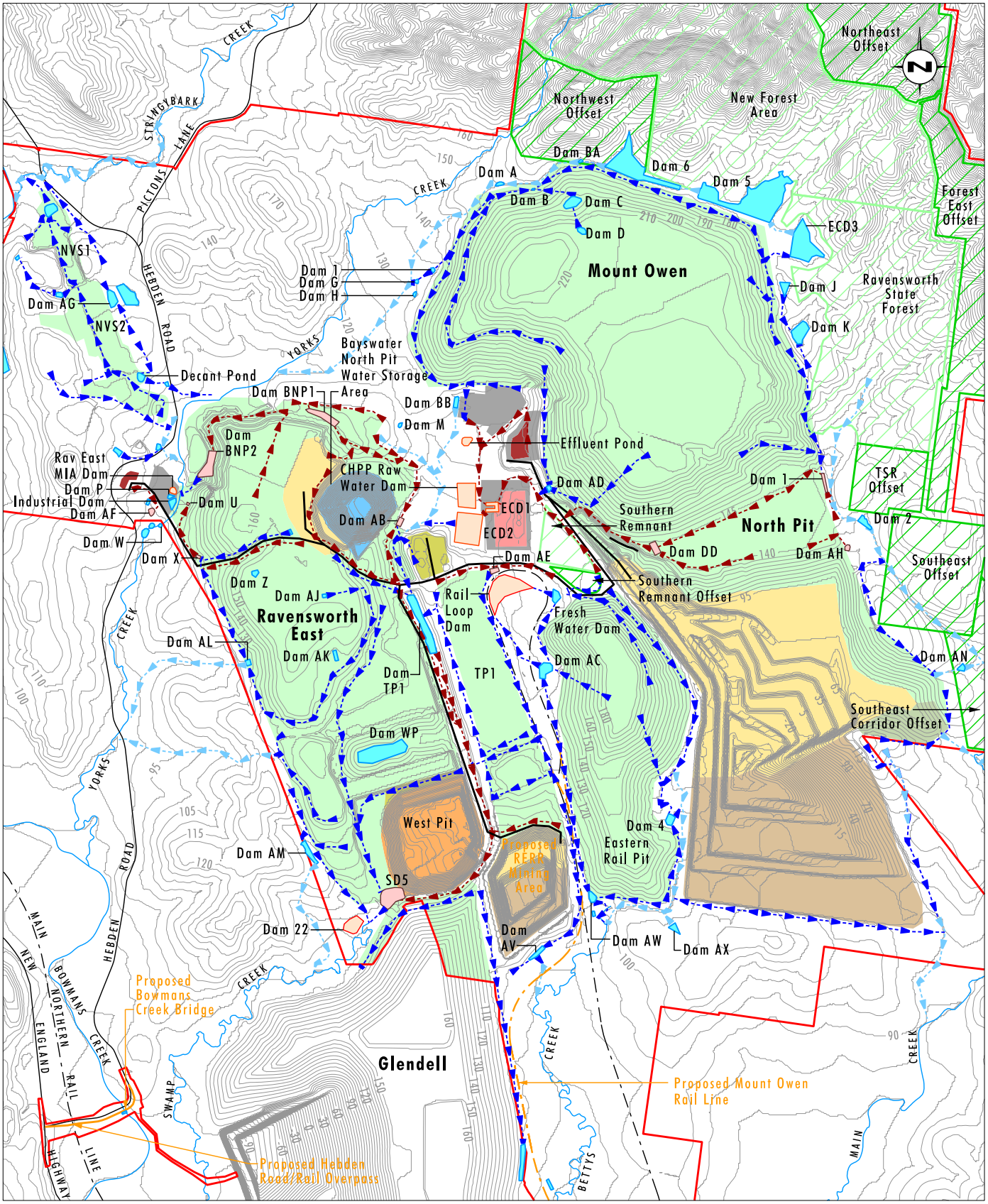


Data Source: Mount Owen (2014)
Note: Contour Interval 5m(AHD). Subject to refinement as part of WMP process

0 0.5 1.0 2.0km
1:40 000

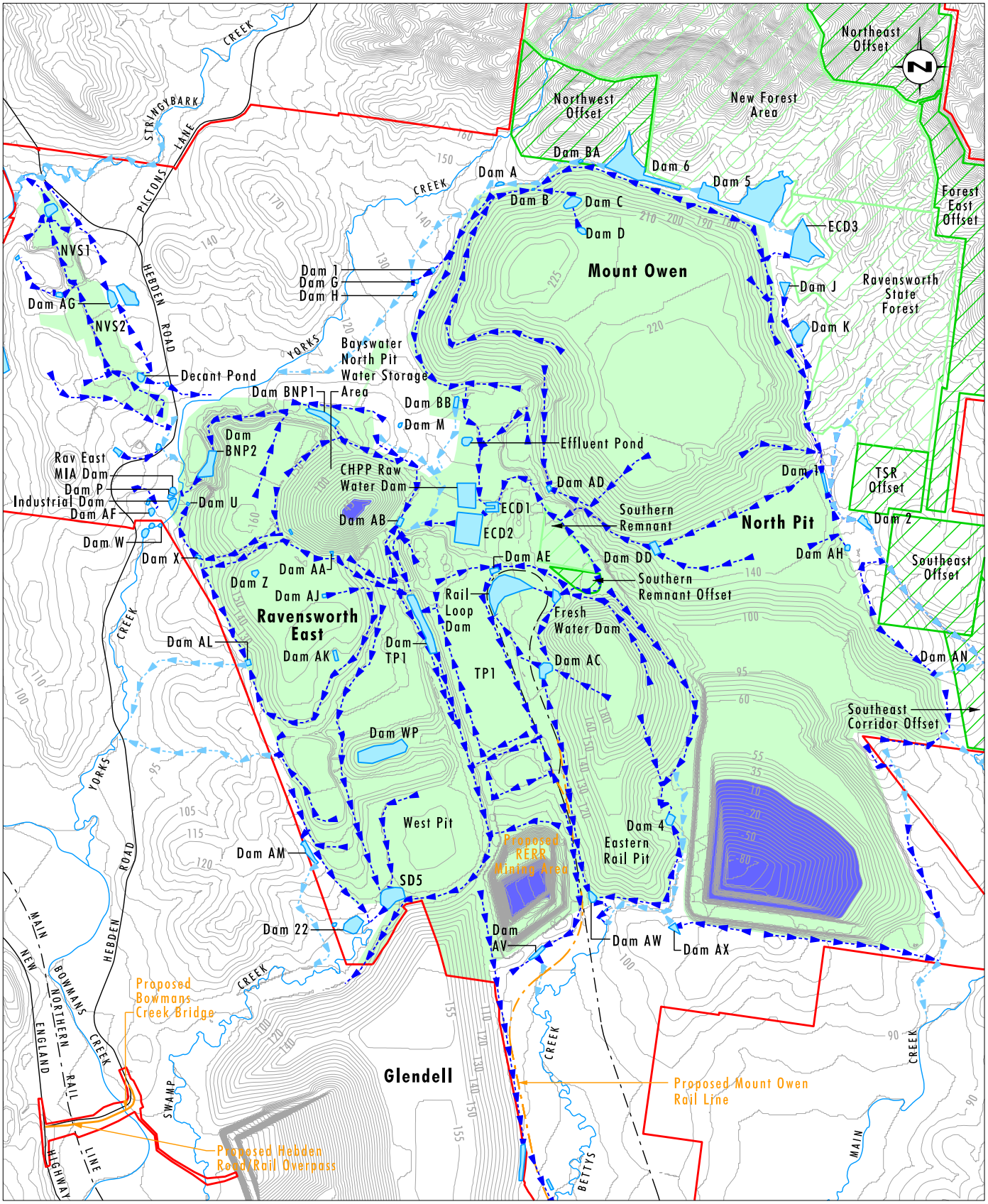
Legend

- Project Area
- Existing Biodiversity Offset Areas
- Ravensworth State Forest
- Existing Railway
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Clean Water Dam
- Sediment Dam
- Mine Water Dam
- Existing Flow Path
- Clean Water Diversion Drain
- Dirty Water Drain
- Drainage Line
- Haul Road
- Active Mining Area
- Active Overburden Emplacement Area
- Coal Stockpile - Product
- Coal Stockpile - ROM
- Infrastructure
- Rehabilitation - Complete
- Rehabilitation - Temporary
- Shaped Not Seeded
- Tailings Placement
- Water Storage Area

FIGURE 5.19

Conceptual Surface Water Management Year 10

File Name (A4): R02/3109_914.dgn
20141023 11.51



Data Source: Mount Owen (2014)
Note: Contour Interval 5m(AHD). Subject to refinement as part of WMP process

0 0.5 1.0 2.0km
1:40 000

Legend

- Project Area
- Existing Biodiversity Offset Areas
- Ravensworth State Forest
- Existing Railway
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Clean Water Dam
- Existing Flow Path
- Clean Water Diversion Drain
- Drainage Line
- Rehabilitation - Complete
- Final Void Water Level

FIGURE 5.20

Conceptual Surface Water Management Final Landform

File Name (A4): R02/3109_915.dgn
20141023 16.14

Table 5.5.4 – Project Gross Water Balance, Annual Import Volumes and Annual Export Volumes

Scenario	10th Percentile (ML)	50th Percentile (ML)	90th Percentile (ML)
Project Gross Water Balance			
Year 1	-2,325	-810	1,660
Year 5	-2,200	-665	1,810
Year 10	-800	340	2,310
Annual Import Volumes (ML)			
Year 1	2,325	1,450	1,840
Year 5	2,210	1,320	1,745
Year 10	670	280	505
Annual Export Volumes (ML)			
Year 1	190	640	3,790
Year 5	195	650	3,840
Year 10	105	530	2,950

The 50th percentile gross water balance indicates that the Project is estimated to be in water deficit in Year 1 and Year 5, while Year 10 of the Project is predicted to operate at a surplus as a result of lower ROM production and, therefore, lower CHPP demands and losses to tailings.

For daily surplus volumes above 34.5 ML/day, the Mount Owen Complex will either need to store water temporarily within water storages on site, mine storage areas and potentially the BNP after cessation of mining, or discharge / export water via other methods. These exports will include licensed discharges (e.g. HRSTS discharge to Swamp Creek).

5.5.6 Surface Water Impacts

A detailed assessment of the potential surface water impacts of the Project is provided in the Surface Water Assessment included in **Appendix 9** with a summary of the key assessment findings included below.

5.5.6.1 Catchment Areas and Annual Flow Volumes

The Project will result in the need to divert runoff upslope of the operational areas and manage runoff from disturbed areas during the operational and rehabilitation phases of the Project. In the absence of local stream gauging data, catchment areas provide an indicator of the potential relative changes in flow volumes that might occur. As such, changes in catchment areas have been used to predict the potential impacts on annual flow volumes.

Table 5.5.5 summarises the predicted impacts on the catchment areas in the Project Area for the following scenarios:

- prior to any mining;
- currently approved final landform;
- Project Year 5 (the predicted Project year with the largest area of catchment contained in the WMS); and
- proposed final landform.

Table 5.5.5 – Predicted Impacts on Catchment Areas

Catchment	Pre-Mining (ha)	Current Area (2012) (ha)[1]	Approved Final Landform (ha)	Project		
				Year 5[1] (ha)	Final Landform[2]	
					Area (ha)	%[4]
Bowmans Creek[3]	**25,055**	**22,010**	**20,390**	**21,590**	**20,520**	**99.4%**
- Stringybark Creek	1,290	1,220	1,300	1,300	1,300	100%
- Yorks Creek	1,230	1,580	1,660	1,800	1,920	116%
- Swamp Creek	2,380	410	1,440	390	1,230	85%
- Bettys Creek	1,810	660	960	700	780	81%
Glennies Creek[3]	**52,335**	**50,265**	**50,405**	**50,215**	**50,255**	**99.7%**
- Main Creek	2,000	2,480	2,620[5]	2,430	2,470	94%

Notes: 1) Excluding WMS.

2) Final Landform is when both the decommissioning of infrastructure and the rehabilitation of the post mining landform are completed.

3) Catchment areas modified to reflect changes due to the Project and approved and proposed Liddell Operations. This does not include impacts from other modifications (such as other mining operations) downstream of the Project Area.

4) Project final landform catchment area as a percentage of the current approved final landform.

5) Catchment area updated and larger than identified in Mount Owen Operations EIS, 2003 (previously 1750 ha), as more accurate terrain data is now available (LiDAR) over entire catchment.

In summary, the Project will result in the following changes to the local catchments, and consequent annual flow volumes, within which Mount Owen and Ravensworth East mines are located:

- no changes to the currently approved final landform, associated catchment areas or annual flow volumes for Stringybark Creek;
- changes to the currently approved final landform catchment areas of Yorks Creek, Swamp Creek, Bettys Creek and Main Creek:
  - an increase in catchment contributing to Yorks Creek (therefore annual flow volumes for Yorks Creek are expected to increase) - considered to be small within the context of ephemeral streams (i.e. the change in flows is less than the seasonal and annual variations in flow volumes);
  - changes in annual flow volumes associated with reductions in catchment areas for Swamp Creek and Bettys Creek - considered to be small within the context of ephemeral streams (i.e. the change in flows is less than the seasonal and annual variations in flow volumes);
  - the proposed reduction of the Main Creek catchment area returning the annual flow volumes closer to those of the pre-mining catchment than would have been achieved by the current approved final landform; and
- negligible impact on major downstream watercourses including Bowmans Creek, Glennies Creek and the Hunter River (due to the limited localised impact; reduction in total contributing catchment is less than 0.6 per cent for both Bowmans Creek and Glennies Creek).

The full details of changes to catchments and annual flow volumes are provided in **Appendix 9**.

5.5.6.2 Flooding

Dynamic flood modelling of the waterways and catchments surrounding the Mount Owen Complex was undertaken for the current landform, current approved final landform, the Project Year 5 landform, and the proposed final landform. Flood events that were simulated included the 10 per cent, 5 per cent and 1 per cent AEP events (also referred to as the 10 year, 20 year and 100 year average recurrence interval (ARI) events). The assessment determined that the Project, with the proposed mitigation measures (refer to **Appendix 9**), will result in a range of impacts from negligible to minor on flood flow velocities and depths, downstream landholders, access along public roads and watercourse stability. It is considered that with the proposed management and monitoring measures (refer to **Appendix 9**) the potential impacts are acceptable. Proposed mitigation measures include additional off line detention capacity adjacent to the Ravensworth East MIA and flow conveyance at Hebden Road along Yorks Creek. Further details on the flooding assessment assumptions and methodologies are provided in the Surface Water Assessment report (refer to **Appendix 9**).

5.5.6.3 Proposed Infrastructure Crossings

Two waterway crossings are proposed as part of the Project; the proposed Bowmans Creek Bridge on Hebden Road and the proposed rail bridge over Bettys Creek.

Currently, during the 1 per cent AEP flood event (that is, the 100 year ARI event) the approaches to the existing Bowmans Creek Bridge on Hebden Road are inundated. Modelling indicates that the proposed Bowmans Creek Bridge on Hebden Road will have negligible impact on peak depth and velocity downstream of the proposed bridge for the 1 per cent AEP event. The peak depth and velocity in Bowmans Creek upstream of the proposed Bowmans Creek Bridge is anticipated to increase slightly due to the raised road embankments for the proposed Bridge restricting floodplain flows. There are no private properties within the affected zone, with all land adjacent to Bowmans Creek in this area owned by Glencore, with the exception of one parcel owned by a government authority. Modelling indicates that peak flows for the 1 per cent AEP event, similar to the existing approaches, will overtop the proposed approaches to the Bowmans Creek Bridge across the Bowmans Creek floodplain, but the proposed bridge will not be overtopped.

The proposed rail bridge across Bettys Creek will result in reduced flows, depths and velocities in Bettys Creek both upstream and downstream of the proposed rail bridge for the 1 per cent AEP event. There are modelled localised water depth and velocity increases at the proposed rail bridge. The increase in flood depths at the crossing are localised and will not affect any private properties as the land adjacent to Bettys Creek is owned by Glencore. Modelling indicates that peak flows for the 1 per cent AEP event do not overtop the proposed rail bridge. As such, it is considered that the proposed rail bridge on Bettys Creek will have negligible impact on flooding and watercourse stability.

5.5.6.4 Water Quality

It is proposed to integrate water management for the Project within the existing WMS, as detailed in the *Mount Owen Complex Water Management Plan* (WMP), to limit the potential impacts of the Project on downstream water quality by managing water that has the potential to cause environmental harm. In conjunction with the proposed WMS, a series of erosion and sediment control measures will be utilised during construction, operation and rehabilitation phases of the Project to manage water quality.

The Project WMS is designed to enable Mount Owen to meet licence conditions within the requirements of the POEO Act, taking account of both historical and current water qualities in the surrounding watercourses and current and future downstream water users. The WMP allows for the ongoing assessment of risk as mining operations progress, and the implementation of improvements and changes where required.

If required, controlled discharges to Swamp Creek will flow via Bowmans Creek to the Hunter River in accordance with existing EPLs and the HRSTS. There are specific requirements for discharge under the HRSTS including certain parameters relating to flow volumes that must be followed to reduce potential impact during discharge events. Any discharges will be controlled so as to stay within the existing creek banks and at a rate to minimise erosion impacts.

The proposed final landform has been designed to minimise the catchment contributing to the proposed final voids. In addition, Mount Owen will investigate the potential to use the BNP void for water storage and the RERR Mining Area for tailings emplacement. These options could provide benefits for other mines within the Greater Ravensworth area. If the final voids remain as water bodies in the final landform, the water balance for the final voids indicates that, at the predicted recovery rates, the equilibrium water levels with the North Pit final void will be approximately 19 m AHD, the BNP final void water level will be approximately 48 m AHD and RERR Mining Area final void water level will be approximately -8 m AHD. As such it is predicted that the final voids will remain self contained systems with no surface spills predicted to downstream watercourses.

Mount Owen is committed to updating the WMP and associated monitoring programs, as required.

It is considered, that with the measures proposed above, the Project will have minimal impact on water quality in downstream watercourses.

Further details on erosion and sediment control measures during both the construction and operational phases of the Project are provided in **Appendix 9**.

5.5.6.5 Geomorphological and Hydrological Values

The Project is not expected to have a significant impact on the geomorphological and hydrological values of local surface water systems. Potential impacts on geomorphological stability and changes to potential erodibility and scour as a result of the Project are as follows:

- higher peak flows with increased flood levels and increased velocities along Yorks Creek due to diversion of clean water runoff from the North Pit emplacement area. Peak flood depths and flow velocities during flood events will increase from the approved final landform, however it is proposed to manage any potential stability impacts and changes to access along Hebden Road during flooding by providing additional off line detention capacity adjacent to the Ravensworth East MIA and flow conveyance at Hebden Road along Yorks Creek. Peak flood flows, depths and velocities in Bowmans Creek will not be influenced by the modelled increases in Yorks Creek. It is considered that with the proposed management and monitoring measures the potential impacts are acceptable;

- lower peak flows with similar or slightly reduced flood levels and velocities in the lower reaches of Swamp Creek and Bettys Creek downstream of the Project Area. Scour potential along the lower reaches of Swamp Creek and Bettys Creek downstream of the Project Area will not be increased from the approved final landform due to the Project; and

- lower peak flows with reduced flood levels and reduced flood duration in the lower reaches of Main Creek compared to the current approved landform. Peak velocities of flow during flood events will remain the same for the Project as the approved final landform. Scour potential along the lower reaches of Main Creek will not be increased from the approved final landform due to the Project.

5.5.6.6 Riparian and Ecological Values

The changes in annual flow volumes associated with changes to catchment areas for Yorks Creek, Swamp Creek, Bettys Creek and Main Creek from the current approved final landform to the proposed final landform are considered to be small within the context of ephemeral streams. The changes in annual flow volumes are also considered to be small on a regional scale. That is, the change in flows being less than the seasonal and annual variations in flow volumes, when comparing dry years to wet years. In addition, the Project is considered to have negligible impacts on baseflows (refer to **Appendix 10**). The Project is consequently considered likely to have negligible impact on ecosystems and downstream users as the predicted impact is within the natural variation of the existing creek systems.

5.5.6.7 Water Users

As discussed in **Section 5.5.2.3**, there are no private landholders located immediately downstream of the Project Area on Yorks Creek, Swamp Creek and Bettys Creek. There are two private landholders with access to Main Creek located downstream of the Project Area.

There are no known licensed water users on waterways directly downstream of the Project Area along Yorks Creek, Swamp Creek, Bettys Creek or Main Creek. There are known licensed water users on Bowmans Creek and Glennies Creek downstream of the Project Area. There are private landholders downstream of the Project Area on Main Creek, Glennies Creek and Bowmans Creek that retain basic landholder rights for domestic and stock use.

The Project will not reduce annual flow volumes in Main Creek compared to the currently approved landform conditions (refer to **Table 5.5.5**), therefore basic landholder rights on Main Creek and Glennies Creek will not be affected by the Project.

The Project will result in a negligible reduction to the catchment area of Bowmans Creek and Glennies Creek (less than 0.6 per cent). As such the Project is considered to have negligible impact on basic landholder rights downstream of the Project Area on Bowmans Creek or Glennies Creek.

5.5.6.8 Cumulative Impacts

The surface water assessment indicates that the Project is expected to have negligible impacts on flows, water quality and water users relative to the existing approved impacts immediately downstream of the Project Area, on Bowmans Creek and Glennies Creek, and on the Hunter River.

It is considered that the Project will have negligible cumulative impacts on flows in downstream watercourses, water quality and downstream users when compared to the current approved final landform.

Further details on cumulative impact are provided in the Surface Water Assessment in **Appendix 9**.

5.5.7 Surface Water Monitoring and Management Measures

Mount Owen will continue to manage its operations in accordance with the WMP, EPL and the HRSTS. Subject to the Project being approved, the WMP will be updated to reflect the changes to the surface water catchments and additional monitoring and management measures. A summary of the proposed water management measures is provided below, with further details of the ongoing approach to surface water monitoring and management are provided in **Appendix 9**.

In addition to the Project WMS (refer to **Section 5.5.4**), mitigation measures are proposed to mitigate flooding impacts on Yorks Creek and water quality impacts associated with disturbance areas.

5.5.8 Yorks Creek Flooding

As detailed in Section 6.2.2.1 of **Appendix 9**, to minimise the potential impacts of the additional catchment area flowing to Yorks Creek from the North Pit emplacement area, additional off line detention capacity adjacent to the Ravensworth East MIA and flow conveyance at Hebden Road are proposed.

The proposed off line detention capacity will be provided by modifying the existing Industrial Dam to provide off line detention storage for flood events above the 10% AEP event. The modifications to the Industrial Dam will include construction of an overflow spillway from Yorks Creek to the Industrial Dam and a low flow outlet pipe from the Industrial Dam to Yorks Creek.

The additional flow conveyance will be provided at the Hebden Road crossing of Yorks Creek and will consist of an additional box culvert under the road.

5.5.9 Erosion and Sediment Control Measures

Erosion and sediment control will be undertaken in accordance with the *Mount Owen Complex Erosion and Sediment Plan* (ESCP), which will be updated if the Project is approved. The ESCP provides a framework for the management of erosion and sedimentation at the Mount Owen Complex.

The objective of the ESCP is to ensure that appropriate structures and programs of work are in place to:

- identify activities that could cause erosion and generate sediment;
- describe the location, function and capacity of erosion and sediment control structures required to minimise soil erosion and the potential for transport of sediment downstream;
- ensure erosion and sediment control structures are appropriately maintained;
- fulfil the statutory conditions of the project approval; and
- meet the requirements of the Blue Book (Landcom 2004 and DECC 2008) and the Draft Guidelines for the Design of Stable Drainage Lines on Rehabilitated Minesites in the Hunter Coalfields (DIPNR undated).

5.5.9.1 Construction

Construction environmental management plans will detail the specific inspection, maintenance and revegetation requirements for each works area based on the construction program schedule. These control measures will be set out in a detailed Erosion and Sediment Control Plan for ground disturbance works and will be in accordance with relevant guidelines for erosion and sediment control, including the relevant volumes of the Blue Book (i.e. volumes 2A, 2C, 2D & 2E).

When work is required within or adjacent to watercourses, work will be in accordance with guidelines from *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom 2004) and *Volumes 2A, 2C, 2D and 2E* (DECC 2008) (the Blue Book), including:

- works within the riparian zone will maximise, where possible the preservation of any existing vegetation and minimise disturbance;
- designs for works within or near water bodies will ensure the retention of natural functions and maintenance of fish passage in accordance with NSW Fisheries Guidelines (undated) *Fish Friendly Waterway Crossings*; and
- planned works will, where possible, be scheduled for forecasted dry weather periods.

5.5.9.2 Operations

During the operational phase, additional WMS components will be constructed as work progresses. The operational phase will involve the ongoing management of the WMS, and be consistent with:

- Landcom 2004. Managing Urban Stormwater – Soils and Construction, Volume 1, 4th Edition; and
- Department of Environment and Climate Change (DECC) 2008. Managing Urban Stormwater – Soils and Construction, Volume 2E – Mines and Quarries.

5.6 Groundwater

A comprehensive assessment of potential groundwater impacts has been undertaken for the Project by Jacobs and is provided in **Appendix 10**. The assessment was prepared in accordance with the DGRs (refer to **Table 5.6.1**) and relevant water planning policies and guidelines. Specifically in relation to groundwater, the DGRs required the following:

Table 5.6.1 – Groundwater Assessment Director-General's Requirements

Groundwater Assessment Requirements	Section of Report
Detailed modelling of potential groundwater impacts, including any potential impacts on alluvial aquifers.	**Sections 5.6.2** and **5.6.2.1**
Impacts on affected licensed water users and basic landholder rights.	**Sections 5.6.1.2** and **5.6.2.4**
Impacts on riparian, ecological, geo-morphological and hydrological values of watercourses, including environmental flows.	**Sections 5.6.2.1** and **5.6.2.3**
Assessment of impacts of salinity from mining operations, including disposal and management of coal rejects and modified hydrogeology, a salinity budget and the evaluation of salt migration to surface and groundwater sources.	**Appendices 9** and **10**

Table 5.6.1 – Groundwater Assessment Director-General's Requirements – cont.

Groundwater Assessment Requirements	Section of Report
Assessment of groundwater impacts against the minimal impact considerations in the NSW Aquifer interference Policy.	**Section 5.6.3**
Identification of any licensing requirements or other approvals under the *Water Act 1912* and / or *Water Management Act 2000*.	**Section 5.6.4**
A description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant WSP or water source embargo.	**Section 5.6.4**
A detailed description of the proposed water management system (including sewage), water monitoring program and measures to mitigate surface and groundwater impacts.	**Section 5.6.5**

This section provides a summary of the key findings of the groundwater assessment.

5.6.1 Existing Groundwater Resource

5.6.1.1 Groundwater Features

The two main hydrogeological features occurring within and surrounding the Project Area are:

- **The alluvial aquifers along the creek lines** – as discussed in **Section 5.5**, the Project Area contains Bettys Creek, Swamp Creek and Yorks Creek, tributaries of Bowmans Creek, and Main Creek, a tributary of Glennies Creek. Both Bowmans and Glennies Creeks are tributaries of the Hunter River. The alluvial aquifers associated with these systems in the Project Area are shallow unconfined aquifers of limited extent with unconsolidated alluvium. Alluvials associated with Bettys Creek, Swamp Creek, Yorks Creek and Main Creek are not high yield systems.

- **The deeper hard rock aquifers that contain the coal measures** – these aquifers are semi-confined and contain sandstones, siltstones and coal seams. Water yields from the hard rock aquifers within the Project Area are low and are much less than the alluvial aquifers as well as having slower groundwater movement. There has been extensive depressurisation of these hard rock aquifers within and surrounding the Project Area, as a result of previous and current mining operations.

The existing groundwater monitoring program at the Mount Owen Complex and surrounds consists of a series of nested piezometers targeting the alluvium and deeper hard rock aquifers. Additional bores were installed in 2012 and 2014 targeting the alluvial aquifers of Yorks Creek, Swamp Creek, Bowmans Creek, Main Creek and Bettys Creek as well as a number of additional bores targeting further definition of the hard rock aquifer surrounding the Project.

Groundwater in the regional hard rock aquifer moves down dip and down gradient from areas of recharge where individual seams sub-crop and outcrop in the north near the Hunter Thrust (refer to **Figure 2.5**) and in the west near Lake Liddell. Rates of recharge are very low through unweathered Permian bedrock, but slightly higher where more permeable rocks sub-crop and outcrop. Monitoring indicates that the Hunter Thrust is a significant barrier to groundwater flow.

Extensive coal mining in the area has been undertaken for many years and has resulted in the depressurisation of the hard rock aquifer and corresponding effects on the local hydrogeological regime.

Groundwater quality in the alluvial and hard rock aquifers in the region varies with water quality in the alluvium generally slightly less saline than in the coal measures. Alluvial groundwater in the region is generally classified as fresh to brackish while the coal seam aquifers are generally brackish.

5.6.1.2 Existing Bores, Wells and Water Users in the Area

A search of the NOW database identified 47 registered bores within 4 kilometres of the Project Area. All of the bores within the 4 kilometre radius of the Project Area are owned by Glencore operations or other mining companies. The nearest privately owned bore is located over 4 kilometres from the Project Area.

5.6.2 Groundwater Impact Assessment

Potential groundwater impacts associated with the Project were assessed through a computer based model of regional groundwater systems with the model domain extending approximately 20 kilometres around the Project Area. The model includes 20 layers representing stratigraphy from the ground surface down to the Saltwater Creek Formation (refer to **Figure 2.6**). The model includes all existing and approved mining operations within the model domain.

Further details on the approach to groundwater modelling for the Project are contained in **Appendix 10**.

The potential groundwater impacts arising from the Project and the associated modelling predictions are summarised in **Table 5.6.2** based on the detailed assessment findings provided in **Appendix 10**. These potential impacts are discussed in further detail below.

Table 5.6.2 – Summary of Groundwater Impact Predictions

Potential Environmental Impact	Assessment Predictions
Leakage of groundwater from shallow alluvial aquifers of Bowmans and Glennies Creeks and associated tributaries	Negligible Impact
Changes to baseflows in surface drainage systems	Negligible Impact
Impacts on water supply bores and wells	Negligible Impact
Change in water quality	Negligible Impact
Groundwater dependent ecosystems	Negligible Impact

5.6.2.1 Groundwater Drawdowns and Changes to Baseflow

Alluvial Aquifers

In accordance with the Aquifer Interference Policy (AIP) (NOW 2012), and as discussed in **Section 2.5.1**, the proposed North Pit Continuation mining limit has been specifically designed such that it is located at least 200 metres off the high bank of Main Creek in order to minimise impacts on the Main Creek alluvium.

There is predicted to be negligible drawdown impact to the alluvial aquifers of Bowmans Creek and Glennies Creek as a result of the Project. Drawdown in alluvial aquifers associated with Main Creek and Bettys Creek, minor tributaries to Glennies Creek and Bowmans Creek respectively, is predicted to exceed the minimal impact criteria (greater than 2 m drawdown) for aquifer interference activities as specified in the AIP. Further assessment identified that the significance of these alluvial aquifers is limited, with both creeks having low volume, ephemeral surface water flow and largely acting as drainage courses for local runoff. The assessment indicates no groundwater-dependent assets (i.e. groundwater users or environmental requirements) are impacted by the predicted drawdown.

Both Bettys Creek and Main Creek are ephemeral surface water features that largely act as drainage lines for the local area and only generate incidental baseflow following sustained rains. Peak incremental groundwater losses from the Bettys Creek alluvium (representing maximum potential baseflow loss to the creek, assuming groundwater intercepts and flow within the creek) are predicted to be less than 6 ML/year and correlate to mining of the RERR Mining Area. Mining in the BNP is not predicted to impact on the alluvial aquifers. Peak incremental groundwater losses from the Main Creek alluvium (representing maximum potential baseflow loss to the creek, assuming groundwater intercepts and flow within the creek) are predicted to be less than 15 ML/year and correlate to continuation of the North Pit. As stated, these creek systems are ephemeral and as such it is considered that the modelled baseflow impacts in the Bettys Creek and Main Creek systems are overestimated in the modelling and are in reality negligible. The predicted direct impact to Bowmans Creek alluvium is estimated to be negligible at less than 1 ML/year.

No registered bores or groundwater users are located within the extent of predicted drawdown.

Hard Rock Aquifers

Drawdown on the Bayswater seam was modelled for the Project as it represents the primary basal seam mined in the proposed mining areas. The model predicts significant reductions in groundwater pressures with the maximum predicted drawdown in the Bayswater seam of up to 165 metres at the end of mining (2030). The drawdown within the Bayswater seam is limited to within the Project Area and no existing groundwater users are impacted.

Groundwater Users

The nearest private bore holder is located greater than 4 kilometres from the Project Area. No private groundwater users have been identified as being affected or potentially affected by the Project.

Groundwater Quality

The Project is not predicted to affect groundwater quality in any identified aquifers due to the following:

- the Wittingham Coal measures that contain the target seams do not have any significant acid forming potential that could subsequently impact on surface and groundwater resources;

- while there is potential for upward movement of groundwater from the lower quality hard rock aquifer to the alluvial aquifers, historical and current mining in the area will limit this potential as a result of depressurisation of the hard rock aquifer; and

- the final voids at the North Pit Continuation and RERR Mining Area will act as long-term sinks to groundwater and therefore will not impact aquifer water quality, while the BNP final void is predicted to be a source of water to the local hard rock aquifer. It is predicted to discharge higher quality water than is currently observed in the hard rock aquifers and would ultimately flow to the RERR Mining Area.

5.6.2.2 Final Void Water

At the end of mining open voids will remain. The final voids will receive inflows through infiltration through spoils, direct rainfall and runoff. The voids will also lose water to the atmosphere through evaporation. It is proposed that, on completion of mining within the BNP, the void will be investigated to be potentially used for ongoing operational water storage and allow for integration within the GRWSS, as required. As the RERR Mining Area is scheduled later in the Project, the potential for continued use of this area for tailings emplacement will be considered as part of detailed mine closure planning, initiated five years prior to cessation of mining as part of this Project. At this stage, the Project assumes this will be a final void for worst case impact assessment purposes.

The groundwater model predicts that the North Pit Continuation and RERR Mining Area will act as groundwater sinks, while the BNP will act as a groundwater sink until the water level in that pit exceeds 37 metres AHD, above which point water movement would be back into the hard rock aquifers via the coal seam. The groundwater assessment identifies that water movement out of the BNP ultimately flows to the RERR Mining Area.

Salinity in the final North Pit void will remain below observed levels in the receiving aquifers for at least 200 years post-mining.

5.6.2.3 Groundwater Dependent Ecosystems

In general there are four types of Groundwater Dependent Ecosystems (GDEs):

- terrestrial ecosystems;
- baseflow supported aquatic ecosystems;
- wetlands; and
- aquifer ecosystems.

As discussed further in the Ecology Assessment contained in **Appendix 11**, the Project Area contains three vegetation communities that are expected to be dependent on shallow groundwater resources during periods of reduced surface water flow. The Project is not expected to result in an adverse impact on these GDEs identified in the Project Area as leakage from alluvial aquifers and changes to base flows in drainage lines are expected to be negligible (refer to **Section 5.6.2.1**).

A review of the Bureau of Meteorology Atlas of GDEs identified Bowmans Creek and Glennies Creek as systems with potential GDEs within the vicinity of the Project Area. However, impacts to the alluvial aquifers of Bowmans Creek and Glennies Creek are predicted to be negligible and therefore impacts to their GDEs are also expected to be negligible.

Pit Inflows and Dewatering

Groundwater modelling undertaken for the Project includes estimates of the volume and rate of groundwater flow into the open cut pit and dewatering requirements. These estimates are a consideration for the water balance and mine water management system (discussed further in **Section 5.5**) and in establishing the requirements for water licensing (discussed further in **Section 5.5**).

It is estimated that the groundwater inflow into the Ravensworth East and Mount Owen Pits would peak from 2022 to 2026 with a median predicted ingress of 705 ML, the median predicted groundwater ingress to all pits for the duration of the project is 510 ML/year and hence satisfy licensing criteria. These volumes of pit inflow are within the volumes allowed under licenses currently held by Mount Owen as discussed in further detail in **Section 5.6.4**.

5.6.3 Assessment against the Aquifer Interference Policy

The AIP describes the requirements for a proponent when designing a project, completing an EIS and how the NSW Government will assess and regulate aquifer interference activities and describes minimal impact considerations (or minimal harm criteria) for water pressure, water table and water quality.

Predicted groundwater impacts associated with the Project have been assessed in relation to the minimal harm criteria with respect to groundwater sources. The Project was determined to have a Level 2 impact and therefore required further detailed assessment. A summary of the results of the assessment against the minimal harm criteria for both the alluvial and hard rock water sources is contained in **Table 5.6.3** below:

Table 5.6.3 – Summary of Assessment of Minimal Harm Criteria

	Alluvium	**Porous and Fractured Rock**
Water Table	• No high priority GDEs or culturally significant sites within 40 m of the predicted water table variations. • Negligible drawdown within the Glennies Creek and Bowmans Creek alluvial aquifers. • Drawdown within the Main Creek and Bettys Creek alluvial aquifers predicted to be greater than 2 metres however the impacts would not adversely impact or prevent the long-term viability of any water-dependent asset. The extent of this drawdown is also localised to the upper reaches of Main Creek and Bettys Creek. No registered bores or groundwater users are located within the extent of predicted drawdown and the ephemeral nature of these creeks and flow dependence on rainfall events minimises the expectation of impacts to these sources.	• No high priority GDEs or culturally significant sites have been identified within 40 m of the predicted water table variations. • No water supply works have been identified within the zone of depressurisation predicted by the model simulations.

Table 5.6.3 – Summary of Assessment of Minimal Harm Criteria – cont.

	Alluvium	Porous and Fractured Rock
Water Pressure	• Post-mining simulations indicate groundwater heads within the Main Creek and Bettys Creek alluvial aquifers recover to levels equal to or above observed levels at the introduction of the Water Sharing Plans.	• No water supply works have been identified within the depressurisation zone predicted in model simulations.
Water Quality	• The Project is not predicted to adversely affect groundwater quality within the Main Creek and Bettys Creek alluvial aquifers.	• Post-mining simulations predict that void waters will remain lower in salinity than local groundwaters for at least 200 years following the end of mining. The North Pit Continuation and RERR Mining Area voids will remain a sink to groundwater and hence not pose a threat to aquifer water quality. The water quality in BNP void is predicted to be lower in salinity than the surrounding aquifers.

5.6.4 Groundwater Licensing

Mount Owen currently holds licenses to extract groundwater from water sources in the area to accommodate mining operations. These licenses include allocation to extract groundwater from the Glennies Creek alluvium, regulated by the *Hunter Regulated River Water Sharing Plan 2004* and the Jerrys Water Source (Bowmans Creek alluvium) which is regulated under the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009*. Licenses are also held under the *Water Act 1912* to extract water from the deeper hard rock aquifer.

A review of current licenses held by Mount Owen against the licensing requirements identified for the Project confirms that the current licenses held by Mount Owen provide adequate allocation for groundwater extraction associated with the Project. These licence allocations are sufficient to meet the median predicted water take from the hard rock aquifer source under the Project.

5.6.5 Groundwater Management and Monitoring Commitments

As discussed in **Section 2.5**, the proposed conceptual mine plan for the North Pit Continuation includes a set back of at least 200 metres from the high bank of Main Creek, meeting the minimal harm criteria outlined in the AIP.

The *Mount Owen Complex Water Management Plan* details the approach to water management, including groundwater management at Mount Owen. The *Mount Owen Complex Groundwater Monitoring Program* provides the details of the groundwater monitoring network as well as containing trigger levels for groundwater quantity and quality that if exceeded require an investigation and where appropriate a response. This response process is outlined in the *Mount Owen Complex Surface Water and Groundwater Response Plan*.

Mount Owen currently undertakes groundwater monitoring in accordance with the *Mount Owen Complex Groundwater Monitoring Program,* refer to **Figure 2.4**. This protocol currently includes the following groundwater monitoring:

- nested piezometer (NPZ) series bores, targeting the shallow bedrock overburden and deeper hard rock aquifer;
- standpipe piezometers targeting the alluvium of Swamps Creek, Yorks Creek and Bowmans Creek; and
- vibrating wire piezometers targeting the hard rock aquifer.

It is proposed to update the *Mount Owen Complex Groundwater Monitoring Program* to include the piezometers that have been installed as part of the Project in addition to any further monitoring bores that maybe required during the Project Mount Owen will continue to monitor the existing Water Management and Groundwater Monitoring Network in accordance with the (*Mount Owen Complex Water Monitoring Plan*) to provide data for on-going evaluation and incorporation into future updates of the numerical groundwater model.

The results of the monitoring will be subject to an annual review and reported in the Mount Owen Complex Annual Review. The groundwater model will be periodically updated and refined as additional data and monitoring results become available.

Should the Project be approved, the *Mount Owen Complex Water Management Plan*, *Groundwater Monitoring Program* and *Surface Water and Groundwater Response Plan* will be updated to reflect the Project.

5.7 Ecology

A comprehensive assessment of potential ecological impacts has been undertaken for the Project by Umwelt and is provided in **Appendix 11**. The assessment was prepared in accordance with the DGRs (refer to **Section 3.2**) and relevant guidelines and legislation. The DGRs are identified in **Table 5.7.1** below.

Table 5.7.1 - Director General Requirements - Ecology

Ecology Assessment Requirements	Section of Report
Measures taken to avoid, reduce or mitigate impacts on biodiversity.	**Section 5.7.6**
Identification of existing vegetation within disturbance areas, and the ecological values of this habitat.	**Section 5.7.3**
Accurate estimates of proposed vegetation clearing.	**Section 5.7.5.1**
A detailed assessment of potential impacts of the development on any: • terrestrial or aquatic threatened species or populations and their habitats, endangered ecological communities and groundwater dependent ecosystems.	**Sections 5.7.3.2** and **5.7.5.3**
A detailed assessment of potential impacts of the development on any: • remnant vegetation, habitat corridors, and existing Biodiversity Offset Areas.	**Sections 5.7.5.1** and **5.7.5.4**
A comprehensive offset strategy for the development including a justification of how the strategy would maintain or improve the terrestrial and aquatic biodiversity values of the region in the medium to long term, and how the strategy would be integrated with the *Upper Hunter Strategic Assessment* process.\	**Section 5.7.8**

In addition, the Commonwealth Department of the Environment (DoE) has determined that the Project constitutes a 'controlled action' under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and approval from the Commonwealth Environment Minister is required through accreditation of the NSW Government assessment process. Supplementary DGRs were received from DP&E for the Project on 8 November 2013 (refer to **Appendix 1**). In August 2014, Mount Owen sought a variation to the controlled action to allow for the optimisation of the North Pit Continuation. This application for variation was approved on 25 August 2014.

The supplementary DGRs require that while the EIS may assess all relevant Matters of National Environmental Significance (MNES) in an integrated manner in the main EIS, it must be accompanied by a separate appendix that deals with all relevant matters in one discrete location. On 19 September 2014 DoE confirmed that the Supplementary DGRs would remain applicable to the varied action.

A separate report has been prepared, providing a full description of how each of the relevant matters has been addressed and is provided in **Appendix 4**.

This section provides a summary of the key findings of the ecological assessment.

5.7.1 Regional Ecological Context

The vegetation communities mapped in the Project Area are consistent with the vegetation community descriptions described by Peake (2006) who mapped Hunter Valley floor vegetation on behalf of the former Hunter-Central Rivers Catchment Management Authority (HCRCMA) (now the Hunter Local Land Services).

All habitats in the region have been extensively cleared or modified for agriculture, largely for cattle grazing. Communities occurring on floodplains and more fertile soils in the Hunter Valley floor have been most extensively cleared (Peake 2006). Because of the widespread clearing of habitats in the region, those remaining contain important refuges for a number of fauna species, many of which are now threatened due to habitat loss and fragmentation. The broad fauna habitat types of grassland, riparian, woodland / forest and aquatic habitat found within the Project Area are representative of the broad habitat types within the surrounding region.

Most remaining forest and woodland remnants on the Hunter Valley floor are small, with 87 per cent being less than 10 hectares in size, and the median remnant size being 1.6 hectares (Peake 2006). Approximately 65 per cent of all remnant vegetation on the Hunter Valley floor occurs within the relatively few remnants that are over 100 hectares in area, with the largest remnant, which is mostly within Myambat Military Area near Denman, being approximately 2,250 hectares. Two large national parks are situated approximately 18 kilometres to the south-west of the Project Area (Wollemi and Yengo National Parks). These National Parks contain large areas of native vegetation and offer a wide range of good quality fauna habitats. Smaller, yet significant areas of National Park also exist approximately 30 kilometres to the north-east of the Project Area (Mount Royal and Barrington Tops National Parks).

Ravensworth State Forest and the adjoining existing Mount Owen Biodiversity Offset Areas (refer to **Figure 5.21**) represent an important link and refuge area between remnant patches of vegetation in the central Hunter Valley. Ravensworth State Forest (including the New Forest area) is located in the north-eastern portion of the Project Area and is zoned for environmental conservation under the Singleton LEP. This forest forms an important and integral component of the preservation of the flora and fauna of the upper Hunter Valley (Umwelt 2003a). A key Project design objective was to avoid disturbance of Ravensworth State Forest and the existing Mount Owen Biodiversity Offset Areas.

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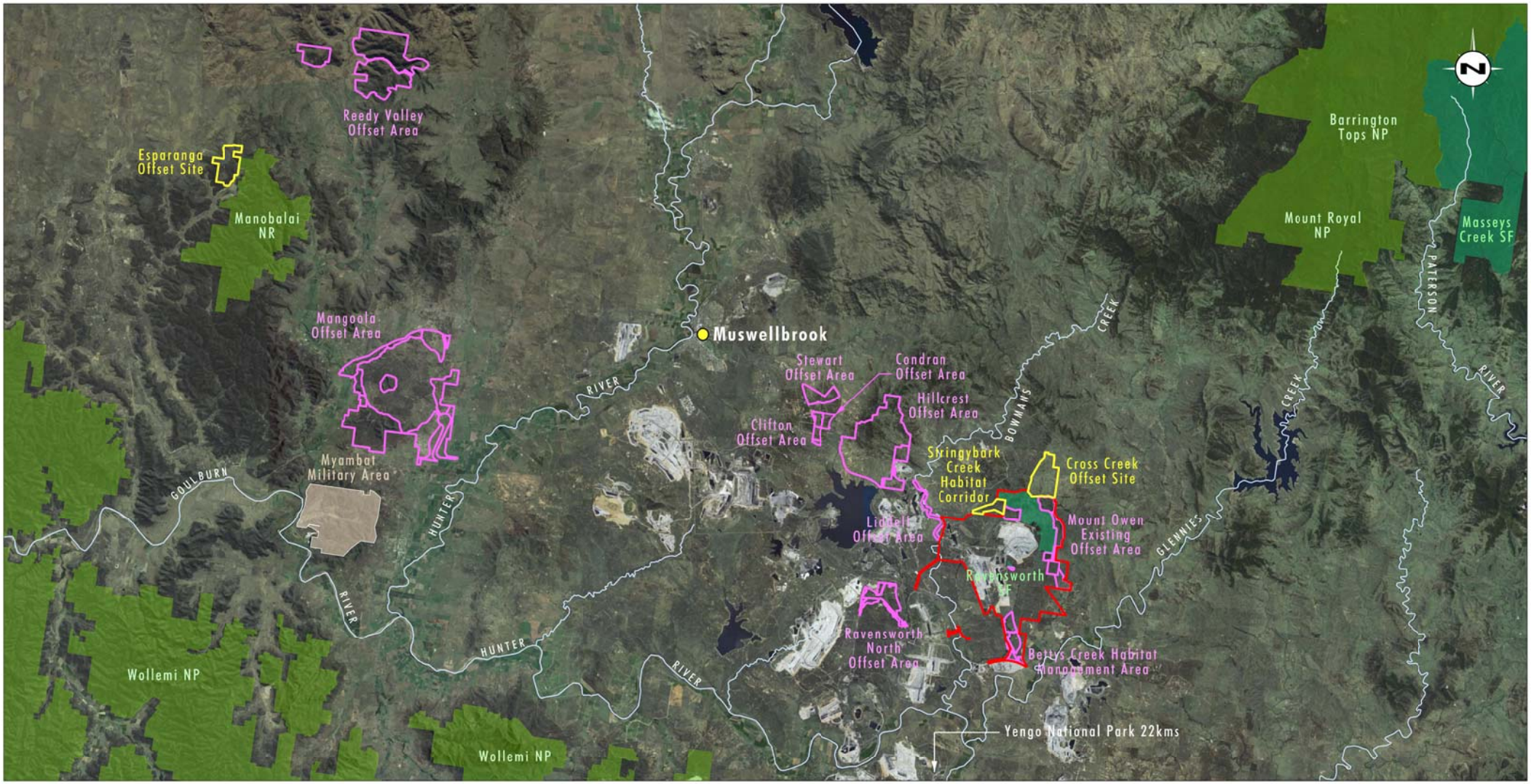

Image Source: Google Earth (2009)
Data Source: Department of Lands (2003), LPI (2012), OEH (2013), State of NSW (2013), Mount Owen (2014)

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FIGURE 5.21

Glencore Biodiversity Offset Areas Regional Setting

Legend

- Project Area
- Existing Glencore Offset Areas
- Proposed Mount Owen Offset Sites
- National Park/Nature Reserve (NP/NR)
- State Forest (SF)
- Crown Reserve

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5.7.2 Ecological Survey Methodology

A detailed survey methodology was designed and executed in order to gain a thorough understanding of the ecological features of the Project Area. The methods included a detailed review of relevant literature, reports and vegetation mapping, as well as searches of relevant ecological databases. This included regional and sub-regional vegetation mapping reports, site-specific monitoring surveys, ecological surveys undertaken in the vicinity of the Project Area and also relevant ecological database searches. The information obtained was used to inform survey design, and was also used to assist in the assessment of potentially occurring threatened and migratory species, Endangered Populations (EPs) and Threatened Ecological Communities (TECs).

A large amount of ecological data has been previously collected from the Project Area during past ecological surveys and assessment, and annual flora and fauna monitoring surveys undertaken between 1996 and 2014.

The Project specific flora field surveys were carried out in late spring 2011, spring 2012 and in multiple seasons in 2014. Field survey allowed sampling of vegetation and field reconnaissance to identify spatial vegetation patterns. Survey methods included vegetation survey quadrats, biometric plots / quadrats, meandering transects, rapid assessment points and field reconnaissance to identify spatial arrangement of vegetation across the Proposed Disturbance Area. Throughout flora surveys of the Proposed Disturbance Area, targeted searches were carried out for threatened flora species including Austral toadflax (*Thesium australe*), *Euphrasia arguta,* Illawarra greenhood (*Pterostylis gibbosa*), leek orchid (*Prasophyllum* sp. Wybong), lobed blue-grass (*Bothriochloa biloba*)[6], *Ozothamnus tesselatus,* slaty red gum (*Eucalyptus glaucina*) and painted diuris (*Diuris tricolor*).

Vegetation mapping was undertaken using best-practice techniques to delineate vegetation communities across the Proposed Disturbance Area through the identification of repeating patterns of plant species assemblages in each of the identified strata.

Fauna surveys were carried out to identify the fauna species and their habitats occurring, or considered to have the potential to occur in the Proposed Disturbance Area, including threatened species, migratory species, EPs and species of local or regional significance. Fauna surveys were undertaken by Umwelt within the Proposed Disturbance Area (and surrounds) in August 2011, February and June 2012, January 2013 and March, April and July 2014. During each of the fauna survey periods, a variety of survey techniques were employed including mammal trapping, hair funnel sampling, bird searches, reptile searches, amphibian searches, spotlighting, call playback, Anabat echolocation call detection and harp trapping. Reference was made to the relevant OEH fauna survey guidelines (DEC 2004) when designing the field survey, with appropriate survey methods selected that maximised the opportunities of identifying the full suite of fauna species that occur within the Project Area. Targeted fauna surveys were also undertaken for green and golden bell frog (*Litoria aurea*), swift parrot (*Lathamus discolor*) and regent honeyeater (*Anthochaera phrygia*).

Aquatic fauna survey, including detailed habitat assessments and aquatic vertebrate sampling, was undertaken in October 2012. Habitat assessment and aquatic vertebrate sampling were conducted in Bowmans Creek, with two replicate surveys undertaken at upstream and downstream locations near the proposed Bowmans Creek Bridge.

[6] Surveys for lobed blue-grass (*Bothriochloa biloba*) were undertaken in spring 2011 and 2012 when the species was listed as vulnerable under the EPBC Act. This species has since been de-listed and is not considered further in the Ecological Impact Assessment.

5.7.3 Existing Flora

A total of 355 flora species were recorded during flora surveys, of which approximately 26 per cent were not native to the area. Six species recorded (representing 1.7 per cent of species recorded) are declared noxious in the Singleton control area. The diversity of species recorded in the Proposed Disturbance Area and Project Area is considered likely to be greater than in surrounding areas due to the extent of clearing for agriculture, expansion of mining operations and lack of natural regeneration in actively used portions of the locality.

5.7.3.1 Vegetation of the Proposed Disturbance Area

Surveys of the Proposed Disturbance Area identified eight native and one non-native vegetation communities (excluding variants) (refer to **Figure 5.22**). These vegetation communities were aligned with vegetation map units as described in the Hunter Remnant Vegetation Project (Peake 2006), and were also aligned with vegetation community classifications from the Greater Hunter Native Vegetation Mapping (Sivertsen *et al*. 2011), where applicable.

The vegetation communities recorded in the Proposed Disturbance Area include:

- Central Hunter Bulloak Forest Regeneration;
- Central Hunter Grey Box – Ironbark Woodland (EEC – TSC Act);
- Central Hunter Ironbark – Spotted Gum – Grey Box Forest (EEC – TSC Act);
- Planted Ironbark – Spotted Gum – Grey Box Forest (EEC – TSC Act);
- Central Hunter Swamp Oak Forest;
- Derived Native Grassland;
- Hunter Valley River Oak Forest;
- Kunzea Closed Shrubland; and
- Mine rehabilitation.

The dominant communities identified in the Proposed Disturbance Area are Derived Native Grassland, Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC and Central Hunter Bulloak Forest Regeneration.

Two vegetation communities recorded in the Proposed Disturbance Area and one within the wider Project Area conform to descriptions provided by the NSW Scientific Committee of a listed EEC and are described below.

Central Hunter Grey Box – Ironbark Woodland EEC

Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions is listed as an EEC under the TSC Act. Central Hunter Box – Ironbark Woodland recorded in the Proposed Disturbance Area conforms to this EEC. This community is a common woodland community in the Project Area, but is restricted to only a small portion in the south of the Proposed Disturbance Area and in the north-west of the Project Area near Hebden Road. The Project Area contains approximately 82.6 hectares of the community, of which approximately 4.4 hectares occurs within the Proposed Disturbance Area.

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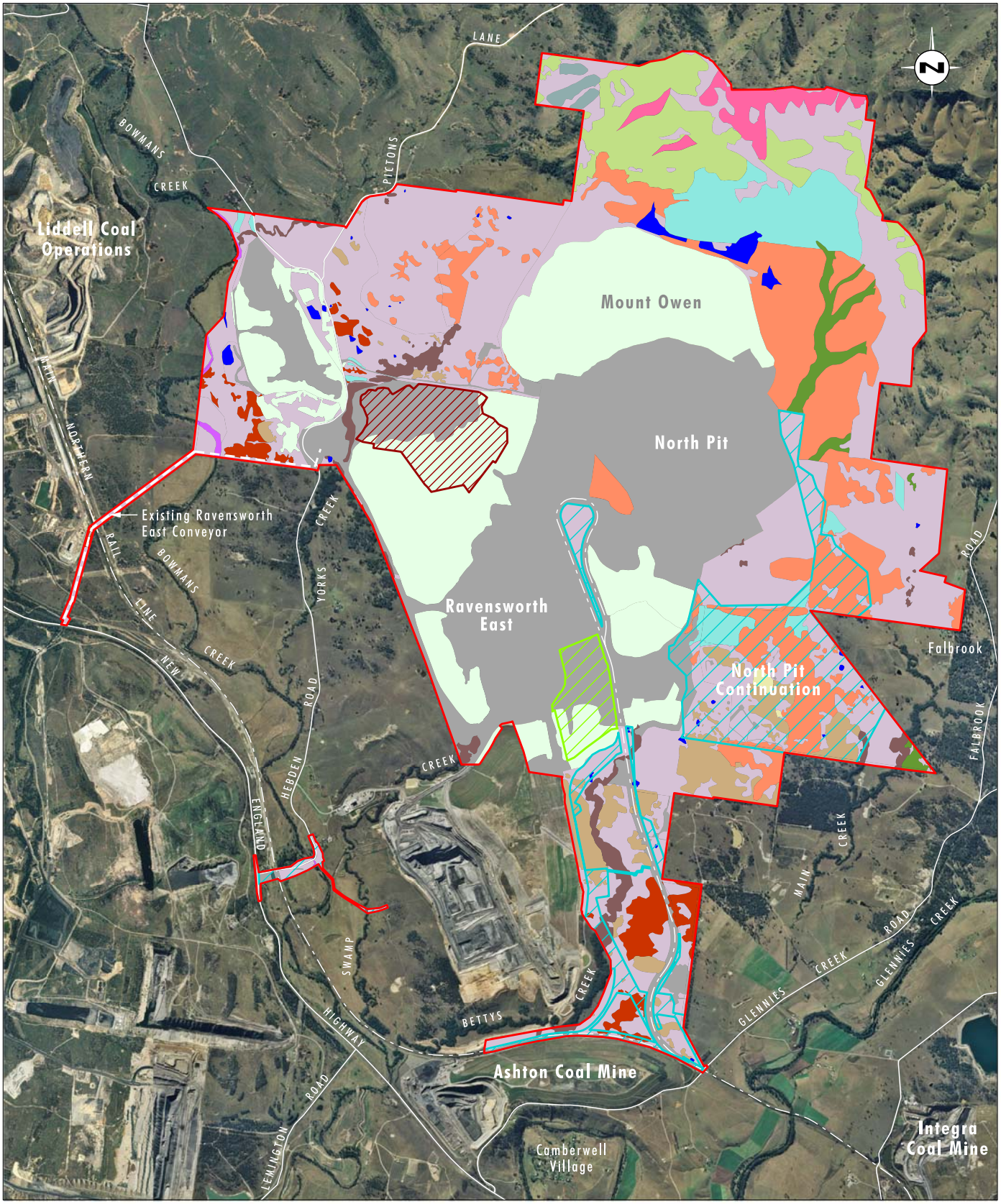

Image Source: Mount Owen (2012-2013)
Data Source: Mount Owen (2014)

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Legend

- Project Area
- Proposed Disturbance Area
- Bayswater North Pit
- Proposed RERR Mining Area

Vegetation Communities:

- Disturbed Land
- Barrington Footslopes Dry Spotted Gum Forest
- Central Hunter Bullock Forest Regeneration
- Central Hunter Swamp Oak Forest
- Central Hunter Ironbark - Spotted Gum - Grey Box Forest
- Central Hunter Grey Box - Ironbark Woodland
- Derived Native Grassland
- Dry Rainforest
- Hunter Lowland Red Gum Forest
- Hunter Footslopes Sheltered Forest
- Hunter Valley River Oak Forest
- Planted Ironbark - Spotted Gum - Grey Box Forest
- Kunzea Closed Shrubland
- Water Body
- Mine Rehabilitation

FIGURE 5.22

Vegetation Communities within the Project Area

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Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC

Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions is listed as an EEC under the TSC Act. This community has been recorded throughout the Proposed Disturbance Area, particularly in the eastern portion of the Project Area within and around Ravensworth State Forest. The Project Area contains approximately 699.3 hectares of the community, of which 131.9 hectares (including 27.4 hectares of planted forest) occur within the Proposed Disturbance Area.

Hunter Lowland Redgum Forest EEC

Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions is listed as an EEC under the TSC Act. This community occurs between Muswellbrook, Beresfield, Mulbring and Cessnock.

This community has been recorded within the Project Area, concentrated in the Bettys Creek drainage depressions in Ravensworth State Forest and in the south-east corner of the Project Area near Main Creek. A total of 48.7 hectares has been mapped in the Project Area. The community does not occur within the Proposed Disturbance Area.

Four vegetation communities have been mapped within the Project Area, but do not occur in the Proposed Disturbance Area. Given that there is no impact proposed as part of the Project, these communities have been mapped through referencing regional scale mapping, with limited ground truthing that has aimed to identify community dominants rather than to provide sufficient plot-based data to accurately describe and delineate vegetation communities. These communities include:

- Hunter Lowland Redgum Forest EEC;
- Barrington Footslopes Dry Spotted Gum Forest;
- Dry Rainforest; and
- Hunter Footslopes Sheltered Forest.

Barrington Footslopes Dry Spotted Gum Forest, Hunter Footslopes Sheltered Forest and Dry Rainforest communities occur on the northern slopes of the Project Area, in the northern Biodiversity Offset Areas and the New Forest Area. Hunter Lowland Red Gum Forest EEC occurs within Ravensworth State Forest and on a drainage flat associated with Main Creek, in the south-east of the Project Area.

5.7.3.2 Threatened Species and Endangered Populations

Two threatened flora species were recorded within the Project Area either as part of the current survey, or from other sources such as previous surveys, database searches or literature reviews. The location of each of the threatened flora species is shown on **Figure 5.23**, with the species recorded being:

- slaty red gum (*Eucalyptus glaucina*) – vulnerable under the TSC Act and EPBC Act; and
- *Ozothamnus tesselatus* – vulnerable under the TSC Act and EPBC Act.

Despite the substantial amount of field sampling that has been conducted across the Proposed Disturbance Area and Project Area generally, only one specimen of Slaty red gum has been previously recorded which has subsequently been removed by approved mining

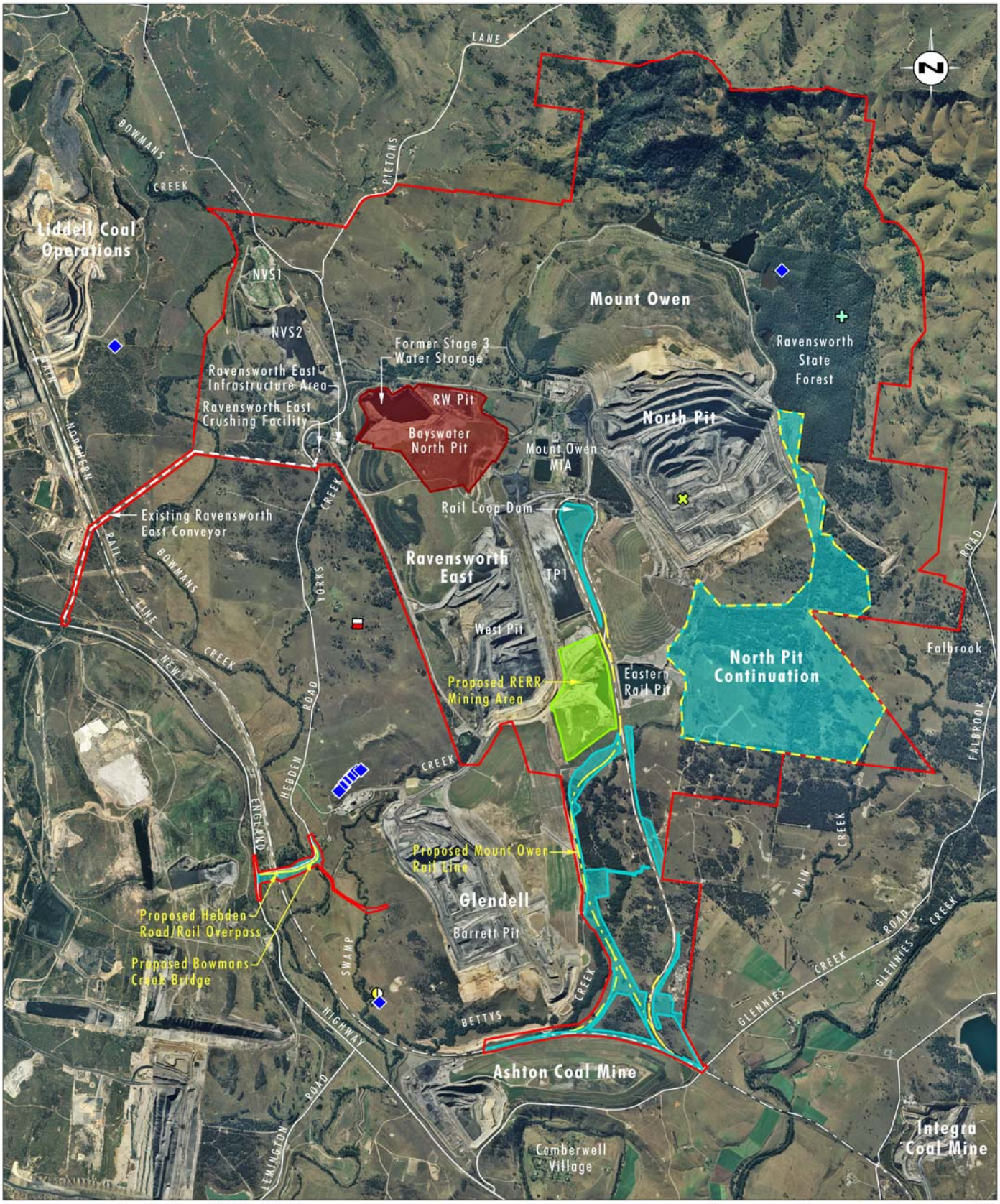

Image Source: Mount Owen (2012-2013)
Data Source: Mount Owen (2014), Atlas (2012), Umwelt (2012)

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Legend

- Project Area
- Proposed Disturbance Area
- Proposed North Pit Continuation
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Proposed RERR Mining Area
- Bayswater North Pit
- *Acacia pendula* population in the Hunter Catchment
- *Cymbidium canaliculatum* population in the Hunter Catchment
- *Eucalyptus camaldulensis* population in the Hunter Catchment
- *Eucalyptus glaucina*
- *Ozothamnus tesselatus*

FIGURE 5.23

Threatened Flora Species and Endangered Populations within the Project Area and Surrounds

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operations in the currently approved North Pit. It is unlikely that this species occurs in the Proposed Disturbance Area.

Ozothamnus tesselatus has been previously recorded during surveys undertaken within Ravensworth State Forest to the north-east of the Proposed Disturbance Area (Cole *et al* 2004). The species was not recorded during Umwelt surveys in the Proposed Disturbance Area, despite target surveys for this species. The species may occur in the habitats around Ravensworth State Forest.

Three endangered flora populations (EPs) listed under the TSC Act have been recorded in proximity to, but not within, the Proposed Disturbance Area. The locations of the endangered flora populations are shown on **Figure 5.23**. These are:

- *Cymbidium canaliculatum* Population in the Hunter Catchment;
- Acacia pendula Population in the Hunter Catchment (*Acacia pendula*); and
- *Eucalyptus camaldulensis* Population in the Hunter Catchment.

A tiger orchid (*Cymbidium canaliculatum*) was recorded in a eucalypt east of Hebden Road, however does not occur in the Project Area or Proposed Disturbance Area.

Weeping myall (*Acacia pendula*) has been previously recorded along Swamp Creek near the Project Area and in the north of Ravensworth State Forest. The species is also present and naturally recruiting within a planted rehabilitation area to the west of the Glendell MIA outside the Project Area. The naturally recruiting *Acacia pendula* conforms to the Weeping Myall in the Hunter Catchment endangered population, however, it does not occur in the Proposed Disturbance Area.

River red gum (*Eucalyptus camaldulensis*) has been previously recorded along Swamp Creek near the Project Area. River red gum has not been recorded in the Proposed Disturbance Area and is not expected to occur.

5.7.4 Existing Fauna

A total of 271 fauna species have been recorded in the Project Area, comprising 174 bird species, 27 reptiles, 17 frog species and 53 mammals. Fifteen (5.5 per cent) of these species were introduced species (birds and mammals).

A total of 29 threatened fauna species (as listed under the TSC Act and / or the EPBC Act) were recorded within the Proposed Disturbance Area or wider Project Area either as part of the Project surveys, or from other sources such as annual monitoring surveys, database searches or literature reviews. **Table 5.7.2** below lists the threatened fauna species recorded or those considered likely to occur within the Project Area and the Proposed Disturbance Area. The Proposed Disturbance Area and wider Project Area are not considered to provide habitat for any listed endangered fauna populations. Where location data was available, the record location of each threatened species is shown on **Figures 5.24**, **5.25** and **5.26**.

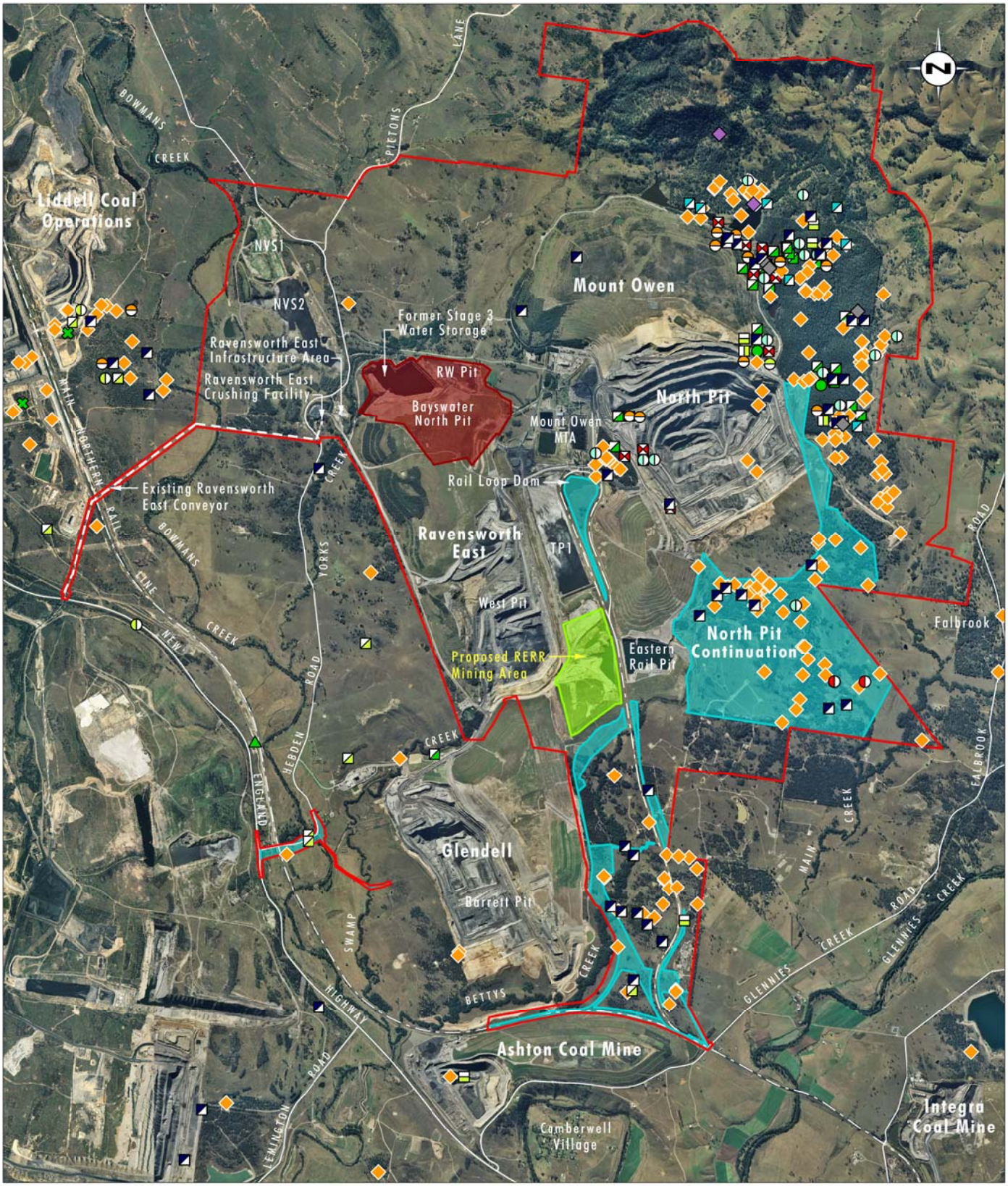

Image Source: Mount Owen (2012-2013)
Data Source: Mount Owen (2014), Atlas (2013), Umwelt (2008, 2012)

Legend

- Project Area
- Proposed Disturbance Area
- Proposed RERR Mining Area
- Bayswater North Pit
- Black-chinned Honeyeater (eastern subspecies)
- Black-necked Stork
- Blue-billed Duck
- Brown Treecreeper (eastern subspecies)
- Diamond Firetail
- Flame Robin
- Grey-crowned Babbler (eastern subspecies)
- Hooded Robin (south-eastern form)
- Little Eagle
- Little Lorikeet
- Masked Owl Pellet Location
- Masked Owl
- Powerful Owl
- Scarlet Robin
- Speckled Warbler
- Spotted Harrier
- Swift Parrot
- Varied Sittella

FIGURE 5.24

Threatened Avifauna Species within the Project Area and Surrounds

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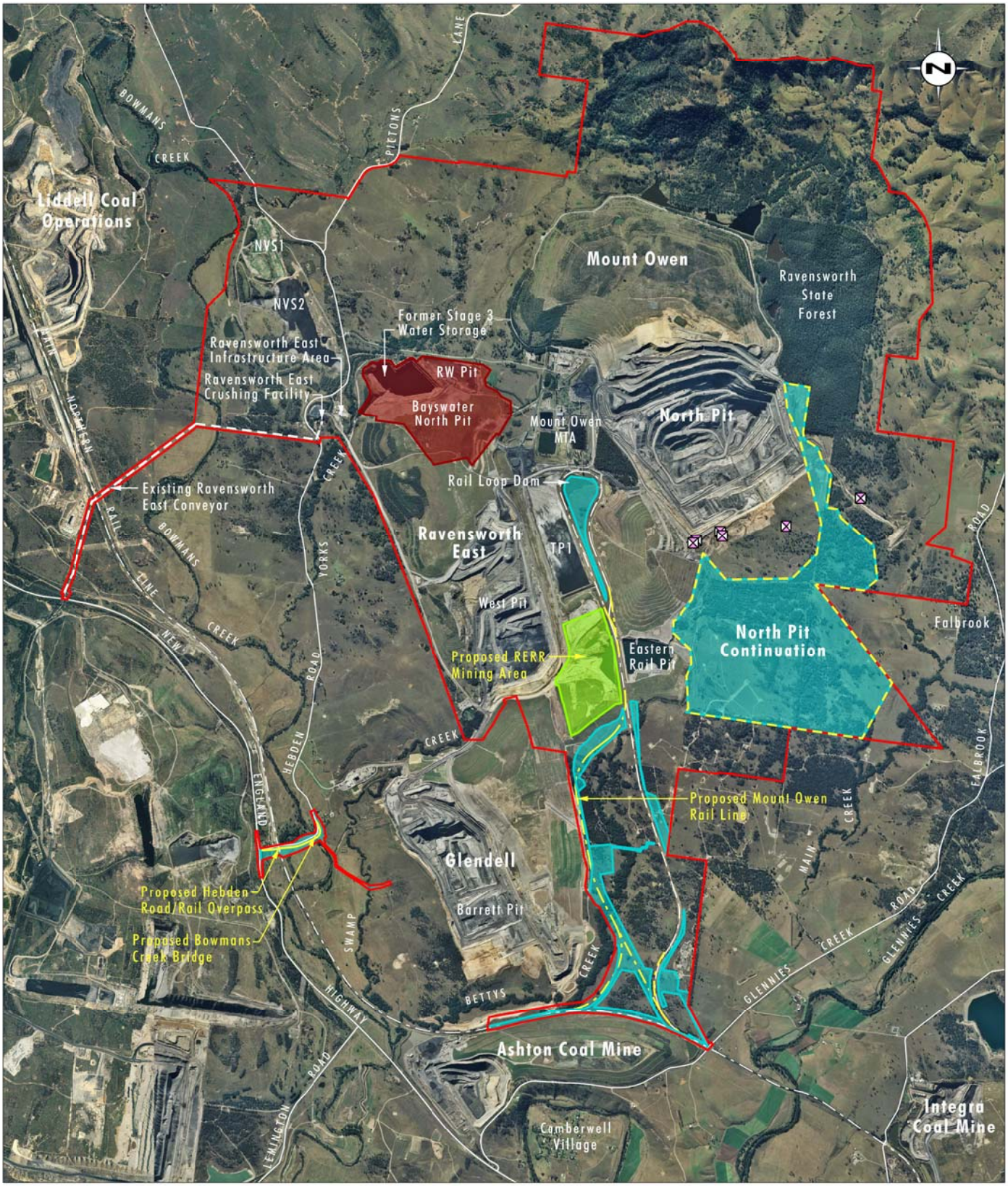

Image Source: Mount Owen (2012-2013)
Data Source: Mount Owen (2014), Atlas (2012), Umwelt (2012)

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Legend

- Project Area
- Proposed Disturbance Area
- Proposed RERR Mining Area
- Bayswater North Pit
- Proposed North Pit Continuation
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Green and Golden Bell Frog

FIGURE 5.25

Threatened Amphibian Species within the Project Area and Surrounds

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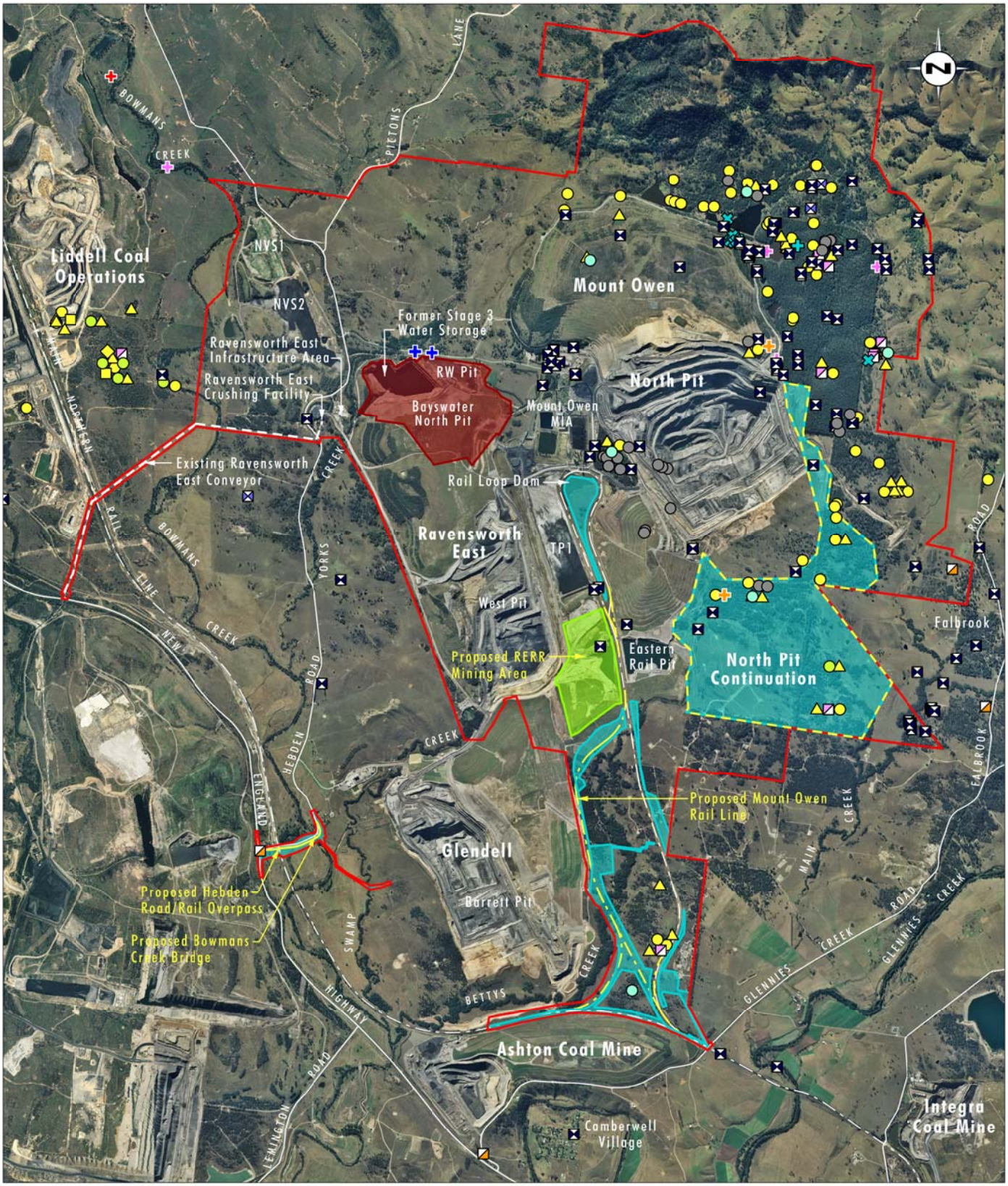

Image Source: Mount Owen (2012-2013)
Data Source: Mount Owen (2014), Atlas (2013), Umwelt (2012)

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Legend

- Project Area
- Proposed Disturbance Area
- Proposed RERR Mining Area
- Bayswater North Pit
- Proposed North Pit Continuation
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Brush-tailed Phascogale
- East-coast Freetail Bat
- Eastern Bentwing-bat
- Eastern Cave Bat
- Eastern False Pipistrelle
- Greater Broad-nosed Bat
- Grey-headed Flying-fox
- Koala
- Little Bentwing-bat
- New Holland Mouse
- Southern Myotis
- Spotted-tailed Quoll
- Squirrel Glider
- Yellow-bellied Sheathtail-bat

Other Features:

- Spotted-tailed Quoll Den Site
- Spotted-tailed Quoll Latrine Site
- Juvenile Spotted-tailed Quoll Road Kill - indicative

FIGURE 5.26

Threatened Mammal Species within the Project Area and Surrounds

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Table 5.7.2 – Threatened Fauna Species Recorded in the Project Area and Proposed Disturbance Area

Species Name Common name *Scientific name*	Status		Recorded in Project Area?	Recorded in Proposed Disturbance Area?	Year Last Recorded in the Project Area
	TSC Act 1995	EPBC Act 1999			
swift parrot *Lathamus discolor*	E	E	✓	×	2014
spotted-tailed quoll *Dasyurus maculatus*	V	E	✓	✓	2013
green and golden bell frog *Litoria aurea*	E	V	✓	×	1999
koala *Phascolarctos cinereus*	V	V	✓	✓	2012
New Holland mouse *Pseudomys novaehollandiae*	-	V	✓	×	2007
grey-headed flying-fox *Pteropus poliocephalus*	V	V	✓	×	2010
large-eared pied bat *Chalinolobus dwyeri*	V	V	✓	×	2008[1]
little eagle *Heiraaetus morphnoides*	V	-	✓	×	2001
spotted harrier *Circus assimilis*	V	-	✓	✓	2012
little lorikeet *Glossopsitta pusilla*	V	-	✓	✓	2012
powerful owl *Ninox strenua*	V	-	✓	×	2007
masked owl *Tyto novaehollandiae*	V	-	✓	✓	2012
brown treecreeper *Climacteris picumnus victoriae*	V	-	✓	×	2012
speckled warbler *Chthonicola saggitata*	V	-	✓	✓	2012
black-chinned honeyeater *Melithreptus gularis gularis*	V	-	✓	×	2004
grey-crowned babbler *Pomatostomus temporalis temporalis*	V	-	✓	✓	2012
varied sittella *Daphoenositta chrysoptera*	V	-	✓	×	2009
hooded robin *Melanodryas cucullata cucullata*	V	-	✓	×	2011
scarlet robin *Petroica boodang*	V	-	✓	×	2011

Table 5.7.2 – Threatened Fauna Species Recorded in the Project Area and Proposed Disturbance Area – cont.

Species Name Common name *Scientific name*	Status TSC Act 1995	 EPBC Act 1999	Recorded in Project Area?	Recorded in Proposed Disturbance Area?	Year Last Recorded in the Project Area
flame robin *Petroica phoenicea*	V	-	✓	×	2006
diamond firetail *Stagonopleura guttata*	V	-	✓	✓	2012
brush-tailed phascogale *Phascogale tapoatafa tapoatafa*	V	-	✓	×	2011
squirrel glider *Petaurus norfolcensis*	V	-	✓	✓	2012
yellow-bellied sheathtail bat *Saccolaimus flaviventris*	V	-	✓	×	2012
east coast freetail-bat *Mormopterus norfolkensis*	V	-	✓	✓	2012
little bentwing-bat *Miniopterus australis*	V	-	✓	×	2001[1.]
eastern bentwing-bat *Miniopterus schreibersii oceanensis*	V	-	✓	✓	2012
southern myotis *Myotis macropus*	V	-	✓	✓	2012
greater broad-nosed bat *Scoteanax rueppellii*	V	-	✓	✓	2012

Note: 1) Tentative recording only.

The green and golden bell frog within the Project Area has been monitored annually since its discovery in Bettys Creek in 1994, conducted by frog researchers from the University of Newcastle. The absence of individuals at historical sites, or the intermittent observation of single individuals, or very small numbers of green and golden bell frogs, fits with the pattern of observation of bell frogs in the Upper Hunter over a period of more than a decade. Records of the species in the Project Area indicate an area of historic habitat for the green and golden bell frog as the species has not been confidently recorded since 1999. The species is not considered to be limited in the Project Area by factors relating to habitat suitability, rather infection by the amphibian disease, Chytridiomycosis, is likely to limit the persistence of the species.

A total of seven migratory species listed under international conventions have been recorded during Project specific surveys or annual fauna monitoring. The habitats of the Proposed Disturbance Area were assessed in detail and are not considered to be suitable for an important population of any migratory species, as defined by the EPBC Act impact assessment guidelines and a significant impact on migratory species is not expected to occur as a result of the Project.

The Hunter River catchment provides habitat for the Darling River hardyhead (*Craterocephalus amniculus*) EP listed under the *Fisheries Management Act 1994* (FM Act). Potential habitat was recorded for the Darling River hardyhead (*Craterocephalus amniculus*) EP in Bowmans Creek. There are no additional listed threatened aquatic species, populations and endangered ecological communities occurring in the Hunter Catchment. No

threatened aquatic species were recorded during the current or previous assessments. No additional threatened aquatic species, populations or EECs have potential to occur within the Proposed Disturbance Area.

5.7.5 Flora and Fauna Impacts

Assessment of the potential impact of the Project on threatened species, endangered populations and TECs has been undertaken in accordance with State and Commonwealth legislation and policy. The scale of the assessment under the State and Commonwealth legislation differs with NSW legislation assessing the impacts of the Project at a local scale while assessments in accordance with Commonwealth legislation considers the impacts of the Project at a regional scale.

Without consideration of mitigation actions or biodiversity offsetting, the Project has the potential to result in impacts on the ecological features of the Proposed Disturbance Area. A total of 2,794 hectares of native vegetation occurs in the Project Area providing known habitat for 29 threatened fauna species, one threatened flora species and approximately 830 hectares of EEC as listed under the TSC Act. The Project will result in clearing of approximately 451.5 hectares of native vegetation which includes 223.7 hectares of native woodland, forest and riparian vegetation; 223.1 hectares of derived native grassland and 4.7 hectares of shrubland. Approximately 33.5 hectares of the Proposed Disturbance Area is disturbed land associated with existing mining operations, in addition to established road and rail infrastructure. It is noted that approximately 86.9 hectares of existing mine rehabilitation is proposed to be cleared in the BNP and RERR Mining Area, with these areas having been previously disturbed as part of existing approved operations.

Impact Avoidance

As outlined in **Section 2.5**, Mount Owen undertook detailed iterative studies as part of the Project's development, including the identification of potential environmental impacts that required consideration in Project design. Key factors in Project design have been designed to ameliorate the impacts on significant ecological features, such as threatened species, EPs, TECs and / or their habitats. The approach adopted has been to seek to avoid ecological impact and maximise use of existing disturbed areas as much as possible. The continuation of mining operations within the Project Area has been designed to avoid disturbance of the existing Biodiversity Offset Areas. Mount Owen is committed to the continuation of existing management and protection and proactive management of the existing Biodiversity Offset Areas.

The Project design process also resulted in the rail bridge across Bettys Creek being a span bridge designed to reduce disturbance to the Bettys Creek bed. In addition, the piers for the proposed Bowmans Creek Bridge have been designed to be located outside of the low flow channel of Bowmans Creek to minimise direct impacts to the bed and bank.

Further, as part of the iterative mine design and assessment process, the Proposed Disturbance Area was altered in order to avoid impact to the Hunter Lowland Redgum Forest EEC.

5.7.5.1 Impacts on Vegetation Communities

The Project will result in the removal of approximately 217.7 hectares of woodland and forest communities, approximately 6.0 hectares of riparian vegetation, approximately 4.7 hectares of Kunzea Closed Shrubland and approximately 223.1 hectares of Derived Native Grassland.

Table 5.7.3 shows the area of vegetation communities proposed to be directly impacted by clearing in the Proposed Disturbance Area. It should be noted that the Proposed Disturbance Area takes into account the potential disturbance envelopes associated with proposed construction and North Pit Continuation. Additionally, the Project would result in the removal of approximately 86.9 ha of exotic grassland-dominated rehabilitation in the BNP and RERR Mining Area and combined with the Proposed Disturbance Area is considered a worst case scenario.

Table 5.7.3 – Area of Each Vegetation Community to be removed as a Result of the Project

Formation	Vegetation Community	Area of Vegetation to be Removed (ha)
Derived Native Grassland	Derived Native Grassland	223.1
Forest and Woodland	Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC	131.9
	Central Hunter Bulloak Forest Regeneration	54.0
	Planted Ironbark – Spotted Gum – Grey Box Forest EEC	27.4
	Central Hunter Grey Box - Ironbark Woodland EEC	4.4
Shrubland	Kunzea Closed Shrubland	4.7
Riparian	Hunter Valley River Oak Forest	0.2
	Central Hunter Swamp Oak Forest	5.8
Subtotal		**451.5**
Mine Rehabilitation (in the BNP and RERR Mining Area)	Exotic Grassland-Dominated Rehabilitation	86.9
Total		**538.4**

Detailed assessment has been conducted in accordance with the EP&A Act tests of significance, and the Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC is considered to be potentially significantly impacted by the Project. No EECs listed under the EPBC Act have been recorded in the Project Area or Proposed Disturbance Area.

5.7.5.2 Impacts on Threatened Flora Species and Populations

The Project is not likely to result in a substantial impact on flora species diversity in the Project Area as the high quality, intact communities in Ravensworth State Forest and adjacent Mount Owen Biodiversity Offset Areas will not be impacted as a result of the Project.

No threatened flora species or endangered populations were identified within the Proposed Disturbance Area.

5.7.5.3 Impacts on Fauna Habitat and Fauna Species

The Project will result in the loss of a substantial and important area of habitat for a range of woodland-dependent threatened fauna species recorded in the Proposed Disturbance Area and wider Project Area. The loss of 217.7 hectares of native woodland / forest, 4.7 hectares of shrubland, 6.0 hectares of riparian habitat, 86.9 hectares of mine rehabilitation and 223.1

hectares of Derived Native Grassland is considered likely to result in the reduction of the local population of the threatened species recorded in the Proposed Disturbance Area.

The Project is considered likely to result in a significant impact at the State level on the spotted-tailed quoll (*Dasyurus maculatus*) and squirrel glider (*Petaurus norfolcensis*). It is noted that the impact of the Project on the spotted-tailed quoll is not considered to be significant at the Commonwealth level, as discussed below.

The Project may also result in a significant impact on the following additional threatened fauna species:

- masked owl (*Tyto novaehollandiae*);
- brown treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*);
- speckled warbler (*Chthonicola sagittata*);
- grey-crowned babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*);
- varied sittella (*Daphoenositta chrysoptera*);
- hooded robin (south-eastern form) (*Melanodryas cucullata cucullata*);
- diamond firetail (*Stagonopleura guttata*);
- brush-tailed phascogale (*Phascogale tapoatafa tapoatafa*);
- yellow-bellied sheathtail-bat (*Saccolaimus flaviventris*);
- east coast freetail-bat (*Mormopterus norfolkensis*);
- southern myotis (*Myotis macropus*); and
- greater broad-nosed bat (*Scoteanax rueppellii*).

These species (in addition to Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC noted in **Section 5.7.5.1**) have been categorised as 'potentially significantly impacted' as there are a range of factors that reduce the certainty as to whether the Project will result in a significant impact. These factors include (but are not limited to) certainty regarding the importance of habitat utilisation in the Proposed Disturbance Area; the cryptic nature of many of these species; and the uncertainty regarding the local populations of these species occurring within and beyond the Proposed Disturbance Area.

The potential for a significant impact cannot be ruled out based on current knowledge and therefore, following application of the precautionary principle, a total of seven threatened bird species, five threatened mammal species and one EEC are considered to be potentially significantly impacted (without mitigation) at a state level by the Project.

Threatened Species Assessed under the EPBC Act 1999

The 'Action', being the proposed activities in the Proposed Disturbance Area, was deemed to comprise a 'Controlled Action' by the DoE on 24 October 2013, due to the potential for significant impacts on the matters protected under the EPBC Act: the removal, fragmentation and / or isolation of potential habitat for three EPBC Act listed endangered species, being the spotted-tailed quoll (*Dasyurus maculuts maculatus*), swift parrot (*Lathamus discolor*) and regent honeyeater (*Anthochaera phrygia*), is considered by the DoE to likely have a significant impact as a result of the Project.

The DoE also determined that the 'Action' be assessed through accreditation of the NSW Government assessment process. Supplementary DGRs were issued on 8 November 2013 and a detailed response to each of the matters raised is addressed in the MNES report (refer to **Appendix 4**).

The EPBC Act lists criteria which are used to determine whether an action is likely to have a significant impact on MNES. These criteria are addressed in the Assessment of Significance provided in **Appendix 11**. Further details are provided below for spotted-tailed quoll (*Dasyurus maculatus maculatus*), swift parrot (*Lathamus discolor*) and regent honeyeater (*Anthochaera phrygia*).

Swift Parrot and Regent Honeyeater

Swift parrots historically occurring in the box / gum habitats of the Project Area and potentially occurring regent honeyeaters, are considered to comprise part of a population, as defined by the Significant Impact Guidelines 1.1 (DoE, 2013). The Project is not expected to result in a significant impact on these endangered species as the Project will not:

- lead to a long-term decrease in the size of a population;
- fragment an existing population into two or more populations;
- adversely affect habitat critical to the survival of a species;
- disrupt the breeding cycle of a population;
- modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;
- introduce disease that may cause the species to decline; and
- interfere with the recovery of the species.

The loss of approximately 163.7 hectares (approximately 0.00015 per cent of potential habitat within the Hunter Valley) of potential box-ironbark woodland habitat will result in a reduction of the potential area of occupancy for the populations of the swift parrot and a potentially occurring population of the regent honeyeater, however is unlikely to substantially reduce the area of known occupancy. Therefore, it is considered unlikely that the Project would result in a significant impact on the swift parrot or potentially occurring regent honeyeater.

Spotted-tailed Quoll

A small local population of a broader Barrington Footslopes (southern and western footslopes) regional population of the spotted-tailed quoll occurs in the Mount Owen Complex locality and within the Project Area, the species has mainly been recorded in Ravensworth State Forest and existing mine rehabilitation. Den and latrine sites have been recorded within the Project Area and more broadly along Bowmans Creek approximately 6 kilometres to the west of the Project Area. In late 2012, a successful breeding event was recorded at Bowmans Creek approximately 6.5 kilometres north-west of the Proposed Disturbance Area. No breeding has been recorded in or close to the Project Area, however active den sites in the Project Area are located in stockpiled timber associated with ongoing rehabilitation and

adjacent to or within the intact native vegetation of Ravensworth State Forest. No den sites have been located within the Proposed Disturbance Area. The spotted-tailed quoll has been recorded using mine rehabilitation as part of a broader foraging / home range that is centred on native woodland / forest habitat and the ongoing use of mine rehabilitation and regeneration areas indicates that the species is likely to persist in the future. During April-July 2013, an individual male spotted-tailed quoll was recorded using woodland habitats at five locations within the Proposed Disturbance Area.

The Project is not expected to result in a significant impact on the spotted-tailed quoll, at a Commonwealth level, as the Project will not:

- lead to a long-term decrease in the size of a population;
- fragment an existing population into two or more populations;
- adversely affect habitat critical to the survival of a species;
- disrupt the breeding cycle of a population;
- modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;
- introduce disease that may cause the species to decline; and
- interfere with the recovery of the species.

The Project will result in the loss of approximately 223.7 hectares of woodland forest and riparian habitat and 223.1 hectares of derived native grassland habitat for the spotted-tailed quoll, which is a reduction in potential area of occupancy. While the Project will remove habitat for this species, the area of habitat to be removed is not important, notable, or of consequence, in accordance with the Significant Impact Guidelines 1.1 (DoE, 2013) and it will not lead to a significant reduction in habitat for the species.

Based on the information provided above, the Project is unlikely to result in a significant impact on the spotted-tailed quoll on a Commonwealth level.

5.7.5.4 Impacts on Existing Biodiversity Offset Areas and Habitat Corridors

The Project has been designed to avoid impacts on existing Mount Owen Biodiversity Offset Areas in addition to the Bettys Creek Habitat Management Area and the ecological values of the existing offset areas will not be directly impacted.

A habitat corridor, known as the Southern Wildlife Corridor, was previously established as part of the 1994 Project approval immediately south of the currently approved North Pit, within the Proposed Disturbance Area. The Southern Wildlife Corridor was established in 1994 to join retained vegetation to the west of the then mining area (known as the Southern Remnant), a 45 hectare remnant capable of supporting ecological diversity, with remnant vegetation associated with Ravensworth State Forest to the east and additional remnant vegetation to the south-east of the then mining area.

In 2004, approval was granted to impact 35 hectares of the Southern Remnant which resulted in a reduction of the Southern Remnant to 10 hectares. It was considered that the remaining 10 hectares would not likely support viable fauna populations for all species; although it would provide a valuable seed source and habitat once reconnected through mine rehabilitation, thus providing increased value in the medium to long term. Whilst it was acknowledged that the Southern Wildlife Corridor was established in 1994 to form the primary link between the southern and northern remnants of the Ravensworth State Forest, the success of the 2004 offset strategy including the currently approved Biodiversity Offset Areas did not include the Southern Wildlife Corridor and moreover, was not dependant on the restoration of the Southern Wildlife Corridor. The existing Biodiversity Offset Areas provide alternative links to the vegetation to the south-east. Similar to the currently approved rehabilitation strategy, reinstatement of a corridor is a key consideration in the design of the mine rehabilitation and final landform for the Project.

5.7.6 Flora and Fauna Management Commitments

Mount Owen has sought to avoid and minimise potential impacts on the ecological values of the Project Area throughout the Project planning process. However, the detailed ecological assessment (refer to **Appendix 11**) indicates that, without appropriate mitigation, the Project would have a likely significant impact at a State level on two mammals and a potentially significant impact on seven threatened bird species, five mammal species and one EEC.

Accordingly, Mount Owen has committed to the design and implementation of a comprehensive strategy to mitigate the residual impacts of the Project. Further to this, a comprehensive biodiversity offset strategy has been developed, which includes the protection and enhancement of native vegetation and threatened species habitat, to develop a positive long-term outcome for the threatened species and key ecological features impacted by the Project. The proposed Biodiversity Offset Strategy is outlined in **Section 5.7.8**.

A range of management strategies are currently utilised by Mount Owen to limit impacts on native flora and fauna in the Project Area. These strategies are currently detailed in the Mount Owen Complex Flora and Fauna Management Plan and will be incorporated into a revised and consolidated Landscape Management Plan (LMP) should the Project be approved. The LMP will be reviewed and updated within 12 months of any Project approval. The strategies will include:

- feral animal and weed control;
- rehabilitation of disturbed areas with species characteristic of extant vegetation communities;
- use of native species in revegetation, and the linkage and integration of rehabilitation areas with existing vegetated areas to improve ecological function and provide appropriate fauna habitat, except in areas identified for improved pasture;
- management of erosion and sedimentation to ensure that adjoining vegetation communities and aquatic systems are not adversely impacted;
- adaptive management, as required, if a previously unrecorded or assessed threatened species is identified in the Proposed Disturbance Area during operations;
- ongoing monitoring and maintenance of revegetation works and habitat enhancement activities; and
- an adaptive approach to ongoing monitoring of native flora and fauna.

Appendix 11 provides detailed information regarding the ecological impact mitigation strategies.

The aim of the rehabilitation of the Proposed Disturbance Area will be to re-establish those vegetation communities and fauna habitats currently recorded and connect, as far as practicable, the habitat areas to the north and south of the Proposed Disturbance Area with a vegetated corridor. A range of preliminary criteria relating to biodiversity issues has been developed to direct the rehabilitation activities.

Rehabilitation of post-mining areas will be completed as soon as practicable after shaped areas become available, and will target Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC. All rehabilitation works will be scheduled to commence as soon as practicable after disturbance and reformation of the landscape. This approach will minimise the disturbed area at any point in time and hence reduce the ecological impact of the Project.

Approximately 518 hectares of rehabilitation is proposed as part of the Project, in addition to rehabilitation commitments resulting from previous project approvals. This includes rehabilitation in both the Proposed Disturbance Area and Ravensworth East, however excludes rehabilitation required under previous approvals. The total area of post mining rehabilitation for the Mount Owen Complex will be approximately 1,900 hectares. In the long term, in combination with existing biodiversity offsets, this will result in approximately 2,418 hectares of additional woodland and forest, once the currently proposed mining is completed, compared to when mining first commenced at Mount Owen Mine in 1993.

5.7.7 Fauna Habitat Reinstatement

A range of fauna habitat reinstatement measures are proposed to mitigate the impacts of the Project on biodiversity. Increasing the habitat complexity and range of micro habitats occurring in the post-mining landscape will result in the increased utilisation of the rehabilitation by a much wider range of fauna species, thereby meeting the objective of the re-establishment of fauna habitats and threatened species habitats in the post-mining landform. Strategies include:

- The re-establishment of ground fauna habitat through the relocation of cleared vegetation and rocks in targeted rehabilitation areas, where practicable. This will contribute to the more rapid development of fauna species diversity in the medium to long term as vegetation re-establishment progresses.

- Installation of supplementary arboreal habitat, such as nest boxes, once rehabilitated vegetation communities are of sufficient maturity.

- The retention or augmentation of dams in the post-mining landform to facilitate the re-colonisation of woodland fauna communities. Dams generally provide a source of permanent water in the landscape and associated fauna species such as frogs and invertebrates will constitute suitable prey for many additional fauna species such as reptiles.

5.7.7.1 Protection and Management of Arboreal Species and Habitat

A robust tree felling procedure is implemented at Mount Owen Complex to minimise the potential for impacts on native fauna species (including threatened species) as a result of the clearing of hollow-bearing trees. This procedure is detailed in the existing Flora and Fauna Management Plan and will be updated and consolidated within the LMP within 12 months of Project approval.

5.7.7.2 Spotted-tailed Quoll Habitat Enhancement

Given the known presence of a spotted-tailed quoll (*Dasyurus maculatus*) population in the Project Area, specific habitat enhancement measures will be undertaken within the proposed Stringybark Creek Habitat Corridor to assist the persistence of this species within the Project Area, and broader local area and include:

- Salvage of trees felled during construction works and emplacement within the Stringybark Creek Habitat Corridor as log piles. This will increase the amount of potential foraging and denning habitat for this species in the local area. It is notable that two currently known den sites at Mount Owen and the known breeding den located at Liddell, to the west of the Project Area, are located in similar log piles.

- Salvage and placement of large rocks and boulders into piles as further potential denning habitat.

5.7.7.3 Monitoring Requirements

Currently, annual ecological monitoring is undertaken within the Project Area which focuses on the monitoring of flora and fauna species across remnant vegetation sites, and regeneration and rehabilitation sites.

As part of the revision of the existing LMP for this Project, it is proposed that the existing ecological monitoring in the Project Area be reviewed and the monitoring scope be expanded to include the proposed Biodiversity Offset Areas. This review will consider all existing commitments, and will review the existing monitoring program to develop a consolidated, efficient and informative approach to ecological monitoring for the Project. Attention will be paid to making best use of the existing long-term data sets for the Project Area, while ensuring all monitoring is targeted to features that:

- provide a good indication of the status of the ecological value that the operation aims to protect;

- are relatively simple to measure and are reproducible;

- allow for floristic composition and structure to be monitored over time using basic statistical analysis;

- specifically targets those threatened species and EECs potentially significantly impacted by the Project; and

- allow for comparison to reference (control) sites.

Details on the monitoring program will be documented within the revised LMP, to be completed within 12 months from the date of approval, if granted. This document will contain the specific requirements of the monitoring program, including methods to be used, monitoring frequencies and locations.

The outcomes of the ecological monitoring program will be reported in the Annual Review and be made available on the Mount Owen website.

5.7.8 Biodiversity Offset Strategy

A Biodiversity Offset Strategy is proposed to compensate for residual impacts on those species, vegetation communities and ecological features that are likely to be, or could potentially be, significantly impacted by the Project. The Biodiversity Offset Strategy has been developed in accordance with the DGRs and in a manner consistent with Commonwealth and State offsetting policies.

The objectives of the Biodiversity Offset Strategy are to:

- maintain or improve the terrestrial and aquatic biodiversity values of the region in the medium to long term;
- identify land-based offsets that contain as many as possible of the threatened vegetation communities, threatened flora species, threatened fauna species and potential and actual habitat for threatened species impacted by the Project;
- identify land-based offsets that are strategically located;
- identify land-based offsets in which an environmental gain can be made via appropriate management strategies;
- secure offsets in perpetuity;
- to develop a management strategy for the proactive environmental management of the proposed offset sites, but with appropriate consideration of the existing rural nature of the area;
- as a minimum provide a suite of land-based offsets that have the same ecological value as the residual impacts of the Project on threatened vegetation communities, threatened flora species and threatened fauna species and their habitats; and
- demonstrate how the strategy would be integrated with the Upper Hunter Strategic Assessment process.

The key components of the Biodiversity Offset Strategy for the Project include the following land-based components:

- Long-term conservation of a 367 hectare property located adjacent to existing Mount Owen Biodiversity Offset Areas, known as the Cross Creek Offset Site. The Cross Creek Offset Site provides targeted ‘like for like’ vegetation and threatened fauna habitats and opportunities for environmental improvement. It is strategically located in the vicinity of a number of existing and proposed Glencore Biodiversity Offset Areas.
- Long-term conservation of a 303 hectare property located in the Manobalai region, known as the Esparanga Offset Site. The Esparanga Offset Site adjoins Manobalai Nature Reserve in a priority conservation area located in the Great Eastern Ranges and the Upper Hunter Strategic Assessment priority area and provides high conservation value vegetation communities and ‘like for like’ threatened fauna habitat.
- Stringybark Creek Habitat Corridor regeneration strategy that will provide a 97.5 hectare corridor that links existing high quality habitat associated with the existing Mount Owen Biodiversity Offset Areas and Ravensworth State Forest with adjacent corridors and proposed conservation areas at Glencore’s Liddell Operations to the west of the Project Area. The Stringybark Creek Habitat Corridor includes key commitments relating to the establishment of spotted-tailed quoll habitat.

- On-site mine rehabilitation that comprises key commitments to native vegetation community re-establishment and fauna habitat augmentation.

The Cross Creek property is located immediately adjacent to the Mount Owen offset areas (refer to **Figure 5.27**) and comprises 367 hectares, of which approximately 51.7 hectares comprises Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC listed under the TSC Act. The remaining area of the property, approximately 315.3 hectares, comprises native grassland, which is likely to have once supported Central Hunter Ironbark – Spotted Gum – Grey Box Forest. The regeneration of the woodland community would provide a significant environmental gain as an outcome of offsetting for the Project, balanced with the immediate outcome of protecting 51.7 hectares of Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC, a community that will be potentially significantly impacted by the Project. In the long term, there will be a net gain of approximately 315.3 hectares of vegetation.

The Esparanga Offset Site is located in the Manobalai locality of the Hunter Valley (refer to **Figure 5.28**), approximately 40 kilometres by road north-west of Muswellbrook, and 65 kilometres by road south-west of Scone. A significant biodiversity asset of the Esparanga Offset Site comes from its position in the landscape, particularly its proximity to Manobalai Nature Reserve and its location within the corridor proposed as part of the Great Eastern Ranges Initiative. It is also considered reasonably likely that the area will form part of the Upper Hunter Strategic Assessment priority offset area. The Esparanga Offset Site provides a direct 'like for like' offset for the vast majority of the fauna species that are expected to be impacted by the Project, including the squirrel glider and the spotted-tailed quoll. As discussed previously, the DoE has deemed the proposed Action, a Controlled Action. It is considered that Esparanga provides an appropriate offset for the spotted tailed quoll. Opportunity also exists at the Esparanga Offset Site for environmental gain initiatives, including the regeneration of approximately 90 hectares of Derived Native Grassland habitat to the White Box Woodland EEC and CEEC community.

Stringybark Creek Habitat Corridor has been identified as a priority area for habitat restoration for the spotted-tailed quoll and Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC (along with other targeted fauna species that will also benefit from habitat restoration initiatives such as woodland birds and bats, including the swift parrot and regent honeyeater). The Stringybark Creek Habitat Corridor is approximately 97.5 hectares and will focus on the creation of substantial foraging and denning habitat for the spotted-tailed quoll (*Dasyurus maculatus*) which is known to utilise drainage lines as movement and dispersal corridors. The establishment of the habitat corridor will facilitate movement of the spotted-tailed quoll and other fauna species (including threatened fauna species) to other remnant native vegetation areas in the region such as the Hillcrest Offset Area managed by Glencore's Ravensworth Surface Operations north-west of the Project Area and the Mountain Block Offset Area and Bowmans Creek Riparian Corridor proposed as part of the Glencore Liddell Continued Operations Project, which are proposed as offsets to provide habitat for the spotted-tailed quoll (refer to **Figure 5.27**).

The inclusion of revegetation in biodiversity offsetting is increasing in importance and proponents, including Mount Owen, are demonstrating improved outcomes and increasing confidence in relation to the re-establishment of key vegetation communities and fauna habitats. Mine rehabilitation is also being incorporated into the Upper Hunter Strategic Assessment as a means for mining proponents in the Hunter Valley to offset impacts to biodiversity. The Upper Hunter Strategic Assessment will not be finalised within the proposed approval schedule for the Project. Nevertheless, consideration was given to the aims and objectives of the Upper Hunter Strategic Assessment in offsetting impacts to biodiversity, including consideration of the location of the likely priority offset areas.

umwelt

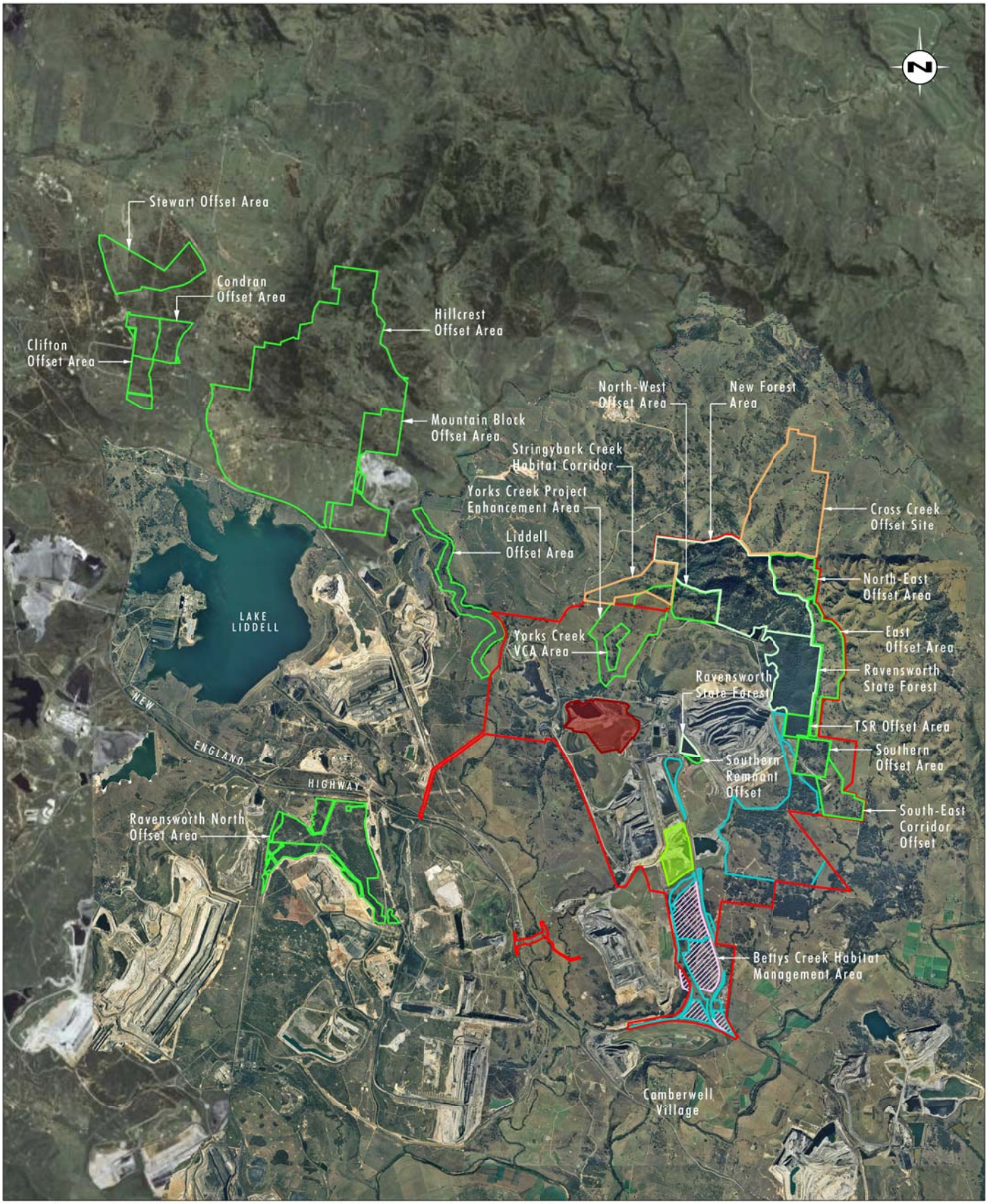

Image Source: AAM (2013), Mount Owen (2012-2013), Google Earth (2008)
Data Source: Mount Owen (2014), Department of Lands (2013)

0 2.0 4.0 6.0km
1:120 000

Legend

- Project Area
- Proposed Disturbance Area
- Proposed RERR Mining Area
- Bayswater North Pit
- Approved Glencore Offsets
- Proposed Mount Owen Offsets
- Bettys Creek Habitat Management Area
- Ravensworth State Forest

FIGURE 5.27

Strategic Location of Cross Creek Offset Site in the Mount Owen Offset Cluster

File Name (A4): R02/3109_881.dgn
20141008 12.09

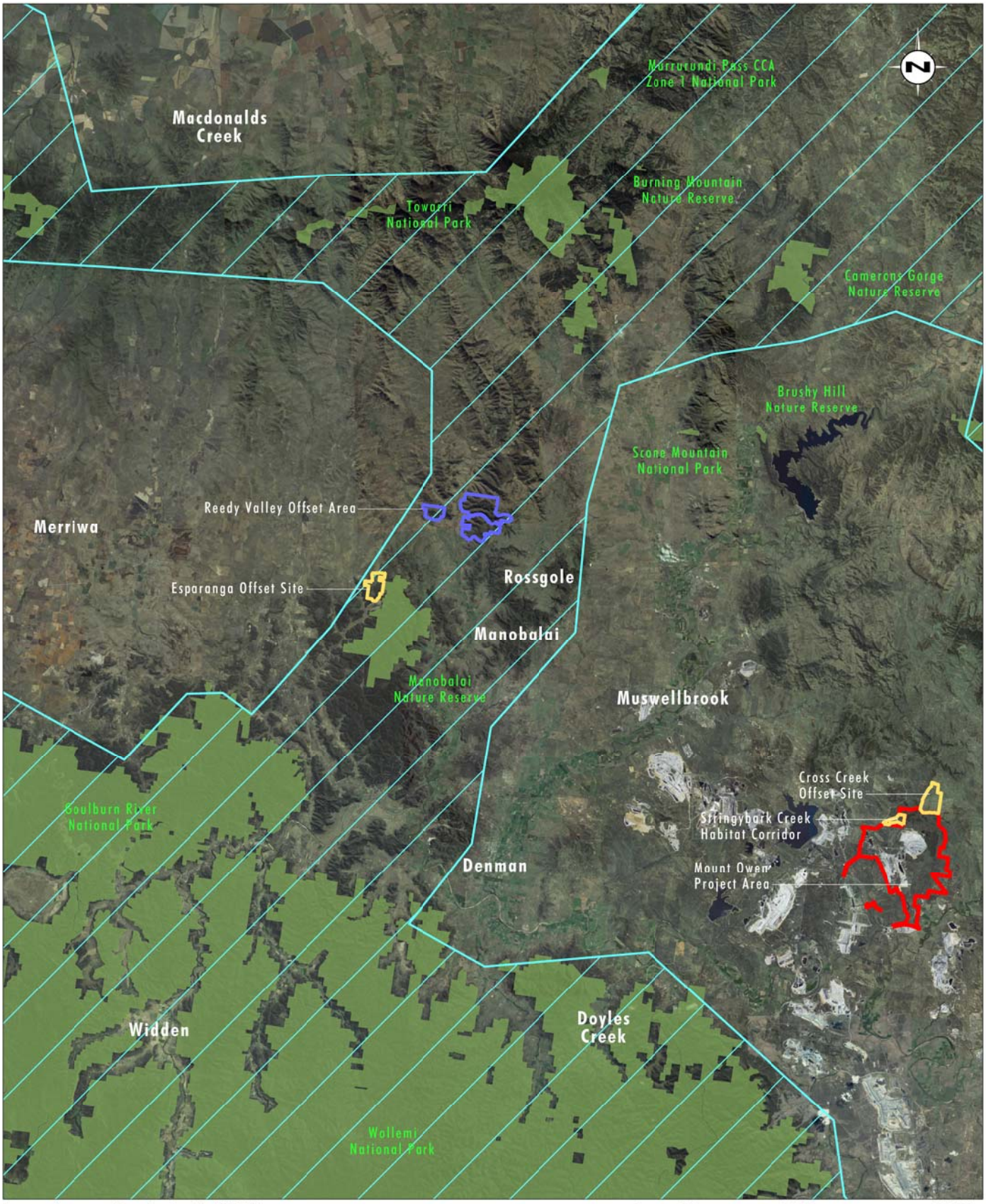

Image Source: Google Earth (2004)
Data Source: Mount Owen (2014), DECC (2008), Department of Lands (2009)

0 5.0 15.0 30.0km
1:500 000

Legend

- Project Area
- Proposed Mount Owen Offsets
- Bulga Offset Area
- National Parks and Reserves
- Great Eastern Ranges Conservation Corridor Initiative

FIGURE 5.28

Strategic Location of the Esparanga Offset Site in the Glencore Manobalai Offset Cluster

File Name (A4): R02/3109_882.dgn
20140822 13.46

Table 5.7.4 provides a summary of the Biodiversity Offset Strategy for the Project for vegetation communities.

Table 5.7.4 – Offsetting Outcomes for Vegetation Communities Impacted by the Project

Impact and Offset Scenario	Impact Area (ha)	Cross Creek Offset Site (ha)	Esparanga Offset Site (ha)	Stringybark Creek Habitat Corridor (ha)	Total Offset Area (ha)	Offset Ratio
Woodland Impacts Offset With Woodland	223.7	51.7	211.4	27.8	290.9	1.3:1
Woodland Impacts Offset With Woodland and Regenerated DNG	223.7	367	303	94.6	764.6	3.4:1
Central Hunter Ironbark – Spotted Gum – Grey Box Forest Impacts Offset With Woodland and Regenerated DNG Areas	159.3	367	114.3	43.8	525.1	3.3:1

Table 5.7.5 includes consideration of mine rehabilitation outcomes in addition to the Biodiversity Offset Strategy for the Project for vegetation communities in an offsetting context.

Table 5.7.5 – Biodiversity Offset Package with Rehabilitation

	Area of Impact (ha)	Biodiversity Offset Strategy Total Offset Area Without Rehabilitation	Biodiversity Offset Strategy Total Offset Area Including Rehabilitation
Woodland Impacts Offset with Woodland, Regenerated DNG and Rehabilitation	223.7	764.6	1,023.6
Spotted Gum - Ironbark –Grey Box Forest Impacts Offset With Spotted Gum - Ironbark –Grey Box Forest, DNG and Spotted Gum - Ironbark –Grey Box Forest Rehabilitation Areas (like-for-like)	159.3	432.4	691.4
Spotted Gum - Ironbark –Grey Box Forest Impacts Offset With Woodland, DNG and Rehabilitation Using Similar Vegetation Communities	159.3	546.7	805.7

Note: 1) Consistent with the approach in the EIS and as discussed with DP&E and OEH, for this 'similar vegetation' calculation, rehabilitation was given a discounted per hectare ratio value of 0.5 (i.e. every 1 hectare of rehabilitated woodland is counted as 0.5 hectares for offsetting purposes).

The Biodiversity Offset Strategy for the Project includes 432.4 hectares of like-for-like Central Hunter Ironbark – Spotted Gum - Grey Box Forest EEC (woodland and regenerated Derived Native Grassland (DNG) areas) and 114.3 hectares of high conservation value vegetation communities with similarity to Central Hunter Ironbark – Spotted Gum - Grey Box Forest EEC.

Each of the three proposed land-based Biodiversity Offset Sites (Cross Creek Offset Site, Esparanga Offset Site and the Stringybark Creek Habitat Corridor) will be subject to passive and active regeneration activities in order to improve ecological value and threatened species habitat and increase the area of native woodland and forest that will be conserved in the long term.

5.8 Agricultural Resources

A comprehensive Agricultural Impact Statement (AIS) has been prepared by Umwelt to assess the potential impacts associated with the Project in relation to agricultural resources and enterprises (refer to **Appendix 12**). This detailed assessment has been prepared as required by the DGRs as outlined **Table 5.8.1**.

Table 5.8.1 - Agricultural Impact Statement Director-General Requirements

Agriculture Impact Statement Requirements	Section of Report
Soils and land capability.	**Section 5.8.2**
Landforms and topography.	**Section 5.8.4**
Other areas within the vicinity of the mine, including land within the nearby Ravensworth State Forest.	**Section 5.8.4.3**

Also as required by the DGRs, the AIS includes a specific focused assessment of the impacts of the Project on strategic agricultural land, having regard to the gateway criteria in the *Upper Hunter SRLUP* (2013). This assessment confirms that the Project will not impact strategic agricultural land and does not trigger the gateway criteria.

The AIS has been prepared in accordance with 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) (OEH 2013).

The AIS documents and maps existing agricultural resources, land use agricultural enterprises and production history in the Mount Owen Complex locality, defined in this case as a radius of 10 kilometres from the Project Area. For context, some information is also presented about the broader regional status and production of agricultural land uses.

The following sections provide an overview of the outcomes of the detailed AIS, included in full in **Appendix 12**.

5.8.1 Current Agricultural Enterprises

The area surrounding the Mount Owen Complex is part of the Glencore landholdings managed as a grazing enterprise.

Existing agricultural uses in the locality, outside the land owned by Glencore, are dominated by cattle grazing, but also include fodder crops on irrigated floodplain and terrace landforms along Glennies Creek (refer to **Figure 5.3**). There are also a number of rural residential properties and Camberwell Village is located within the Mount Owen Complex locality.

Ravensworth State Forest is located within the Project Area, but is not proposed to be disturbed as part of this Project.

A portion of the information gathered regarding current agricultural enterprises was obtained through consultation with Colinta Holdings Pty Limited (currently manage grazing on Glencore owned land, refer to **Section 1.3.1**) and two private landholders. Consultation was specific to the agricultural assessment and was aimed at learning more regarding the existing agricultural enterprises in the locality. Information collected as part of the broader consultation was also used in the AIS.

5.8.2 Soil Resources

Soil landscapes are defined by distinctive associations of terrain, soil and vegetation at the landscape scale, which provide an integrated picture of the physical character of the landscape.

For the Upper Hunter region, soil landscape mapping and descriptions were completed by Kovac and Lawrie (1991) at a scale of 1:250,000. Key conclusions from this regional scale information specific to the Project Area and locality include:

- other than the Hunter Soil Landscape which occurs on the floodplain and terraces of the Hunter River and its major tributaries (such as Bowmans Creek and Glennies Creek), the landscape is characterised by undulating to steep terrain, with erodible (susceptible to sheet and gully erosion), low fertility soils. Some higher fertility soils occur to the north of Singleton and the Glennies Creek Dam;
- soils are generally slightly to moderately acid;
- the minimum profile depth described for each soil landscape (35 to 40 centimetres) is widespread on upper to mid slopes; and
- lower slopes often have poorly drained soils with heavy clay B horizons.

Further details regarding regional scale mapping are provided in the AIS (refer to **Appendix 12**) and in **Section 5.1**.

5.8.2.1 Soil Sampling Program

A program of field observations and sampling of soils was conducted in the Proposed Disturbance Area to verify the results of regional scale soil mapping (Kovac and Lawrie 1991, OEH 2013, DP&I 2012a). Soil sampling was not required in the BNP and RERR Mining Area as these areas have previously been disturbed as part of approved operations. The soil sampling program included field based descriptions of soil materials and laboratory testing of A and B horizon materials from selected profiles / soil types. The objectives of this survey (September 2012, July 2013 and June 2014) were to:

- describe, classify and map the soil types within the Proposed Disturbance Area;
- assess the Land and Soil Capability (LSC) to determine the potential agricultural value of the Proposed Disturbance Area;
- verify the mapping of BSAL identified in the *Upper Hunter SRLUP* (DP&I 2012b) within the Proposed Disturbance Area; and
- analyse the suitability of the soils for use in rehabilitation.

As required by the *Guidelines for Preparing Agricultural Impact Statements* (DP&I 2012a) and the *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land* (OEH 2013), the survey and assessment has been conducted by qualified Umwelt soil scientists, including peer review by an experienced soil scientist who is a Grade 3 Certified Professional Soil Scientist (CPSS) by the Australian Soil Science Society.

Further details regarding the soil survey rationale and strategy, and peer review process, are provided in **Appendix 12**.

It should be noted that soil sampling was not carried out in the proposed Biodiversity Offset Areas. Desktop analysis of characteristics was conducted and supplemented by a site visit and surface soil inspection. Soil resources in the Offset Areas will not be modified by the Project.

5.8.2.2 Soil Landscapes and Profile Types

Four different soil types were identified within the Proposed Disturbance Area; Stratic Rudosol, Clastic Rudosol, Brown Sodosol and Brown Kurosol (refer to **Figures 5.29** to **5.31**). Representative soil profiles for each soil type are briefly described below in **Table 5.8.2**.

Table 5.8.2 - Representative Soil Profiles

Stratic Rudosol – LSC Class 4
This soil occurs on recently deposited alluvial landforms, along the floodplain and low terraces of Bowmans Creek. It has limited profile development from the surface to the subsoil.
Clastic Rudosol – LSC Class 7
This soil type occupies a relatively small area. The soils are young depositional materials associated with Bowmans Creek and tributaries of Main Creek. The principal profile feature is a gravel layer between the light textured A1 horizon (to 20-25 cm) and heavy clay B horizon.
Brown Sodosol – LSC Class 4-7
This soil type covers most of the Proposed Disturbance Area off the alluvial terraces. The soils have strong texture contrast profiles, with light textured topsoils (A1 and A2 horizon to 20 cm) overlying poorly drained, strongly structured subsoils which are dispersible.
Brown Kurosol – LSC Class 4-5
This soil type occupies a relatively small area. These soils are reasonably well drained sandy loam to clay loam topsoils with a strong texture contrast at 0.05 to 0.25 metres to a poorly drained, strongly structured sodic clay B-horizon which is also strongly acidic.

Rudosols were the most common soil type in the Hebden Road Upgrade section of the Proposed Disturbance Area and in the south-eastern portion of the North Pit Continuation area, associated with the tributaries of Main Creek. Sodosols were the dominant soil type in the proposed rail line area and remaining sections of the North Pit Continuation area (refer to **Table 5.8.3**). A small area of Kurosols occur on the eastern edge of the North Pit Continuation area.

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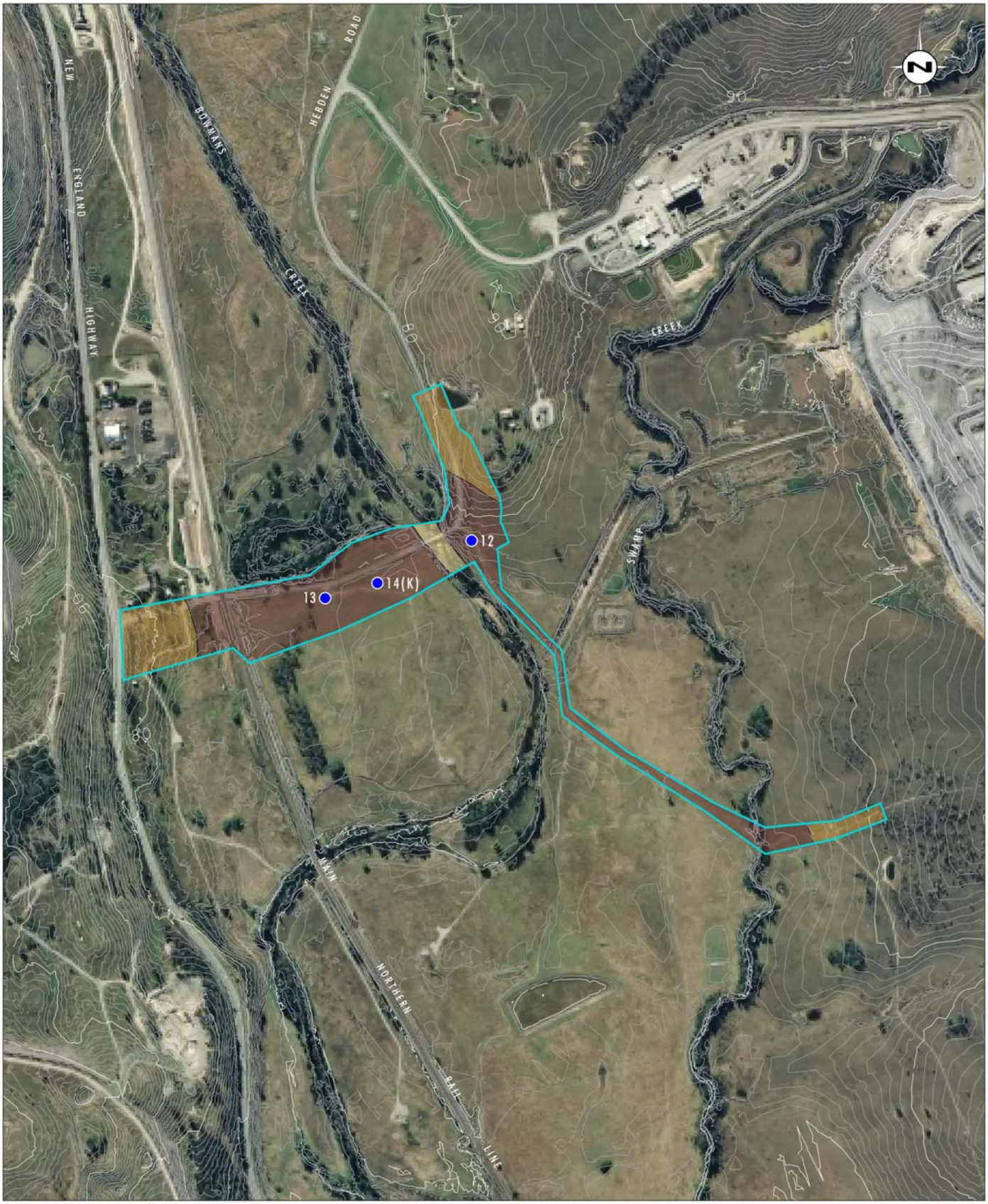

Image Source: Mount Owen (2013)
Data Source: Mount Owen (2014)
Note: Contour Interval 1m

0 100 250 500m
1:10 000

Legend

- Proposed Disturbance Area
- Brown Sodosol
- Clastic Rudosol
- Stratic Rudosol
- Soil Sampling Site

FIGURE 5.29

Proposed Hebden Road Upgrade Works Area - Soil Types

File Name (A4): R02/3109_883.dgn
20141008 12.10

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North Pit

North Pit Continuation

Eastern Rail Pit

18(A)
1
27
26
2
3
4
23(J)
22(F)
19(E)
24(D)
25(B)
20(L)
5
21(C)
7
6

Image Source: Mount Owen (2013)
Data Source: Mount Owen (2014)
Note: Contour Interval 1m

0 0.25 0.5 1.0km
1:20 000

Legend

- Proposed Disturbance Area
- Brown Kurosol
- Brown Sodosol
- Clastic Rudosol
- Stratic Rudosol
- Soil Sampling Site

FIGURE 5.30

Proposed North Pit Continuation Area - Soil Types

File Name (A4): R02/3109_884.dgn
20141008 15.47

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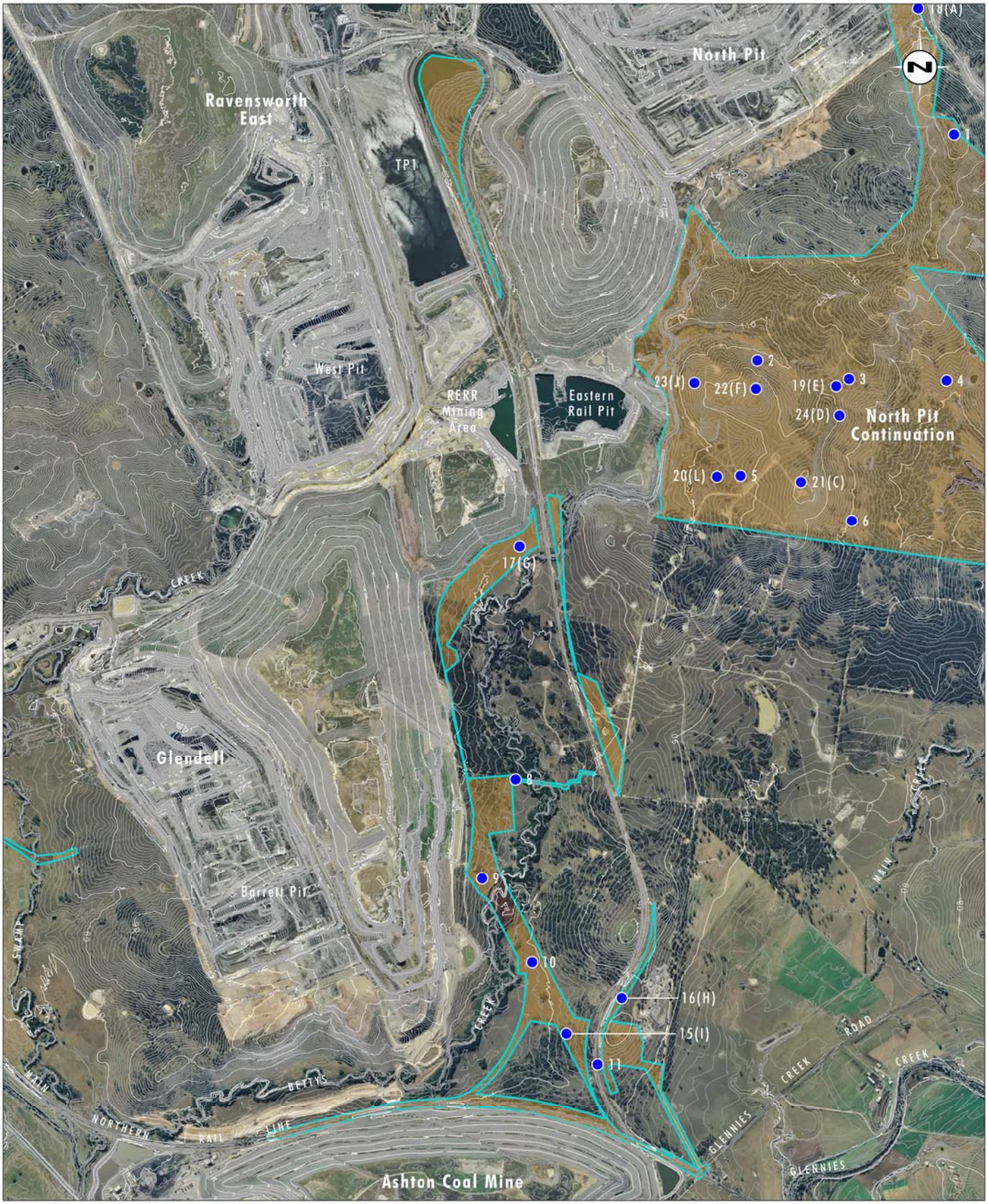

Image Source: Mount Owen (2013)
Data Source: Mount Owen (2014)
Note: Contour Interval 1m

0 0.5 1.0 1.5km
1:30 000

Legend

- Proposed Disturbance Area
- Brown Kurosol
- Brown Sodosol
- Stratic Rudosol
- Soil Sampling Site

FIGURE 5.31

Proposed Rail Upgrade Works Area - Soil Types

File Name (A4): R02/3109_885.dgn
20141008 15.49

Table 5.8.3 – Overview of Soil Types in the Proposed Disturbance Area

Soil Type		Soil Landscape	Land Area	
			Hectares	Percentage (%)
1	Stratic Rudosol	Hunter	15.8	3.2
2	Clastic Rudosol	Hunter, Bayswater	2.7	0.6
3	Brown Sodosol	Bayswater	461.8	95.2
4	Brown Kurosol	Bayswater	4.7	1.0
Total.			**485**	**100.0**

The *NSW Land and Soil Capability Assessment Scheme (Second Approximation)* (OEH 2013) considers a range of biophysical soil hazards. The most limiting hazard determines the overall LSC ranking of the soil. Details of the assessment of soil profiles in the Proposed Disturbance Area are included in **Appendix 12**.

With regards to the proposed Offset Areas, soil landscapes mapped as occurring within the Cross Creek Offset Area are Rosevale and Greenland; soil landscapes mapped as occurring within the Esparanga Offset Area are Ant Hill, Bow, Sandy Hollow and Lees Pinch; with the Bayswater and Rosevale soil landscape mapped within the Stringybark Creek Habitat Corridor.

Detailed descriptions of the soil landscapes occurring in the Proposed Disturbance Area and Offset Areas are included in **Appendix 12**.

5.8.2.3 Land and Soil Capability

Table 5.8.2 presents the LSC for the Proposed Disturbance Area, and relevant LSC descriptions are provided in **Table 5.8.4**. The most common limiting constraint is soil structure decline, followed by acidity and shallow soil depth. The fine sandy soil materials on the terrace of Bowmans Creek are susceptible to wind erosion when dry.

Based on this analysis, the Proposed Disturbance Area contains LSC Classes 4 to 7 which represent moderate through to very low capability land (refer to **Table 5.8.4** and **Figures 5.32** to **5.34**).

Table 5.8.4 - LSC Class Descriptions

LSC Class	General Definition	Present in the Vicinity of the Project Area (based on regional scale mapping)
Land capable of a variety of land uses (cropping with restricted cultivation, pasture cropping, grazing, some horticulture, forestry, nature conservation)		
4	**Moderate capability land**: 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 specialised management practices with a high level of knowledge, expertise, inputs, investment and technology.	Land mapped as Class 4 occurs in all directions around the Project Area, predominantly from the south-west to the east; with small areas of Class 4 land north and west of the Project Area.

Image Source: Mount Owen (2013)
Data Source: Mount Owen (2014)
Note: Contour Interval 1m

0 100 250 500m
1:10 000

Legend

- Proposed Disturbance Area
- Infrastructure Not Assessed
- LSC Class 4
- LSC Class 6
- LSC Class 7
- Soil Sampling Site

FIGURE 5.32

Proposed Hebden Road Upgrade Works Area
Land and Soil Capability

File Name (A4): R02/3109_886.dgn
20141008 15.49

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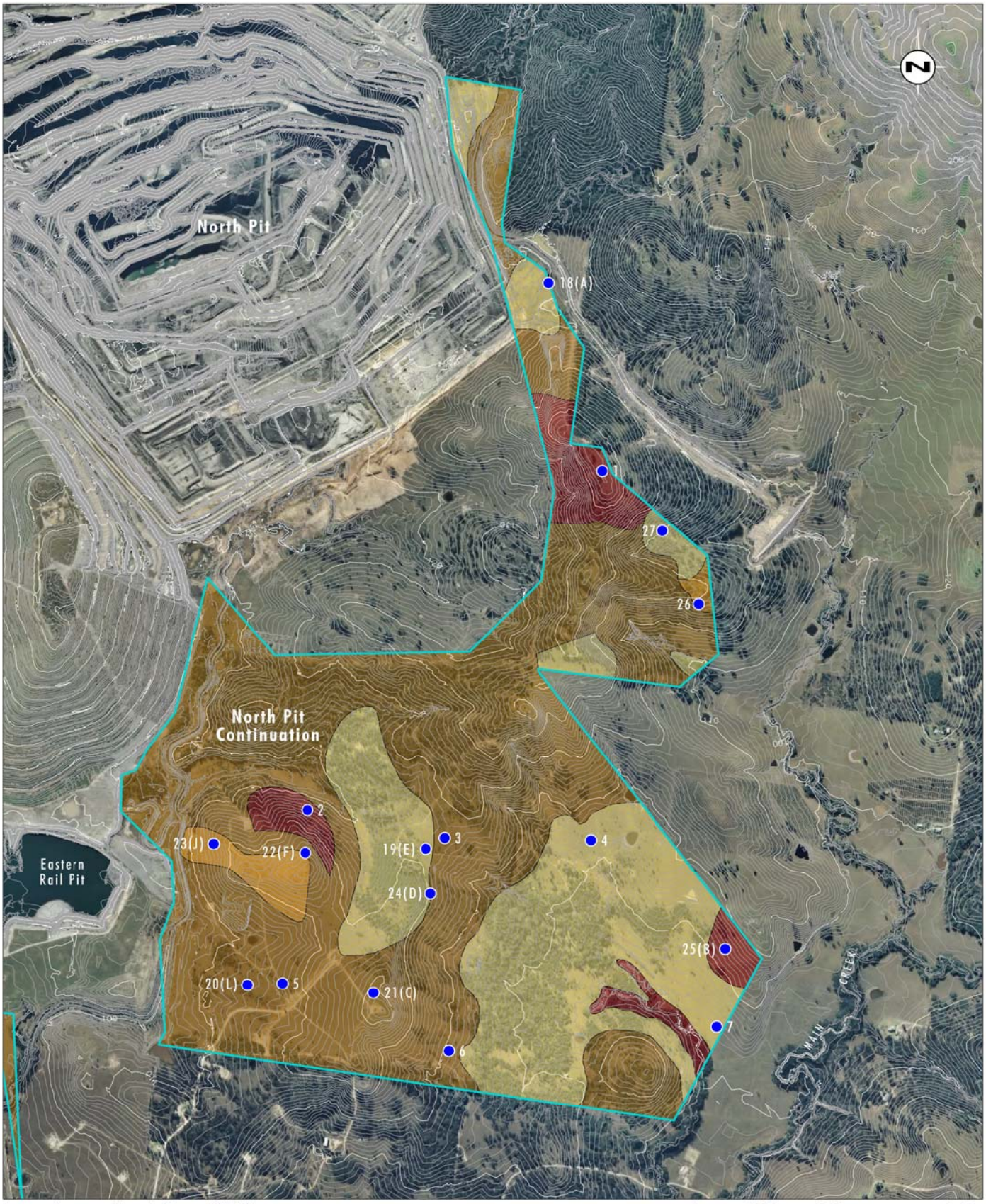

Image Source: Mount Owen (2013)
Data Source: Mount Owen (2014)
Note: Contour Interval 1m

0 0.25 0.5 1.0km
1:20 000

Legend

- Proposed Disturbance Area
- LSC Class 4
- LSC Class 5
- LSC Class 6
- LSC Class 7
- Soil Sampling Site

FIGURE 5.33

Proposed North Pit Continuation Area Land and Soil Capability

File Name (A4): R02/3109_887.dgn
20141008 15.50

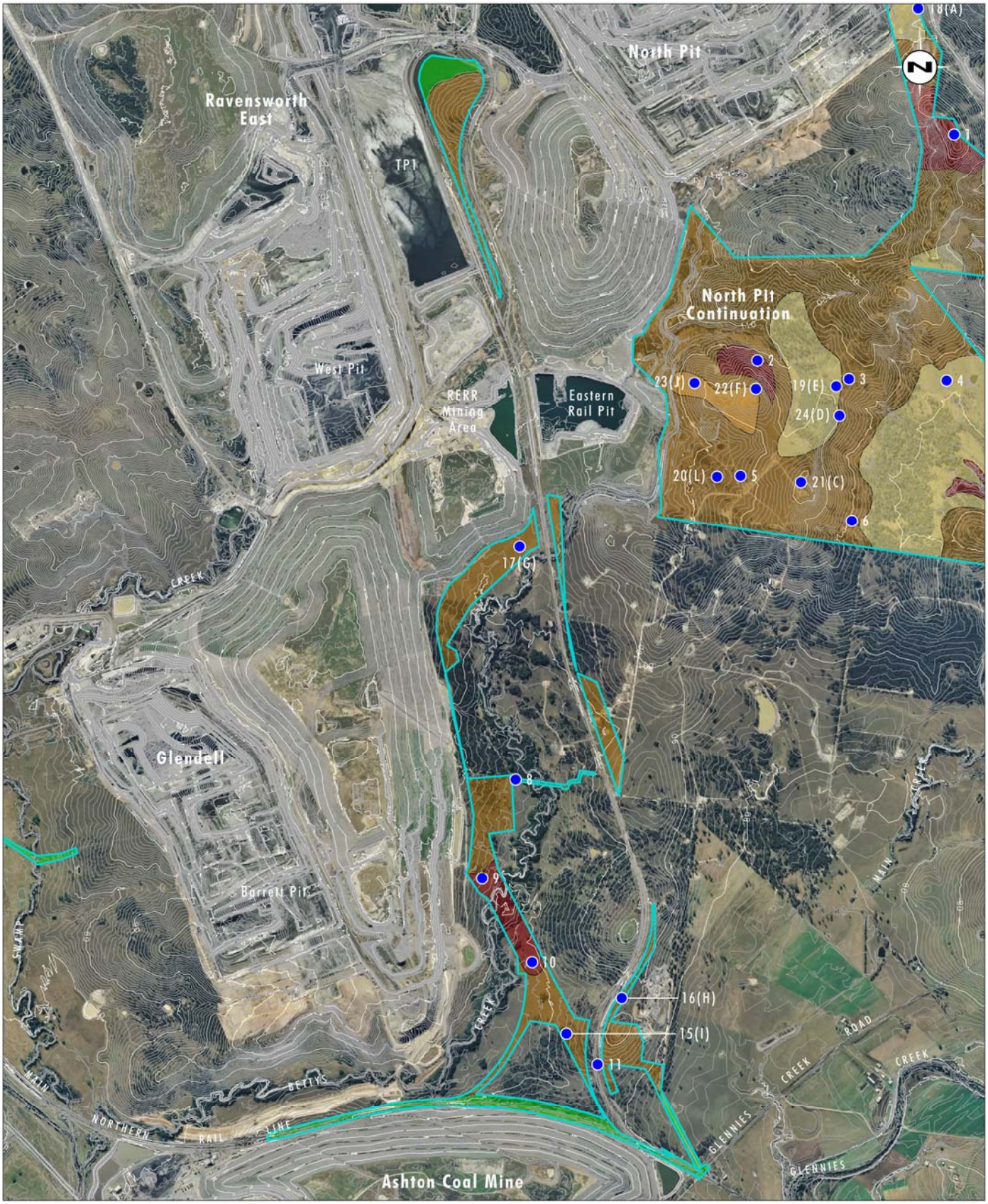

Image Source: Mount Owen (2013)
Data Source: Mount Owen (2014)
Note: Contour Interval 1m

0 0.5 1.0 1.5km
1:30 000

Legend

- Proposed Disturbance Area
- Infrastructure Not Assessed
- LSC Class 4
- LSC Class 5
- LSC Class 6
- LSC Class 7
- Soil Sampling Site

FIGURE 5.34

Proposed Rail Upgrade Works Area Land and Soil Capability

File Name (A4): R02/3109_888.dgn
20141008 16.00

Table 5.8.4 - LSC Class Descriptions (cont.)

LSC Class	General Definition	Present in the Vicinity of the Project Area (based on regional scale mapping)
5	**Moderate - low capability land**: 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.	Land mapped as Class 5 occurs in all directions around the Project Area and also occurs within the Project Area.
Land capable for a limited set of land uses (grazing, forestry and nature conservation, some horticulture)		
6	**Low capability land**: 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	Land mapped as Class 6 land is the dominant LSC class within the Project Area.
Land generally incapable of agricultural land use (selective forestry and nature conservation)		
7	**Very low capability land**: 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	Areas of land mapped as Class 7 are located to the east, north and north-west of the Project Area.

There is widespread potential for soil acidification across the Proposed Disturbance Area due to soils with low buffering capacity and low surface pH. These characteristics are associated with LSC Class 4 and 5 land. These limitations could be managed with the use of acid tolerant perennial pastures and / or the use of lime, but ongoing management practices or inputs are required to overcome constraints and maintain sustainable productivity.

There is widespread risk of soil structure decline across many of the Sodosol soils of the Proposed Disturbance Area. The majority of sampling sites recorded moderate surface soil sodicity which would require maintenance of surface soil vegetation cover to prevent erosion and inputs of gypsum to effectively manage the sodium levels. The subsoils were also strongly sodic and prone to dispersion adding to the limitations of these soils. These constraints are associated with LSC Class 6 land, which can have limited land uses such as grazing, forestry and nature conservation.

Class 7 land only occupies limited areas of the Proposed Disturbance Area where there are localised soil depth issues, including a gravel layer inhibiting rooting depth, and two sites (9 and 10) (refer to **Figure 5.34**), with very high surface Exchangeable Sodium Percentage (ESP) levels that may have been affected by previous land management activities that has caused the topsoil to have been lost through sheet erosion.

With regards to Offset Areas, LSC classes mapped as occurring within the Cross Creek and Esparanga Offset Areas and Stringybark Creek Habitat Corridor, as part of OEH mapping for the Upper Hunter SRLUP 2012, are Class 3 and Class 5 to 7.

5.8.2.4 Soil Fertility

Each soil type was assessed on the basis of soil fertility factors as classified by the Australian Soil Classification (ASC). The Stratic Rudosol soils associated with the Bowmans Creek floodplain and terraces are classified as moderately low fertility and yet are mapped at a regional scale as probable BSAL. Soil testing undertaken in the field and the laboratory at Sites 13 and 14 (refer to **Figure 5.29**) show that the typical indicators of inherent soil fertility, including Cation Exchange Capacity (CEC), Particle Size Analysis / Texture, and Organic Carbon, reinforce the ASC classification. CEC is moderately low (10-11 meq/100g), Particle Size Analysis identifies a relatively low clay percentage (13 per cent) in a fine loamy sand and Organic Carbon (Walkley Black) is moderate (2.89 per cent). The surface pH (Ca Cl_2) is 5.6 – 5.8 and, in combination with a low buffering capacity and mean annual rainfall between 550 and 700 millimetres, indicates a potential acidification risk which is identified as LSC Class 4.

The Clastic Rudosols are classified as low fertility under the ASC. This is also reinforced by laboratory testing of Sites 12 and 25 (refer to **Figures 5.29** and **5.30**) which measured a low CEC (7.2-7.4 meq/100 gm), a low clay percentage (10 per cent) and a moderately low Organic Carbon (1.91 per cent). The surface pH (measured in Calcium Chloride (CaCl2) solution) is 4.9 to 5.0 and the buffering capacity of the soil is low, indicating a potential soil acidification risk. Further, these soils are constrained by a 30 centimetre thick gravel layer within the root zone which effectively limits the depth of the soil, placing these soils in LSC Class 7.

The Brown Sodosols and Kurosols are classified as having moderately low fertility under the ASC. The sites tested within the Proposed Disturbance Area (refer to **Figures 5.29** to **5.31**) had Cation Exchange Capacities ranging from low (2.8 meq/100 gm) to high (35.6 meq/100 gm) where the high values had high sodium levels and low Calcium to Magnesium ratios associated with them. Surface pH (measured in Calcium Chloride (CaCl2) solution) was generally below 5, surface soils had low clay percentages, low buffering capacity and moderately low Organic Carbon levels. LSC Classes ranged from 4 to 7 with the constraints relating to potential acidification and soil structural limitations.

The fertility classes and LSC classification fail to meet the criteria for BSAL across the Proposed Disturbance Area.

With regards to the offset areas, soils in the Cross Creek Offset Area and Stringybark Creek Habitat Corridor are mapped at a scale of 1:250,000 by OEH 2013 as having moderately low to moderately high soil fertility, while soils in the Esparanga Offset Area are mapped as having low to moderately high soil fertility.

5.8.3 Strategic Biophysical Agricultural Land Verification

The Upper Hunter SRLUP (DP&I 2012b) identifies agricultural land that is considered to be of strategic significance because of its land capability, productivity or other economic and social value to the region. Within the locality of the Project Area, the strategic mapping undertaken for the Upper Hunter SRLUP (DP&I 2012b) indicates potential BSAL along the floodplains and terraces associated with Bowmans Creek, Glennies Creek and Hunter River.

This regional mapping indicates that the Proposed Disturbance Area associated with the proposed continuation of mining does not include any potential BSAL. A minor area of BSAL was mapped in the Hebden Road upgrade portion of the Proposed Disturbance Area. Mapping for the Upper Hunter SRLUP was conducted at the 1:250,000 scale, based on previous soil landscape and land and soil capability mapping, also at 1:250,000 scale. As described in previous sections, soil survey and soil testing (including soil structure, texture, pH, sodicity, CEC and soil fertility) was conducted across the Proposed Disturbance Area to

verify the soil types present and the actual LSC classes of the Project Area. The detailed soil analysis indicates that no land within the Proposed Disturbance Area meets the criteria to be a LSC Class better than Class 4. As outlined in the SRLUP LSC, Class 4 land is not BSAL land. Moreover, no land in the Proposed Disturbance Area meets the criteria for fertility relevant to BSAL land. There is therefore no BSAL land in the Proposed Disturbance Area.

The vast majority of land in the offset areas is mapped at the regional scale with LSC Class 4 or worse and no BSAL. Detailed desktop mapping of terrain in the offset areas and aerial photograph analysis indicate that these are appropriate assessments of the quality of agricultural land in the proposed Biodiversity Offset Areas.

Further details on BSAL verification are provided in **Appendix 12**.

5.8.4 Project Impacts on Agricultural Resources and 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. With management and mitigation measures in place, potential risks associated with the Project on agricultural resources, enterprises, infrastructure and industries are considered low to moderate. Further details are contained in the AIS (refer to **Appendix 12**).

5.8.4.1 Within the Proposed Disturbance Area

The agricultural resources of the Proposed Disturbance Area, which will be directly impacted by the Project, are entirely in the ownership of Glencore. The majority of the land is currently managed as temporarily revegetating land while a small amount (approximately 25 hectares) is currently managed for dryland cattle grazing by Colinta, on behalf of Glencore.

The Project will have a direct impact on LSC Class 4, 5, 6 and 7 land. Overall loss of currently used agricultural land in the south-eastern portion of the North Pit Continuation within Proposed Disturbance Area is approximately 25 hectares. The impacts on specific agricultural resources such as landform and soils, land and soil capability, physical movement of water away from agriculture and vegetation and biodiversity are discussed in **Appendix 12**.

5.8.4.2 Within the Offset Areas

The agricultural resources (landforms, land and soil capability, access to water, etc) of the three biodiversity offset properties included as part of the Project will not be substantially impacted by the Project as the potential land use change involves regeneration of native vegetation with no change to soils, landform or water resources.

Land in the proposed offset areas is recognised to have high biodiversity value and high potential to enhance biodiversity value. On the basis of current government policy to protect remaining areas of EECs and other high biodiversity value aspects of the landscape, the biodiversity value of these properties is considered greater than the agricultural value. Use of the land for biodiversity conservation does not change its underlying agricultural resource value. Terrain, soil, water and water access will remain the same as now.

5.8.4.3 Surrounding the Project Area

The areas surrounding the Project Area are part of the broader land owned by Glencore, with the majority managed as a grazing enterprise.

Existing agricultural uses in the locality, outside land owned by Glencore, is dominated by cattle grazing, but also include fodder crops on irrigated floodplain and terrace landforms along Glennies Creek. There are also several rural residential properties and Camberwell village is located within the locality.

Three rural residential properties (totalling approximately 7 hectares) have been identified as meeting acquisition criteria based on potential noise and air quality impacts.

The Project will have a negligible impact on the agricultural resources of the locality. In particular:

- The Project will have a minimal impact on the availability of water resources for agriculture outside the Project Area. There will be small changes to the catchment area and flows from tributary creeks of Bowmans Creek and Glennies Creek. Both of these creeks have very large catchments, with flows from the creeks in and near the Project Area making up a very small proportion of the available water. The Project will not result in a loss of water quality in these creeks.

- The Project has no direct or indirect impact on the landforms of the locality of 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 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 Mount Owen locality and the region are driven by agricultural and social trends operating at a scale well beyond this locality.

5.8.5 Mitigation of Potential Impacts

Mount Owen is committed to maintaining agricultural production on land it currently owns and manages where this is appropriate from an environmental, safety and operational perspective. This approach has been demonstrated through Mount Owen's management of areas to date and also mitigates the potential cumulative impacts associated with the Project.

The proposed closure plan, final landform and final land use for the Proposed Disturbance Area includes:

- Maintaining agricultural use in the Hebden Road area, except for a very small area of land that will be used for the road and bridge upgrade. These works will improve road safety for residents and commercial enterprises (e.g. quarries) along Hebden Road, as well as improving road access to the Mount Owen Complex.

- Post-mining, the rail line may remain but the area used for construction during the rail upgrade will be regenerated to native vegetation. The North Pit Continuation Area will be rehabilitated primarily for native vegetation (woodland) which is consistent with the significant biodiversity connectivity values of the Project Area and continues the existing approved final land use strategy. Only approximately 25 hectares of the North Pit Continuation Area is currently used for grazing. Approximately 77 hectares within the North Pit Continuation will be focused on topsoil replacement, to achieve LSC Class 4 or 5 land. These parts of the post-mining rehabilitation will be revegetated with a mix of native and introduced pasture grasses as well as scattered woodland species and would be suitable for sustainable grazing uses.

- The Ravensworth East Mine will include areas to be rehabilitated with a focus on providing opportunities of connectivity for native woodland. Additionally, a substantial portion of Ravensworth East will be rehabilitated for future grazing opportunities. Rehabilitation in the RERR Mining Area will be focussed on opportunities for native woodland connectivity (refer to **Section 5.19** for further detail).

- It should be noted that three proposed Biodiversity Offset Areas, Cross Creek, Esparanga and Stringybark Creek Habitat Corridor, are also part of the overall Project and have a total area of approximately 767 hectares. These areas will be managed for biodiversity conservation, but their agricultural resources (such as landform, soil and water resources), will not be changed by the Project.

Mount Owen proposes to prepare and implement detailed management plans during operation and closure. These will set out final closure objectives and indicators, including landform, soil condition, vegetation, water management and land use. The Landscape Management Plan is the overarching Plan to guide future rehabilitation for agricultural and other uses. Land management for the Project will also include management of noxious weeds and feral animals and bushfire management. Plans will be prepared in consultation with relevant stakeholders from agencies and community. Ongoing monitoring of biophysical and other landscape parameters will be reported annually, so that progress towards post-mining agricultural resources and land use commitments can be tracked and management responses adapted as necessary.

5.9 Aboriginal Archaeology and Cultural Heritage

The Project Area is located within the traditional country of the Wonnarua people, 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.

An Aboriginal Cultural Heritage Assessment (ACHA) has been prepared 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 13a**).

Throughout all stages of the assessment process, 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 Plains Clans of the Wonnarua People (PCWP), the Wonnarua Traditional Custodians (WTC) and the Wonnarua Nation Aboriginal Corporation (WNAC) 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 Community RAPs, not being consulted by the PCWP, WTC and the WNAC formed a fourth working group and were consulted by ACHM and Mount Owen to develop their management recommendations and measures relevant to their cultural significance values statements and assessment concerns. 'Community RAPs' is the term used for members of this fourth consultation group.

The full cultural heritage assessment of the WTC does not inform the ACHA as key aspects of this assessment have been requested by the WTC to be kept confidential for cultural and sensitivity reasons. The Community RAPs, the PCWP and the WNAC reports as well as the disclosed summaries of values and recommendation information from the WTC identify the significance of Aboriginal cultural heritage on and around the Project Area. The understanding of significance and the management recommendations provided by the Knowledge Holders and Community RAPs have also informed Mount Owen in its development of cultural heritage management recommendations. The publicly disclosed documents are included in full in the ACHA (refer to **Appendix 13a**).

The full WTC report will be provided separately to DP&E and OEH on a confidential basis for consideration as part of the assessment of the Project.

The Knowledge Holder groups and Community RAPs also participated in an Aboriginal Archaeological Values Assessment, prepared by OzArk Environmental and Heritage Management (OzArk), to assess the scientific (archaeological) value of sites and landscapes identified within the Project Area and provide management recommendations for identified and potential Aboriginal sites. The Aboriginal Archaeological Values Assessment is integrated with the ACHA in **Appendix 13b**.

An overview of these assessments is provided in this section.

5.9.1 Assessment Approach

The ACHA and Aboriginal Archaeological Values Assessment have been aligned to:

- the DGRs for the Project;
- *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC 2005b);
- the principles of The Burra Charter (Australia ICOMOS 1999);
- *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW 2010);
- the key elements of the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH 2011b); and
- the *Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW* (OEH 2010).

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 aim of the ACHA was to document the range of Aboriginal cultural values of the Project Area as identified through consultation with the RAPs and through the integration of historic and archaeological information relating to the Project Area, as informed by the Aboriginal Archaeological Values Assessment.

A flow chart of the process followed is shown on **Figure 5.35**.

The DGRs for the Project required an assessment of Aboriginal cultural heritage (including both cultural and archaeological significance) (refer to **Table 5.9.1**) which must:

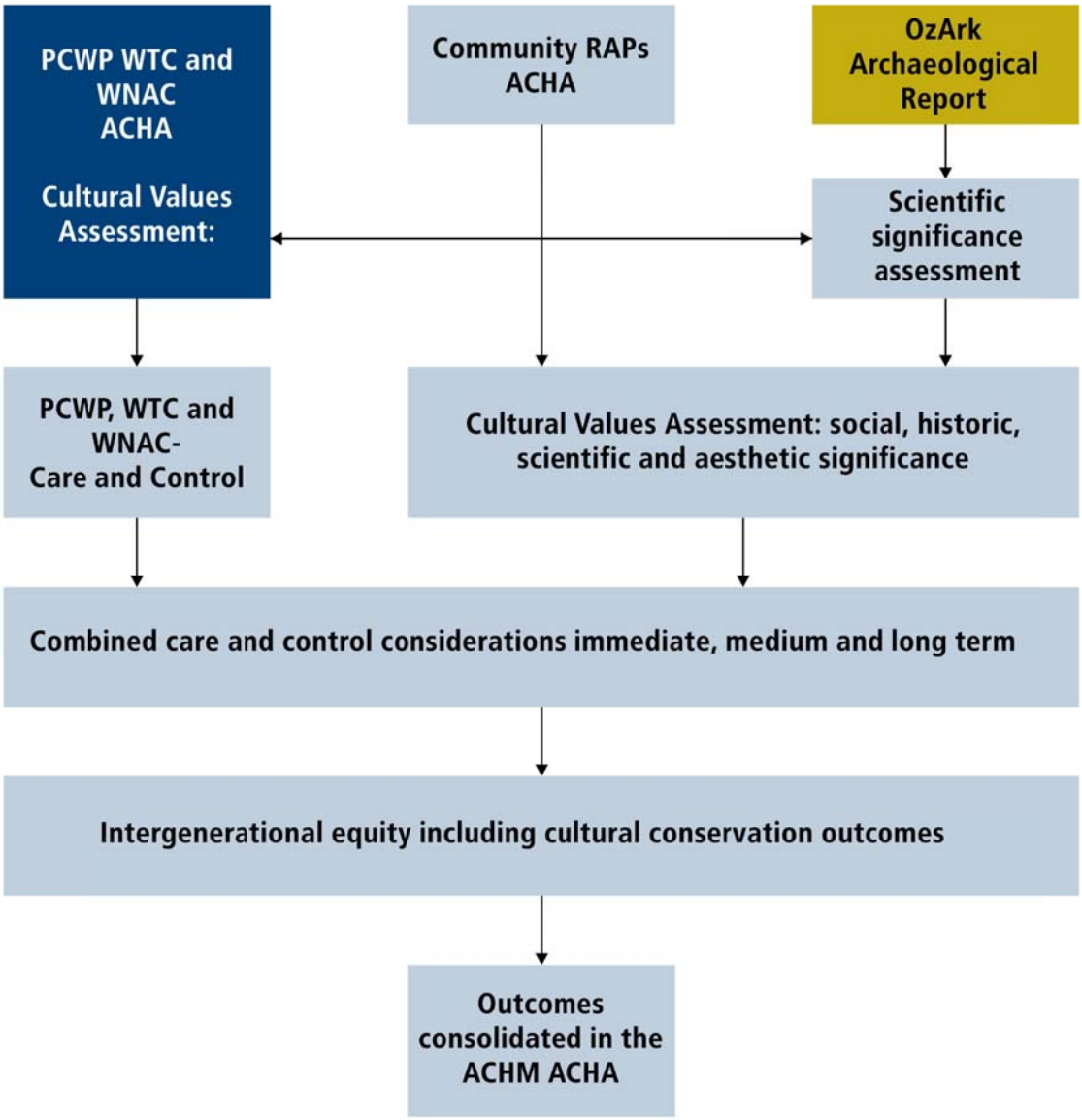

FIGURE 5.35

Integrated ACHA Approach

Table 5.9.1 - Aboriginal Cultural Heritage Assessment Director-General Requirements

Aboriginal Cultural Heritage Assessment Requirements	Section of Report
Demonstrate effective consultation with Aboriginal communities in determining and assessing impacts, and developing and selecting mitigation options and measures.	**Section 5.9.2**
Outline any proposed impact mitigation and management measures (including an evaluation of the effectiveness and reliability of the measures).	**Section 5.9.7**

5.9.2 Consultation Process

Consultation with the Aboriginal community was undertaken with reference to the relevant DEC 2005b and DECCW 2010 guidelines and in accordance with the principles of The Burra Charter (Australia ICOMO 1999).

Consultation for the Project has involved four stages as outlined below:

- **Stage 1:** Mount Owen conducted formal notification of the proposed Project and the ACHA process, and provided the opportunity for Aboriginal parties to formally register their interest in the Project.

- **Stage 2:** Initial Project consultation and briefings were undertaken with RAPs which included field visits to review the Proposed Disturbance Area. 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. A range of consultation forums were used during this process. Stage 2 also included briefings of the WLALC, PCWP, WTC and WNAC.

- **Stage 3:** Mount Owen, OzArk and ACHM conducted further consultation that refined the cultural heritage assessment approach with the Community RAPs. The approach actively involved the Community RAPs in the assessment of their cultural heritage values, the likely Project impacts, if approved, and the development of management measures.

  As part of the assessment approach, Mount Owen also conducted regular consultation and provided support and advice to the PCWP, WTC and WNAC in relation to the Project, and information requirements in relation to the preparation of their separate ACHAs. To assist the groups, Mount Owen also provided access to materials and land to enable them to assess their cultural heritage values, the likely Project impacts, and if approved, their management measures.

  Elders also provided comment on site specific and cultural, social, historic and aesthetic values, which included the value of archaeological and cultural sites, flora and fauna and landscape features to inform the assessment and management measures. This process was assisted by organised bus tours and site visits of cultural sites for the benefit of the RAPs and their Elders.

  Mount Owen conducted further feedback sessions at the end of Stage 3 to review the Community RAPs, PCWP, WTC, WNAC and the WLALC values and recommendations with them, prior to the issue of the draft ACHA report for its 28 day review period. These feedback sessions included a presentation of Aboriginal Archaeological Values Assessment and recommendations by OzArk. This approach provided the opportunity for all RAPs to discuss the draft ACHA reports and recommendations and provide further comment on Aboriginal cultural heritage values and management measures prior to issuing the report for review.

- **Stage 4:** The draft ACHA, which included the Aboriginal Archaeological Values Assessment Report, was issued to the RAPs for the required 28 day review period. Mount Owen, OzArk and ACHM conducted further consultation in relation to the RAPs review of the Project's draft cultural heritage assessment report, and considered feedback in finalising the ACHA. Throughout the course of the Project's consultation, 60 Aboriginal parties registered an interest in the Project. This included 57 parties registering an interest during the formal Stage 1 registration period and 3 parties registering an interest during the course of the assessment process. The 60 RAPs included:
    - three Knowledge Holder groups (PCWP, WNAC and WTC) representing many of the registered RAPs and other group members and elders;
    - the WLALC; and
    - 26 individual Aboriginal parties (Community RAPs), not represented by the above groups).

A full list of all RAPs is contained in **Appendix 13a**.

As outlined in **Section 1.2**, the optimisation of the North Pit mine plan resulted in the need to assess an additional 21 hectares to the Proposed Disturbance Area that was not previously assessed by the Knowledge Holders and Community RAPs as part of the initial cultural heritage and archaeological assessments.

Accordingly, the Knowledge Holders and Community RAPs were notified of this change in April 2014 and additional survey from both an archaeological and cultural heritage perspective was undertaken in April to July 2014. Post the completion of the fieldwork, further consultation with the Knowledge Holders and Community RAPs was undertaken and an addendum to the 2013 ACHA, including a summary of the results of the archaeology survey, was provided to the Knowledge Holders and Community RAPs for a 28 day review period in July / August 2014. The Knowledge Holders and Community RAPs did not provide any comments as a result of this 28 day review period. For further details of the consultation refer to **Appendix 13a** and **13b**.

All Knowledge Holders and Community RAPs were invited to participate in the assessment process from the time of their registration, with extensive consultation undertaken over 21 months to inform Project design, the ACHA and the broader environmental assessment of the Project. Participation opportunities have been provided through:

- small and large group workshops;
- individual meetings including site tours;
- development of 3 independent cultural heritage values assessments by WTC, PCWP and WNAC Knowledge Holder groups;
- 6 days of workshops for the Community RAPs;
- archaeological investigations including survey and test excavation fieldwork onsite;
- walks on Country; and
- general correspondence via phone and email.

Throughout the Project, information was also provided to the Knowledge Holders and Community RAPs in formal meetings and presentations and via mail outs and newsletters.

Full details of the consultation process undertaken in relation to the ACHA are contained in **Appendix 13a**. 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 Mount Owen and / or ACHM, or through the preparation of the three independent reports of the PCWP, WTC or the WNAC. These four sources of information provided the opportunity to identify a range of Aboriginal cultural values of the Proposed Disturbance Area and levels of attachment. This included social values, historic values, scientific values and aesthetic values.

The approach employed by Mount Owen allowed 156 individual Aboriginal community members to contribute to the ACHA process and its outcomes, many of which are Knowledge Holders and Elders.

Mount Owen, ACHM, OzArk and Umwelt would like to thank the Knowledge Holders and Community RAPs for the participation in and contribution to this assessment process.

5.9.3 Previous Aboriginal Heritage Studies

The Project seeks to minimise additional disturbance through the use of existing facilities and operational areas. An extensive history of Aboriginal cultural heritage and archaeological assessments has been conducted at Mount Owen 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 13b** 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 a number of recorded archaeological sites.

Within the Proposed Disturbance Area, 18 recorded sites have been previously salvaged either by a surface collection of artefacts or by manual archaeological investigation. The majority of these sites were associated with Bettys Creek and its environs, although two sites associated with Bowmans Creek are also included. In addition, there have been many areas where grader scrapes have occurred.

These approved salvage programs were conducted to mitigate the loss of archaeological values from approved mine-related impacts. The salvage programs were conducted by qualified archaeologists in conjunction with Aboriginal community representatives and the works have amassed much detailed and useful knowledge about the Aboriginal past including areas within the Proposed Disturbance Area.

The result of this previous archaeological salvage has had the effect of diminishing the numbers of artefacts extant in the Proposed Disturbance Area and the disturbance of the ground, in discrete areas, through manual excavation and grader scrapes.

The areas covered under previous salvages are summarised in **Table 5.9.2** below and shown in **Figure 5.36**. The only land of the Proposed Disturbance Area that has not been subject to previous investigation and associated salvage works is the south-eastern portion of the North Pit Continuation and the Hebden Road upgrade works.

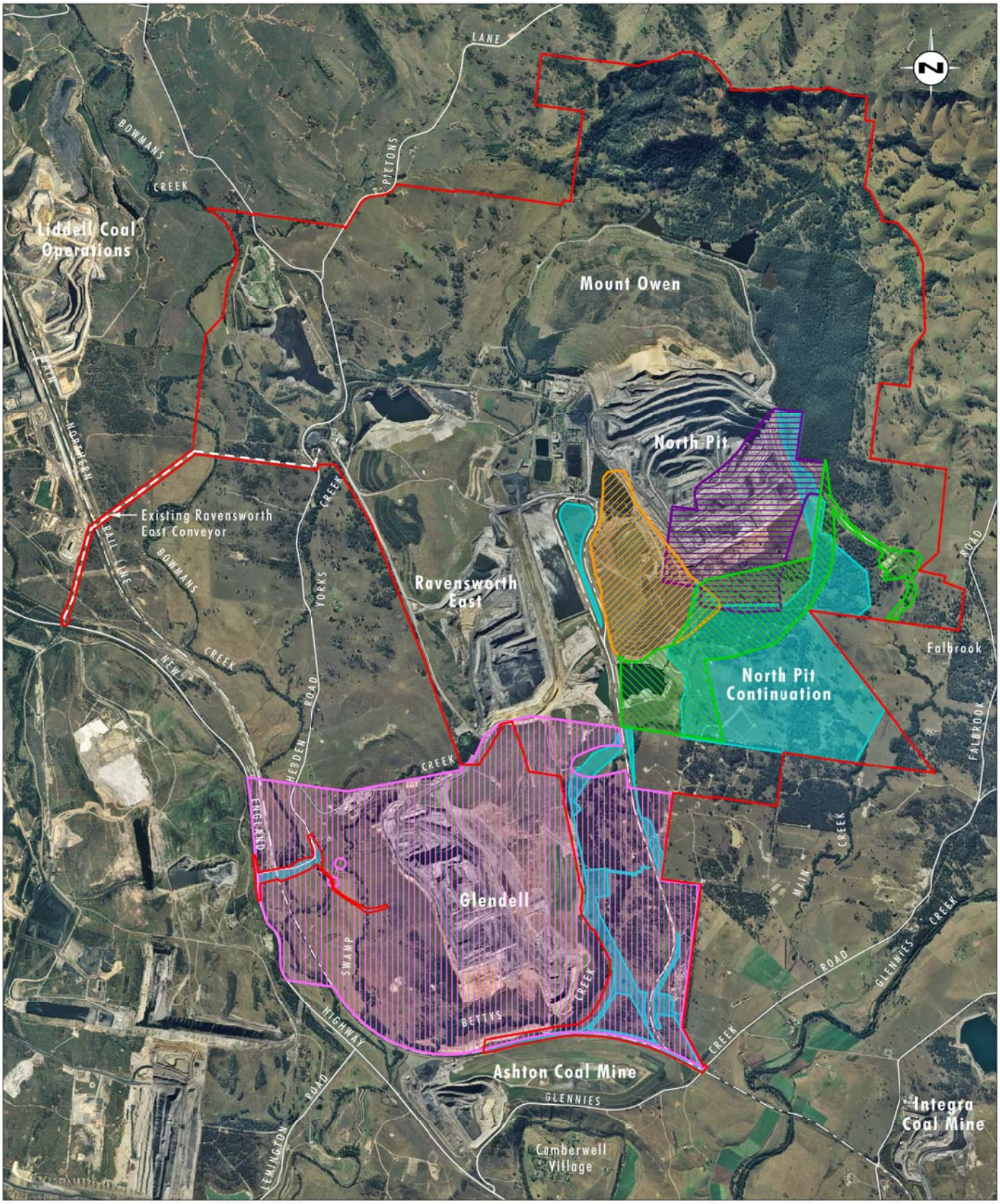

Image Source: Mount Owen (2012-2013)
Data Source: Mount Owen (2014)

0 1 2 3 km
1:60 000

Legend

- Project Area
- Proposed Disturbance Area
- Extension Area AHIP Boundary #1762
- West Dump AHIP Boundary #2131
- Mount Owen Operations Area AHIP Boundary #2267
- Glendell Project Area AHIP Boundary #2267

FIGURE 5.36

Previous AHIP Salvage Areas in Relation to Proposed Disturbance Area

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20141008 16.01

Table 5.9.2 – Total Area Subject to Existing AHIPs and the Proportion of the Mount Owen Proposed Disturbance Area Subject to Existing AHIPs

AHIP Area	Total Area (Hectares)	Mount Owen Proposed Disturbance Area (Hectares)
Extension Area AHIP Boundary #1762	245.9	23.3
Glendell Project Area AHIP Boundary #2267	1351.1	67.9
Mount Owen Operations Area AHIP Boundary #2267	161.1	119.9
West Dump AHIP Boundary #2131	234.2	12.1
Total	1,992.3	223.2

5.9.3.1 Existing Conservation Area and Management / Conservation Zones

The Mount Owen Complex has previously developed an Aboriginal Cultural Heritage Management Plan (ACHMP) in consultation with OEH and the local Aboriginal community. In 1996, Mount Owen established the Yorks Creek Voluntary Conservation Area (VCA) (refer to **Figure 5.37**), which is subject to a formal Conservation Agreement set up under the NP&W Act. This area, covering 28.5 hectares, provides for protection of Aboriginal objects and places within the area and access arrangements for members of the RAPs.

In 2005, Mount Owen suggested to the then Department of the Environment and Conservation (DEC) that the value of the existing Yorks Creek VCA could be further enhanced if remediation works were undertaken within the upper reaches of the Yorks Creek catchment, including the existing Yorks Creek VCA, in relation to the Glendell project. A 220 hectare area of the Yorks Creek catchment was identified as the Yorks Creek Enhancement Project Area. The Yorks Creek Cultural Landscape Restoration Project enhanced the existing VCA and involved the restoration of the upper reaches of Yorks Creek. The project commenced in 2005 and involves a partnership between Mount Owen and the local Aboriginal community to implement management and rehabilitation actions to manage land degradation issues such as soil erosion, fire management, water management and interaction of rehabilitation practise with existing aboriginal sites.

The Yorks Creek VCA, supported by the Yorks Creek Enhancement Project Area, is seen by Mount Owen as an important cultural conservation area in the Project Area and provides the opportunity to build upon this commitment to enable the enactment of a number of care and control and intergenerational equity recommendations endorsed by the RAPs through the ACHA process (refer to **Section 5.9.7**).

5.9.4 Cultural Heritage Values

The region surrounding the Project Area is an area that holds high cultural value for Wonnarua people. Bowmans Creek, Glennies Creek and the St Clair Mission in particular are of great importance to virtually all of those involved in the ACHA. The wider landscape surrounding the Project Area has deep meaning to Wonnarua people.

Hence many of the values expressed by members of the Aboriginal community consulted related to the wider region rather than the Project Area specifically. Connection to St Clair Mission and to other known significant places within the region (i.e. Glennies Creek, Baiame's Cave at Mt Yengo) were also strongly expressed.

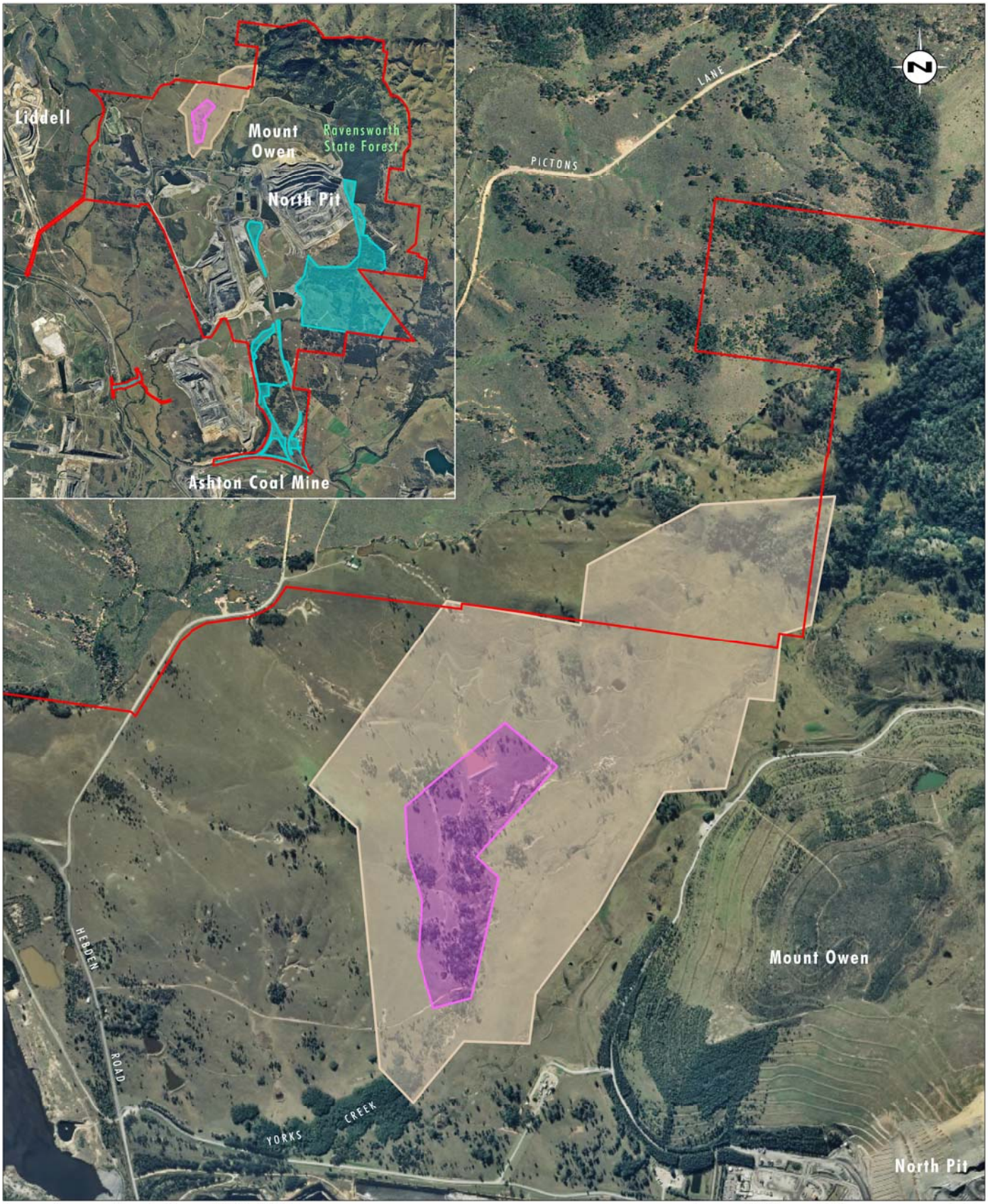

Image Source: Mount Owen (2012-2013)
Data Source: Mount Owen (2014)

0 0.25 0.5 1.0km
1:20 000

Legend

- Project Area
- Proposed Disturbance Area
- Yorks Creek VCA
- Yorks Creek Landscape VCA Remediation Area

FIGURE 5.37

Mount Owen Cultural Heritage Conservation Areas

File Name (A4): R02/3109_716.dgn
20141008 16.02

There was a strong sense of loss and longing, in addition to a variety of expressions of 'connectedness' and 'belonging' to landscapes, waterways, vegetation and the animal communities of the region.

There was a feeling of celebration in those who were speaking for the land today in having survived 200 years since settlement and adapted and overcome this adversity.

Almost all of the RAPs expressed a strong connection to the archaeological sites which occur throughout the Project Area and the wider region in general.

There was a common theme expressed in voicing a concern for the landscape and the continued impact that mining has on Wonnarua land. There was feeling of ‘powerlessness’ of the Aboriginal community when faced with decisions being made regarding this impact.

The destruction of landscapes, including the associated physical, spiritual, and natural values is not condoned by the Aboriginal people. One theme often repeated in the ACHA is the concern that contemporary Aboriginal communities have for the opinion of future generations and the overwhelming fear that people in the future will think the people of today stood by and watched their 'country' being 'destroyed' without defending it.

Many of the Aboriginal community were also deeply concerned about the existence of 'massacre sites' within the former Ravensworth Estate. There is very little supporting historic evidence regarding the actual location of any such sites, despite this being expressed strongly as 'stories' and cultural knowledge held by a knowledge holder. All available evidence indicates that the area is outside, and a number of kilometres from, the Project Area.

The ACHA found evidence of connection to apical ancestors who originate from within Wonnarua country. There is little evidence of any continuing traditional practices or observances of ritual or ceremony within the Project Area, which could be directly attributed to the post-European settlement disruption and dislocation of traditional Aboriginal culture throughout the Hunter Valley.

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 attachment to place is one which is predominantly of contemporary association rather than traditional knowledge, custom, lore or practice. There is traditional knowledge and a strong historical connection expressed by one of the Knowledge Holder groups, however much of the other disclosed information expressed of the Project Area is more historic in nature.

It is 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 by all to be of lower significance.

Positively, the feedback from the Aboriginal community highlighted the benefits of the ACHA process. Participants describe the process as having empowered the groups involved by having provided the opportunity for the Knowledge Holder groups to write their own cultural values assessments, and discuss how this process has benefited the groups as a whole.

5.9.4.1 Conclusion

The wider cultural landscape surrounding the Project Area is of high cultural and historical significance to Wonnarua people. The historical associations with early settlement, conflict, dispossession and survival are important, and the nature of the area as a surviving cultural landscape of significance to numerous members of the Wonnarua people. Overall, the cultural significance of the wider region is considered to be high.

The ACHA has ascertained that there are only 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 irreversibly altered the landscape. The archaeological sites investigated within the Project Area are primarily of low significance. With these extant archaeological sites and the remnant cultural landscape within the Project Area having undergone considerable modification since European settlement, the Project Area has a lower cultural significance than the surrounding region.

5.9.5 Scientific (Archaeological) Significance

The Aboriginal Archaeological Values Assessment report prepared by OzArk is included as **Appendix 13b**.

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 10 years.

5.9.5.1 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 5.9.2**, and commenced in September 2012. Community RAPs, PCWP, WTC, WNAC and the WLALC were involved in all facets of the assessment including a review of survey and test excavation methodology, participation in field survey and test excavation program, and site identification and recording.

Community RAPs, PCWP, WTC, WNAC and the WLALC were provided a draft copy of the Aboriginal Archaeological Values Assessment report for 28 days of review and comment, as an appendix to the draft 2013 ACHA.

The Knowledge Holders and Community RAPs were also provided with a summary of the results of the 2014 survey in an addendum to the 2013 ACHA, which was issued for an additional 28 day review period in July 2014.

5.9.5.2 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 ten days in November and December 2012 and again over one day in April 2014. The survey was undertaken with the assistance of representatives from the three Knowledge Holder groups and a rotating roster amongst the Community RAPs.

The Knowledge Holder groups and the Community RAPs present felt that there had been adequate survey of the Proposed Disturbance Area, although some locations were seen as requiring test excavation. The OzArk archaeologist suggested the area around MOCO OS-04 (refer to **Figure 5.38**) be subject to test excavation, and following discussions with RAPS, all agreed that another location appropriate to test excavate, would be adjacent to MOCO OS-03 (refer to **Figure 5.38**). The test excavation took place over a period of five days from 11 to 15 March 2013 with the participation and assistance of RAPs.

umwelt

Mount Owen
MOCO IF-4
MOCO IF-5
MOCO OS-01
MOCO IF-1
MOCO IF-2
MOCO IF-3
MOCO IF-21
MOCO OS-02
MOCO IF-22
MOCO IF-6
MOCO OS-03
Ravensworth East
MOCO IF-7
MOCO Extension Site #37-3-0649
MOCO IF-8
MOCO IF-9
MOCO IF-10
North Pit Continuation
MOCO IF-11
MOCO IF-13
MOCO IF-12
MOCO IF-15
MOCO IF-14
MOCO OS-04
MOCO Extension Site #37-3-0611
MOCO OS-05
MOCO IF-16
MOCO OS-06
#37-3-0985
MOCO OS-10
Glendell
MOCO IF-20
MOCO IF-19
MOCO OS-11
MOCO OS-07
MOCO OS-08
MOCO Extension Site #37-3-0600
MOCO IF-17
MOCO IF-18
MOCO OS-09
Ashton Coal Mine
HEBDEN ROAD
CREEK
MAIN
NORTHERN SWAMP
NEW ENGLAND HIGHWAY
RAIL LINE
BETTYS
LEMINGTON ROAD
GLENNIES
ROAD
CREEK
MAIN
CREEK
CREEK
CREEK
GLENNIES

Image Source: Mount Owen (2013)
Data Source: Mount Owen (2014), OzArk (2013)

0 0.5 1.0 2.0km
1:40 000

Legend

- Project Area
- Proposed Disturbance Area
- Artefact Scatter
- Extensions to Previously Recorded Sites
- AHIMS Archaeological Site
- Isolated Find

FIGURE 5.38

Recently Recorded Archaeological Sites within the Proposed Disturbance Area

File Name (A4): R02/3109_693.dgn
20141008 16.02

In addition to this, OzArk's archaeologists supported the RAPs and knowledge holders in the field, during March and May 2013, while undertaking cultural values assessments to show where the sites are located and to be generally on hand to answer questions.

5.9.5.3 Survey Results

The survey recorded 42 sites within or adjacent to the Proposed Disturbance Area comprising of 11 artefact scatters and 25 isolated artefacts three additions to previously recorded sites, two of which have been salvaged in the past. (refer to **Figure 5.38**). Additionally, three previously recorded sites were also identified.

Of these 39 sites, 31 will be directly impacted by the Project and eight will be avoided by the Project as they are located outside of the Proposed Disturbance Area. In addition, there are three previously recorded sites within the Proposed Disturbance Area that will also be directly impacted. As such, a total of 34 sites will be directly impacted and eight newly recorded sites will be avoided.

5.9.5.4 Archaeological Significance Assessment

All newly recorded Aboriginal archaeological sites were assessed for their archaeological (scientific) significance. Of the previously recorded sites, only the sites within the Proposed Disturbance Areas were assessed for their archaeological significance.

The overall scientific significance of sites within the Proposed Disturbance Area has been lowered due to:

- wide-spread soil loss that affects nearly all portions of the Project Area and surrounding locality;
- major disturbances from agricultural activities and approved mining activity including built infrastructure, stockpiles, tracks, the diversion of water away from creeks and other mine related impacts such as revegetation programs;
- the archaeological landscape within the Proposed Disturbance Area being fragmented by approved mining; and
- the varying degrees of archaeological salvage that has been carried out.

No areas within the Proposed Disturbance Area have been assessed to have high or moderate scientific significance.

The majority of sites recorded during this assessment have been assessed as having low scientific significance. In most cases this is because the sites are low density artefact scatters or isolated finds located in landforms with thin A Horizon soils where further subsurface archaeological deposits are unlikely. In some cases the artefacts may be more numerous but erosion has affected a large percentage of the site and the visible artefacts are displaced and of limited archaeological value.

Three sites have been assessed as having low-moderate scientific significance. Two of these sites are artefact scatters (MOCO OS-4 and Extension to site #37-3-0611), which have been assessed at a higher value as there is the possibility of further subsurface archaeological deposits at these locations although these deposits are likely to contain a low density of artefacts. The third site (MOCO IF-16) attains this level of significance due to the rarity of the artefact type, rather than its association to other artefacts or to subsurface contexts.

5.9.6 Aboriginal Cultural Heritage Impact Assessment

The Project would directly impact 34 archaeological sites if approved, consisting of 16 artefact scatters and 18 isolated finds. A further 8 sites were identified during the survey, within the Project Area however these will not be impacted.

The Project may result in indirect impacts on Aboriginal cultural heritage values. The indirect impacts identified by the Knowledge Holders and Community RAPs included:

- difficulty in remembering the landscape as it was prior to mining;
- difficulty for Wonnarua people in accessing much of the land in the Hunter Valley due to private ownership and / or mining; and
- regardless of the current condition and / or status of the land in question, Wonnarua people still feel a direct connection to the country of their ancestors, which would be further disrupted by more mining.

The predicted direct and indirect impact on the Aboriginal cultural heritage values of the Proposed 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.

5.9.7 Aboriginal Cultural Heritage Management Measures

The management measures proposed for the Project align to the Principles of the Burra Charter and to the Aboriginal Community Wellbeing Toolkit (OEH 2013) and criteria from OEH. As a result of this assessment process, five of the eight wellbeing principles have been identified as priority areas most aligned to the context of the Project. The five principles most aligned are described as the following:

- Access to Country.
- Sense of Community.
- Cultural and Identity.
- Leadership, empowerment and influence.
- Education and learning.

These principles, in conjunction with the consultation outcomes with the Knowledge Holders and Community RAPs, have informed the development and evaluation of management measures considered for the Project. The Project ACHA management measures were based on the key themes and values that have been asserted through the ACHA process, including:

- the region has high historical values for the RAPs and has high cultural significance to the Wonnarua people;
- the region is an area where there has been recorded conflict between settlers and Aboriginal parties;

- the creeks in the region (in particular Bowmans Creek and Glennies Creek) are significant travel routes as identified by some of the RAPs;

- Bettys Creek is considered significant to some of the RAPs, although the creek has been the subject of 3 approved diversions known as the Upper, Middle and Lower Bettys Creek diversions. The only remaining remnant of the creek is between the middle and lower diversions, immediately east of the Glendell overburden emplacement area;

- the Project has a Proposed Disturbance Area of 381 hectares for mining and 104 hectares for infrastructure (such as access tracks and laydown pads) which will directly impact 34 Aboriginal sites;

- there are no identified sites of medium or high significance scientific aboriginal sites in the 381 hectares of the Proposed Disturbance Area for mining;

- all creeks are of high significance to the Knowledge Holders and Community RAPs though there is no harm to watercourses in the Project's 104 hectare infrastructure Disturbance Area, with span bridges being designed over Bettys Creek and Bowmans Creek;

- there are known sites of cultural significance in the region but these sites are outside the Project Area and will not be harmed by the Project;

- the Project Area is an area with a high level of cumulative and indirect impact as a result of large scale agriculture and subsequent mining since first settlement;

- the many thousand Aboriginal artefacts collected through various stages of previous archaeological salvage have been kept safely, but are not currently stored 'on country'; and

- Mount Owen has a VCA and a Project Enhancement Area which has cultural significance to the Knowledge Holders and Community RAPs (being located around York Creek) and is accessible to the Aboriginal community through the current and existing ACHMP.

Considering these guidelines and input of the ACHA, an appropriate suite of cultural heritage management measures, that appropriately addresses the Project impacts on cultural and scientific values are proposed.

The proposed management and mitigation measures have been categorised 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). Full details of the proposed management measures for the Project are provided in **Appendix 13a**.

The management and mitigation measures have been developed to address intergenerational equity aspects and to respect the regional significance of culturally significant features which surround the Project Area. The management measures have been aligned to be consistent with the management measures recommended by the Knowledge Holders and Community RAPs.

Mount Owen will prepare and implement an ACHMP for the Project within 12 months of Project Approval. Mount Owen will also seek to establish an Aboriginal Cultural Heritage Working Group within six months of project approval to include representatives of the Knowledge Holder groups, the RAPs and the Wanaruah LALC. The ACHMP Plan will be prepared in consultation with the Working Group 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 **Appendices 13a** and **13b.** Key commitments include:

- a staged approach to research and salvage works to ensure that areas required for construction are completed as a priority as part of the ACHMP.

Mount Owen will consult with the Working Group on matters raised in the ACHA, in order to better understand where there may be changes or improvements to existing cultural heritage management mechanisms and protocols. Any changes or modifications to protocols will be incorporated in the Mount Owen ACHMP:

- Mount Owen will revise its onsite induction program to include material to raise awareness of Aboriginal cultural values of the Project Area and local area more generally. The induction material will positively message the Aboriginal Cultural Heritage Values of the area. The induction materials and content will be developed in consultation with the Working Group.

- Mount Owen will undertake salvage (excavation, analysis and collection) as per the recommendations of the Archaeological Values Assessment Report for the salvage of the 34 sites to be harmed within the Proposed Disturbance Area (refer to **Appendix 13b**).

- Mount Owen will ensure the ACHMP includes the new sites identified in the Aboriginal Archaeological Values Assessment Report completed for the Project. Sites identified in the Mount Owen ACHA have been recorded on site cards and submitted to OEH.

- Mount Owen will develop care and control management measures and include 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.

- Mount Owen will construct a suitable fit for purpose artefact storage facility to store cultural heritage artefacts recovered during previous research and salvage programs, and for items recovered for the Project, within 2 years of approval for the Project.

- During construction there will be protective fencing of the sites outside the Project Disturbance Area that were identified by the Aboriginal Archaeological Values Assessment.

- Mount Owen will support funding of a memorial story board or other suitable marker, located in an appropriate location. The wording of any plaque shall be developed through the Working Group.

- Mount Owen will consult with the Knowledge Holders and other stakeholders including Singleton Council in the naming of infrastructure works on Hebden Road and Bowmans Creek.

- Mount Owen will provide funding toward the development of an educational DVD or reference material to record the cultural knowledge as identified in the ACHA including the cultural context and relationship to significant Creation story sites, song lines, and other significant sites in the local area.

- During the life of the Project, Mount Owen will offer assistance towards three trainee scholarships (up to three years in duration) to be undertaken in culture related training areas. The training and education opportunity will include opportunities which may arise from vocational based learning including graduate and postgraduate studies.

The Burra Charter (1999) is the primary guideline policy document for the conservation and protection of Australian cultural heritage. According to the Burra Charter, the destruction of fabric is to be avoided although it is recognised that destruction of fabric is sometimes unavoidable. The Burra Charter recommends that mitigation studies be undertaken in an effort to offset the loss of fabric.

The proposed management and mitigation measures are considered effective in that they 'obtain important evidence about to be lost or made inaccessible'. This loss of fabric (i.e. archaeological sites) will be minimised in the sense that only areas within the Proposed Disturbance Area will be investigated and all archaeological investigations will be framed to address research questions that will allow as much information to be captured before the sites are further impacted by erosion and 'lost' forever. The policy to oversee and control this destruction of fabric would be an ACHMP that would be developed in consultation with the Knowledge Holders and Community RAPs following Project approval.

The ACHMP will include a research and salvage strategy to mitigate the impacts of the Project. This strategy will aim to provide for the long term management and / or long term conservation of all known Aboriginal archaeological sites that will remain within the Project Area and to mitigate the loss of Aboriginal archaeological sites and values arising from the Project through the improved understanding of the former use of the Project Area by Aboriginal people.

5.10 Historic Heritage

A detailed Historic Heritage Assessment has been prepared by Umwelt (refer to **Appendix 14**). This detailed assessment has been prepared as required by the DGRs as outlined **Table 5.10.1**.

Table 5.10.1 – Historical Heritage Assessment Director-General's Requirements

Historic Heritage Assessment Requirements	Section of Report
Include a statement of heritage impact (including significance assessment) for any State significant or locally significant heritage items.	**Section 5.10.3** and **Appendix 14**
Outline any proposed mitigation and management measures (including an evaluation of the effectiveness and reliability of these measures).	**Sections 5.10.4** and **5.10.5** and **Appendix 14**

5.10.1 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 the Project Area. A full description of the historical context of the Project Area is included in **Appendix 14** 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 its settlement by Europeans and subsequent use of the land for pastoral and agricultural activities. In general, the historical heritage resource, with the exception of the Ravensworth Village area (refer to **Section 5.10.3.1**) 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.

Sheep and cattle grazing were undertaken across the Project Area supplemented by agricultural activities with the cultivation of crops. Extant fence lines indicate the enclosing of the landscape to make paddocks and are typical of fences found throughout the Hunter Valley and rural NSW. Farm dams are of some importance as sources of fresh water for dairy cattle and their location relative to fences can help understand how the landscape was used.

Coal was first mined in the Upper Hunter in the Rixs Creek area near Singleton in the 1860s (Rappoport 2006:24). However, early coal operations such as this were not commercially viable because of the then underdeveloped transport network. Development and extension of the Great Northern Railway provided the stimulus needed for the development of coal mining in the area (Dunne 2012:88).

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 is stripped from the surface (Rappoport 2006:24).

5.10.2 Identification of Historic Heritage Items / Sites

As part of the Historic Heritage Assessment, a review of relevant heritage databases was undertaken including:

- NSW State Heritage Register (SHR);
- State Heritage Inventory;
- Australian Heritage Database (including Commonwealth and National Heritage lists and the Register of the National Estate (RNE)); and
- Singleton Local Environment Plan 2013.

The database review identified no listed sites / items within the Project Area (refer to **Figure 5.39**). Several listed heritage sites / items were identified in the vicinity of the Project Area which are shown on **Figure 5.39**, and presented in **Table 5.10.2** below.

Table 5.10.2 – Listed Heritage Items located within the vicinity of the Project Area

Item Name	Location	Listing and Significance	Distance to Project Area and Proposed Disturbance Area
Ravensworth Homestead	463 Hebden Road (Lot 228 DP 752470)	Singleton 2013 LEP – local significance RNE[7]	700 metres west of the Project Area boundary. 3.7 kilometres west of the North Pit Continuation Over 1.6 kilometres south-west of the BNP Over 2.4 kilometres west of the RERR Mining Area

[7] 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.

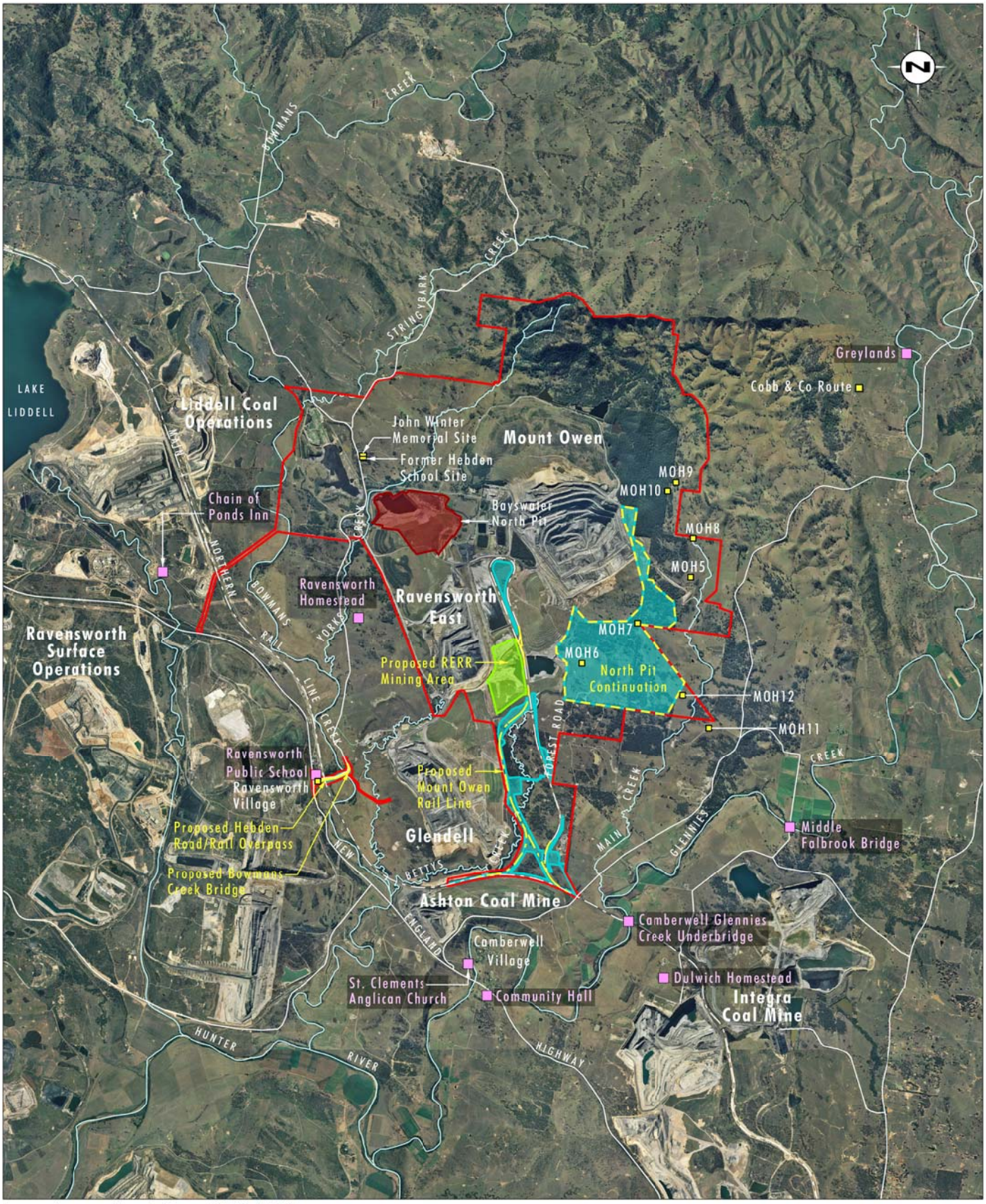

Image Source: Mount Owen (2012-2013)
Data Source: Mount Owen (2014)

0 1.0 2.5 5.0km
1:100 000

Legend

- Project Area
- Proposed Disturbance Area
- Bayswater North Pit
- Proposed RERR Mining Area
- Proposed North Pit Continuation
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Potential Heritage Sites
- Listed Heritage Item

FIGURE 5.39

Location of Listed and Potential Heritage Sites

File Name (A4): R02/3109_920.dgn
20141008 16.03

Table 5.10.2 – Listed Heritage Items located within the vicinity of the Project Area (cont.)

Item Name	Location	Listing and Significance	Distance to Project Area and Proposed Disturbance Area
Former Chain of Ponds Inn (listed as Inn & Outbuildings (former))	Old New England Highway, Liddell (Lot 211 DP 975271)	SHR Singleton 2013 LEP – state significance RNE National Trust of Australia (NSW) register	Over 2 kilometres south-west of the Project Area boundary. Over 7.3 kilometres west of the North Pit Continuation Over 4.2 kilometres west of the BNP Over 6.3 kilometres west of the RERR Mining Area
Middle Falbrook Bridge (over Glennies Creek)	Middle Falbrook Road, Middle Falbrook (road reserve)	SHR Singleton 2013 LEP – state significance. RMS Section 170 NSW State agency heritage register [8] RNE	3 kilometres south-east of the Project Area boundary. Over 3.3 kilometres south- east of the North Pit Continuation Over 8.3 kilometres south-east of the BNP Over 5.5 kilometres south-east of the RERR Mining Area
Greylands and Outbuildings	665 Goorangoola Road, Goorangoola (Lot 111 DP 10854409)	Singleton 2013 LEP – local significance RNE	Over 4 kilometres east of northern Project Area boundary. Over 6.3 kilometres north-east of the North Pit Continuation Over 8.9 kilometres north-east of the BNP Over 9.1 kilometres north-east of the RERR Mining Area
Ravensworth Public School (former)	Hebden Road / New England Highway (Lot 11 DP 825904)	Singleton 2013 LEP – local significance	Immediately adjacent to the Project Area boundary and proposed Hebden Road rail overpass works. Over 4.9 kilometres south-west of the North Pit Continuation 4.5 kilometres south-west of the BNP Over 3.5 kilometres south-west of the RERR Mining Area

[8] Section 170 of the *Heritage Act 1977* (NSW) requires the identification, conservation and management of heritage assets owned, occupied or managed by NSW government agencies through the upkeep of a Register of heritage items (a Heritage and Conservation Register or a S.170 Register). A S.170 Register is a record of the heritage assets owned or managed by a government agency and consists of a list of heritage assets and an assessment of the significance of each asset.

Table 5.10.2 – Listed Heritage Items located within the vicinity of the Project Area – cont.

Item Name	Location	Listing and Significance	Distance to Project Area and Proposed Disturbance Area
St. Clements Anglican Church	20 Glennies Creek Road, Camberwell (Lot 102 DP 738182)	Singleton 2013 LEP – local significance	1.5 kilometres south of the southern Project Area boundary. Over 5.4 kilometres south- west of the North Pit Continuation Over 7.6 kilometres south of the BNP Over 4.7 kilometres south of the RERR Mining Area
Community Hall	3 Lethbridge Street, Camberwell (Lot 2 Sec 13 DP 758214)	Singleton 2013 LEP – local significance	Over 2 kilometres south of the southern Project Area boundary. Over 5.7 kilometres to the south-west of the North Pit Continuation Over 8.1 kilometres south of the BNP Over 5.1 kilometres south of the RERR Mining Area
Camberwell Glennies Creek Underbridge	Camberwell (252.613 kms Main Northern Railway)	Australian Rail Track Corporation Section 170 NSW State agency heritage register	1 kilometre south-east of the south-eastern corner of the Project Area. Over 4.1 kilometres south of the North Pit Continuation Over 7.7 kilometres south-east of the BNP Over 4.6 kilometres south-east of the RERR Mining Area
Former Dulwich Homestead (Kangory Homestead)	485 Middle Falbrook Road, Glennies Creek (Lot 8 DP 246434)	Singleton 2013 LEP – local significance	2.25 kilometres south-east of the south-eastern corner of the Project Area Over 5.1 kilometres to the south of the North Pit Continuation Over 8.9 kilometres southeast of the BNP Over 5.8 kilometres south-east of the RERR Mining Area.

Previous historical archaeological and heritage studies have been undertaken in association with the existing operations. These studies identified a number of sites within and in the vicinity of the current Project Area.

The management of these sites has been undertaken in accordance with relevant approval conditions and management plans. In general, these previously identified sites were representative of early dairy farming in the Upper Hunter in the twentieth century. Following their excavation and / or recording in accordance with the relevant approval conditions, all of the previously identified sites located within the Project Area (RE31 to RE33 and MOH1 to MOH4) have been removed as part of approved works with the exception of MOH5 (refer to **Figure 5.39**).

For this study a targeted site survey was undertaken on 19 February 2013 in order to ground truth:

- the results of the desktop research undertaken;
- the review of previously prepared reports;
- the review of existing topographic maps; and
- previously identified areas of historical potential.

In addition to the listed historical items identified in **Table 5.10.2** above, other potential historical heritage sites / items identified during survey, which currently have no statutory listing, are present within and in the vicinity of the Project Area. The location of the sites / items is shown in **Figure 5.39** and presented in **Table 5.10.3** below.

Table 5.10.3 – Potential Historical Heritage Items Identified within and in the Vicinity of the Project Area

Item Name	Description	Assessed Significance	Location
Ravensworth Village	Former Ravensworth Village	Local significance Further details provided in **Section 5.10.3.1**	South side of Hebden Road at intersection with New England Highway. Within Project disturbance area – construction of Hebden Road rail overpass. Approximately 4.6 kilometres south-west of BNP, approximately 3.6 kilometres south-west of RERR Mining Area, and approximately 4.6 kilometres south-west of North Pit Continuation.
MOH 5	Former homestead and dairy complex	Local significance Further details provided in **Section 5.10.3.4**	Within Project Area - approximately 750 metres from the Proposed Disturbance Area.
MOH6	Former House / dairy site	No significance with no research potential.	Within North Pit Continuation.
MOH7	Timber yards and shed	No significance with no research potential.	Within North Pit Continuation.

Table 5.10.3 – Potential Historical Heritage Items Identified within and in the Vicinity of the Project Area – cont.

Item Name	Description	Assessed Significance	Location
MOH8	Timber yards	No significance with no research potential.	Approximately 4.5 kilometres east of BNP, 3.9 kilometres north-east of RERR Mining Area and approximately 1 kilometre east of North Pit Continuation – within Project Area. No impact.
MOH9	Timber yard / house site	No significance with no research potential.	Approximately 4.2 kilometres north-east of BNP, 4.3 kilometres north-east of RERR Mining Area and approximately 900 metres east of North Pit Continuation – within Project Area. Within existing biodiversity offset area. No impact.
MOH10	Timber loading ramp	No significance with no research potential.	Approximately 4 kilometres north-east of BNP, 4.1 kilometres north-east of proposed RERR and approximately 700 metres east of North Pit Continuation – within Project Area. Within Ravensworth State Forest. No impact.
MOH11	Former House / dairy site	Local significance Further details provided in **Section 5.10.3.5**	Outside Project Area – Approximately 6.1 kilometres south-east of BNP, approximately 3.5 kilometres south-east of RERR Mining Area, approximately 800 metres south-east of North Pit Continuation. No impact.
MOH12	Former house site	No significance with no research potential.	Falbrook Road, Falbrook. Within Project Area – approximately 5.4 kilometres south-east of BNP, approximately 3 kilometres east of RERR Mining Area, and approximately 80 metres outside south-east boundary of North Pit Continuation.

Table 5.10.3 – Potential Historical Heritage Items Identified within and in the Vicinity of the Project Area – cont.

Item Name	Description	Assessed Significance	Location
John Winter memorial site	Memorial and grave site	Local significance Further details provided in **Section 5.10.3.2**	Hebden Road. Within Project Area – approximately 880 metres north-west of BNP, approximately 4.4 kilometres north-west of RERR Mining Area and approximately 5 kilometres north-west of North Pit Continuation. No direct impact.
Former Hebden Public School site	Former 1912 public school site	Local significance Further details provided in **Section 5.10.3.3**	Hebden Road. Within Project Area – approximately 880 metres north-west of BNP, approximately 4.4 kilometres north-west of RERR Mining Area and approximately 5 kilometres north-west of North Pit Continuation. No direct impact.
Cobb & Co. route	Potential location of a former Cobb & Co. route	Well outside of the Proposed Disturbance Area and assessment of significance not required.	West of Goorangoola Road. Outside Project Area – approximately 2.8 kilometres to north-west of the Project area, approximately 4.7 kilometres north-east of North Pit Continuation, approximately 7.8 kilometres north-east of BNP and approximately 8 kilometres north-east of RERR Mining Area. No direct impact.

A number of the sites comprise previously identified areas or sites which are known to contain or have the potential to contain historical heritage items and / or archaeological 'relics'. These comprise the former Hebden Road Public School, the John Winter Memorial site, a former Cobb and Co. route and the Ravensworth Village area. Sites MOH6 to MOH12 are potential new sites identified during the preparation of this assessment and inspected as part of the site survey and these sites are discussed further in **Sections 5.10.3** and **5.10.4**.

5.10.3 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 DGRs 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 (refer to **Section 5.10.1**). 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 development for mineral resources is reflected in the low potential of the archaeological resource and in the evidence of former house and dairy sites and other rural structures and infrastructure. Similar sites, both within the Project Area and in the immediate vicinity, have been assessed and recorded as part of previous heritage studies, archaeological investigative works and archival recordings.

In general terms, with the exception of the Ravensworth Village, the John Winter Memorial site the former Hebden Public School site MOH 5 and MOH 11 (refer to **Sections 5.10.3.1** to **5.10.3.5**), the identified and potential historical heritage components of the Project Area have been assessed as having no significance with no research potential.

Any archaeological remains present within the Ravensworth Village, potentially related to the ownership of the area by the Wolfgang family who both resided there and ran a successful commercial enterprise servicing an itinerant working population would likely be of local significance and have archaeological research potential.

5.10.3.1 Ravensworth Village Area

Ravensworth Village is located at the corner of the New England Highway and Hebden Road (refer to **Figure 5.40**). The village once included a school, train station, store, community hall and several other buildings. The Ravensworth Public School and an adjacent weatherboard house, both located on the north side of Hebden Road, are the only structures remaining in the village area. With the exception of the train station and associated structures (station building, post office etc.) all other buildings are likely to have been located in the area to the south of Hebden Road.

The Ravensworth Village area has the potential for sub-surface remains associated with a history of use and occupation from the late nineteenth century. This site has been assessed as having local significance and archaeological research potential.

5.10.3.2 John Winter Memorial Site

The site comprises a headstone and monument, located immediately adjacent to the former Hebden Public School site (refer to **Section 5.10.3.3**). The headstone inscription indicates the grave is the resting place of John Winter ‘Pioneer of Canberra’ who died at Hebden in 1928.

The John Winter Memorial site is considered to be of local significance, primarily in terms of its potential associative and social significance.

umwelt

Image Source: Mount Owen (2012)
Data Source: Mount Owen (2014)

0 20 40 60 m
1:1 250

Legend

- Project Area
- Proposed Disturbance Area
- Area of Ravensworth Village within Proposed Disturbance Area
- Area of Potential Interest

FIGURE 5.40

Ravensworth Village

File Name (A4): R02/3109_889.dgn
20141008 16.04

5.10.3.3 Former Hebden Public School Site

The former Hebden Public School was opened in October 1912 and closed in December 1973 (NSW Department of Education and Communities).

The former school site comprises a small weatherboard structure built on timber piers with a corrugated iron roof, timber floor and external brick chimney. The locations of other former structures are evident by the presence of areas of remnant timber flooring, concrete piers, concrete slabs and evidence of landscaping such as concrete pathways. The site is enclosed by a relatively recently constructed steel post and wire fence.

The former Hebden Public school site is considered to be of local significance, primarily in terms of its potential social significance.

5.10.3.4 Site MOH5 - Former Homestead and Dairy Complex

Site MOH5 comprises a former homestead and dairy complex located within the Project Area and within an existing Biodiversity Offset Area (refer to **Figure 5.39**). MOH5 comprises a brick chimney with extant timber pier footings indicating the former house is likely to have had timber footings and a raised timber floor. The site is not proposed be impacted as a result of the Project.

Site MOH5 was identified during the preparation of the Mount Owen Operations Historic Heritage Assessment (Umwelt 2003b). The 2003 report assessed Site MOH5 as being of local significance and potentially being subject to impact from vibration due to blasting.

5.10.3.5 Site MOH11 – Former House and Pastoral Site

Site MOH11 is a former house and pastoral site (likely dating from early twentieth century) covering an area measuring approximately 80 by 40 metres located alongside an existing track from the junction of Glennies Creek and Falbrook Road to the east of Main Creek (refer to **Figure 5.39**). The site is located outside the Project Area, approximately 6.1 kilometres to the south-east of the BNP, approximately 3.5 kilometres to the south-east of the RERR Mining Area and approximately 800 metres to the south-east of the North Pit Continuation.

Site MOH11 may date to the early twentieth century when the larger estates were being subdivided and purchased by graziers and farmers or when soldiers were given small holdings and government assistance after World War I to establish small agricultural businesses, such as dairy farms. This site has been assessed as having local significance.

5.10.4 Historic Heritage Impacts and Management Commitments

5.10.4.1 Listed Heritage Items

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 / destruction. None of the listed heritage items (refer to **Table 5.10.2** and **Figure 5.39**) are located within the Project Area and will not be directly impacted as a result of the Project.

Indirect impacts are considered to include vibration from blasting; which has the theoretical potential to damage / destroy / disturb historical heritage items. A detailed Blast Impact Assessment was undertaken for the Project in accordance with the DGRs (refer to **Section 5.4**).

None of the listed heritage items have a predicted ground vibration level that exceeds 3 mm/s, which is below the nominated criterion for each specific item. As such, there are not expected to be any direct or indirect impacts to the listed items as part of the Project. As no impacts on these sites are predicted, no management measures are required in relation to these items as part of the Project. As a result of its proximity to the Proposed Disturbance Area and the proposed Hebden Road rail overpass, the listed former Ravensworth Public School is discussed further below.

Former Ravensworth Public School

The former Ravensworth Public School is immediately adjacent to the Project Area, the Proposed Disturbance Area and specifically the proposed Hebden Road rail overpass. There are unlikely to be any direct impacts to the former school buildings as a result of the proposed Hebden Road works. The former Ravensworth Public School is located over 4.5 kilometres south-west of the BNP, over 3.5 kilometres south-west of the RERR Mining Area and over 4.9 kilometres to the south-west of the North Pit Continuation and will not be indirectly impacted as a result of vibration from blasting.

Prior to the commencement of works for the construction of the Hebden Road rail overpass and if any physical (stockpiling of materials for example) or sub-surface impacts are proposed in the area to the north of Hebden Road (within the Proposed Disturbance Area), the area will be surface surveyed to identify, or confirm the absence of, or the potential for items or remains that may be associated with the listed former Ravensworth Public School.

If any potential items or remains are identified, management measures will be developed in consultation with the Heritage Division, OEH to ensure the items or remains are protected or, if appropriate, mitigated. Mitigation measures could include photographic / archival recording in accordance with Heritage Division, OEH guidelines *Photographic Recording of Heritage Items Using Film or Digital Capture* (2006).

5.10.4.2 Non-listed Sites within and in the vicinity of the Project Area

The majority of the potential historical heritage sites / items present within, and in the immediate vicinity of, the Project Area have been assessed as having no heritage significance and no research potential (refer to **Section 5.10.3**). All of the identified potential sites within the Project Area have been recorded as part of the Historic Heritage Assessment. The photographic catalogue of the recordings are included in **Appendix 14**. As such, no further management is required for the sites assessed as having no significance or research potential identified within the Project Area. Those sites assessed as being of local significance and / or recommended as requiring further management are discussed further below.

Ravensworth Village

Ravensworth Village is located at the corner of the New England Highway and Hebden Road (refer to **Figure 5.40**). An approximate 180 by 100 metre area of the former village located to the south of Hebden Road will be disturbed as a result of the proposed Hebden Road rail overpass. The area of Ravensworth Village located to the south of Hebden Road has the potential for a locally significant archaeological resource.

The late 1800s wine shop and the early 1900s wine shop that replaced the earlier structure were likely located in the area of Lot 16 DP 38725. Although no above ground evidence for these structures survives there is potential for an archaeological resource associated with these former structures and their associated buildings (sheds, cellars, stables and blacksmith's shop), features (cesspits / privies, rubbish pits and bottle dumps) and artefacts.

Prior to the commencement of works for the construction of the proposed Hebden Road rail overpass, on-site archaeological investigation of the Proposed Disturbance Area will be undertaken. The investigations will comprise (subject to consultation with the Heritage Division, OEH) a program of archaeologically monitored machine stripping of the grass cover focusing on the potential area of archaeological interest (the former Wolfgang wine shop and associated buildings likely to have been located in the approximate area of current Lot 2 DP 793886 and Lots 15 and 16 DP 38725), as shown on **Figure 5.40**.

Any archaeological remains (including concentrations / deposits of artefacts, structural remains or deeper cut features) exposed in this area during monitored machine excavation would be recorded and hand excavated as part of the works.

A series of test trenches will be machine excavated across the remainder of the Ravensworth Village area located within the Proposed Disturbance Area (refer to **Figure 5.40**) to identify the potential for archaeological remains surviving. If any archaeological remains are exposed during the monitored machine excavation of test trenches, the remains would be recorded and hand excavated as part of the works. Further machine stripping may be required if any areas of archaeological interest are identified.

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 investigation works will be prepared for the endorsement of the Heritage Division, OEH.

John Winter Memorial Site

The John Winter memorial site is within the north-west corner of the Project Area approximately 880 metres north-west of the BNP, approximately 4.4 kilometres north-west of the proposed RERR Mining Area and over 5 kilometres to the north-west of the North Pit Continuation (refer to **Figure 5.39**).

The site has a predicted maximum ground vibration of 6.4 mm/s (Enviro Strata Consulting 2014a). The inferred safe vibration level for the John Winter Memorial site has been identified to be in the order of 250 mm/s (Enviro Strata Consulting 2014b). As such there are not expected to be any impacts (either direct or indirect as a result of vibrations from blasting) at the John Winter Memorial Site as part of the project and no further management of site is required.

Former Hebden Public School Site

The former Hebden Public School site is within the north-west corner of the Project Area approximately 880 metres north-west of the proposed BNP, approximately 4.4 kilometres north-west of the proposed RERR Mining Area and over 5 kilometres to the north-west of the North Pit Continuation (refer to **Figure 5.39**).

The site has a predicted maximum ground vibration of 6.3 mm/s (Enviro Strata Consulting 2014a). Vibration limits at the site have been identified as 16 to 19 mm/s (Enviro Strata Consulting 2014b).

As such, there are not expected to be any impacts (either direct or indirect as a result of vibration from blasting) at the former Hebden Public School site as part of the Project and no further management of the site is required.

Site MOH11 – Former House and Dairy Site

Site MOH11 is located immediately outside the Project Area boundary and approximately 800 metres to the south-east of the North Pit Continuation. As such, the site will not be directly impacted as a result of the Project (refer to **Figure 5.39**).

There is potential for some impacts to occur as a result of vibration. However, this site is currently a standing ruin located outside the Project Area and will remain as a ruin standing in a rural landscape.

This site has been recorded as part of the preparation of the Historic Heritage Assessment (refer to **Appendix 14**). The photographic catalogue (photographic record sheets) and photographs (as thumbnail image sheets / proof sheets) are included in **Appendix 14**. No further management of site MOH11 is required for the Project. The recording of the site as part of the assessment and the photographic record (**Appendix 14**) are considered to be an appropriate and sufficient level of documentation for this site.

Site MOH5 – Former Homestead and Dairy Complex

Site MOH5 comprises a former homestead and dairy complex located within the Project Area and within the existing Corridor Biodiversity Offset Area. The site is not proposed to be impacted as a result of the Project (refer to **Figure 5.39**).

The Mount Owen Operations Historic Heritage Assessment (Umwelt 2003b) recommended that 'archival recording should be undertaken and a regular monitoring program implemented'. Consequently, Consent Condition 55 of DA 14-1-2004 for Mount Owen requires a photographic recording of the condition and integrity of site MOH5 to be undertaken every 5 years until the cessation of mining to the satisfaction of the Director-General. To date photographic recording in accordance with Consent Condition 55 has been undertaken in 2006 (Umwelt 2006) and 2010 (Umwelt 2010).

The February 2013 site inspection identified that, apart from the continued natural degradation of the timber clad with corrugated iron roof dairy shed, the site appears to be in a similar condition to both its 2003 and 2010 photographically recorded condition.

As two photographic recordings of the site have previously been undertaken, there has been no significant change to the condition and integrity of the site as a result of mining undertaken under the current approval and proposed mining as part of the Project will be moving further away from the site, no further management of site MOH5 is required for the Project.

5.10.5 Mitigation Measures

In addition to the specific management measures outlined in **Section 5.10.4**, a number of additional preventative management measures will be implemented as part of the Project. The additional historical heritage management measures to be implemented for the Project include:

- In the unlikely event that unexpected archaeological remains or potential heritage items not identified as part of this assessment 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 Division, OEH notified in accordance with Section 146 of the *Heritage Act 1977* (NSW).

- In the unlikely event that a potential burial site or potential human skeletal material is exposed within the Proposed Disturbance Area, the following procedure will 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 in the immediate area is to halt immediately to allow assessment and management;
  - contact local police, OEH and the Heritage Division;
  - a physical or forensic anthropologist will 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 Division is to be contacted.

The above process functions only to appropriately identify the remains and secure a 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*.

In accordance with the DGRs for the Project (refer to **Section 3.2**), an evaluation of the effectiveness and reliability of these proposed mitigation measures is provided in the Historic Heritage Assessment (refer to **Appendix 14**). This evaluation found that the proposed mitigation measures are deemed to be effective and reliable in managing the potential heritage impacts associated with the Project.

5.11 Greenhouse Gas and Energy Assessment

The DGRs for the Project (as provided in **Table 5.11.1**) require a full Greenhouse Gas (GHG) assessment be undertaken. Umwelt has prepared the detailed GHG and Energy Assessment (GHGEA) for the Project, a copy of which is provided in **Appendix 15**. A summary of the key findings of the GHGEA is provided in this section.

Table 5.11.1 – Greenhouse Gas and Energy Assessment Director-General's Requirements

Greenhouse Gas and Energy Assessment Requirements	Section of Report
A quantitative assessment of potential Scope 1, 2 and 3 greenhouse gas emissions.	**Section 5.11.4** and **Appendix 15**
A qualitative assessment of the potential impacts of these emissions on the environment.	**Section 5.11.5** and **Appendix 15**
As assessment of reasonable and feasible measures to minimise greenhouse gas emissions and ensure energy efficiency.	**Section 5.11.6** and **Appendix 15**

Mount Owen 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 plans as this results in cost efficiencies and reduced GHG emissions. The Project design therefore inherently minimises GHG emissions from the mining operations. 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;
- selecting equipment and vehicles that have high energy efficiency; and
- scheduling activities so that equipment and vehicle operation is optimised.

Mount Owen is committed to the Glencore Code of Conduct, which specifically requires on-going consideration of greenhouse gas emissions and energy use.

Glencore Coal requires all mine sites to report greenhouse gas emissions on an annual basis through the National Greenhouse and Energy Reporting Scheme (NGERS), in accordance with the requirements of the *National Greenhouse and Energy Reporting Act 2007*.

5.11.1 Greenhouse Assessment Policy Context

There are a number of guidelines in place that outline the methods for undertaking a GHG and energy assessment (GHGEA). The primary guidelines include:

- National Greenhouse Accounts (NGA) Factors (2013); and
- World Business Council for Sustainable Development (WBCSD) and World Resources Institute (WRI) Greenhouse Gas Protocol 2004 (GHG Protocol).

The GHGEA prepared for the EIS has taken account of these guidelines.

The GHGEA framework incorporates the principles of The Greenhouse Gas Protocol 2004 (the GHG Protocol), which provides an internationally accepted approach to the accounting and reporting of GHG emissions. 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 briefly 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 i.e. 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). Scope 3 emissions can include emissions generated upstream of the Project by providers of energy, materials and transport. Scope 3 emissions are only estimates and may have a relatively high level of uncertainty, unreliability and variability.

5.11.2 Methodology

Scope 1 and 2 emissions were calculated based on the methodologies and emission factors contained in the National Greenhouse Accounts (NGA) Factors 2013 (DCCEE 2013). Fugitive emissions have been calculated using both Method 1 and Method 2 approaches, as described in the *National Greenhouse and Energy Reporting (Measurement) Determination 2008* (Clean Energy Regulator 2012). The Method 2 approach was used where gas quantity and composition data was available, however, the majority of fugitive emissions were calculated using the Method 1 approach.

Scope 3 emissions associated with product transport were calculated based on emission factors contained in the National Greenhouse Gas Inventory: Analysis of Recent Trends and Greenhouse Gas Indicators (AGO 2007). Other Scope 3 emissions were calculated using methodologies and emission factors contained in the NGA Factors 2013.

Emission factors for the consumption of construction materials were sourced from the Inventory of Carbon and Energy, Version 2.0 (Hammond, G and Jones, C. 2011).

The detailed GHGEA considered the different Project stages (construction, operations, closure), as mitigation options can be developed for each stage of the Project.

5.11.3 Forecast Energy Consumption

Estimating energy consumption is an important component of establishing the GHG emissions profile of a Project. Energy usage by an open cut mining operation primarily relates to diesel and electricity consumption. Outlined below is a summary of the forecast energy consumption for the Project:

- the construction of the Project is forecast to require approximately 50,000 Gigajoules (GJ) of energy. Diesel is forecast to be the primary energy source;
- the Project is forecast to require approximately 27,568,000 GJ of energy from diesel and grid electricity over 15 years. Annual average energy consumption is forecast at 1,838,000 GJ per annum; and
- the Project is forecast to consume approximately 80,100 GJ during the closure phase. Electricity usage during closure will be negligible; accordingly it has been assumed that all energy will be sourced from diesel.

The Project will have a declining energy usage profile over the life of the Project as fleet numbers decline due to reduced production volumes in the later years of the Project.

The industry average energy use for open cut coal mines in Australia ranges between 430 and 660 Megajoules (MJ)/product tonne (AGSO 2000). The Project is forecast to operate with an average energy use intensity of approximately 531 MJ/Product Tonne, which is within the normal operating range for Australian open cut coal mines.

5.11.4 Forecast Greenhouse Gas Emissions

5.11.4.1 Construction Phase

The GHGEA considers the major construction activities associated with the Project (MIA upgrade works, Hebden Road upgrade works, product stockpile extension and rail upgrade works). Other ancillary construction activities may occur as part of the operations, assessed in **Section 5.11.4.2**.

The construction of the Project is forecast to be associated with approximately 11,300 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 the construction phase.

Approximately 63 per cent of forecast construction related emissions are attributable to the consumption of construction materials. The consumption of energy during construction contributes approximately 33 per cent of construction emissions, while approximately 4 per cent of construction emissions are attributable to the transport of construction materials.

5.11.4.2 Operational Phase

The Project is forecast to be associated with approximately 137,653,000 tonnes CO_2-e of GHG emissions over the 15 years of operation (refer to **Section 2.3.1**). This includes Scope 1, 2 and 3 emissions.

Scope 1 emissions from the Project are primarily from the combustion of diesel and release of fugitive emissions. Fugitive emissions result from the release of gas stored in the materials mined (primarily carbon dioxide and methane). The Project is forecast to generate approximately 5,085,000 tonnes CO_2-e of Scope 1 emissions during its operational phase. Annual average Scope 1 emissions are forecast at 339,000 tonnes CO_2-e per annum.

Scope 2 emissions from the Project are those emissions associated with the production of electricity used by the Project. These emissions occur at the point of energy generation, not at the mine site. The Project is forecast to be associated with approximately 811,000 tonnes CO_2-e of Scope 2 emissions from consuming electricity during its operation phase. Annual average Scope 2 emissions are forecast at approximately 55,000 tonnes CO_2-e per annum.

The Project is forecast to be associated with approximately 131,769,000 tonnes CO_2-e of Scope 3 emissions during its operation phase. Scope 3 emissions will be generated by third parties during product transport and consumption activities (for example, electricity generators). Annual average Scope 3 emissions are forecast at approximately 8,784,000 tonnes CO_2-e.

Approximately 96 per cent of the Project's GHG emissions occur downstream of the Project, and are generated by third parties. Approximately 4 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. That is, there is potential for these emissions to be double counted when compared to relevant benchmarks such as national or global emissions targets (e.g. Scope 2 emissions reported by Mount Owen will also be reported by the electricity generator and contractors).

5.11.4.3 Closure and Rehabilitation Phase

The Project is forecast to generate approximately 5,600 tonnes CO_2-e of Scope 1 emissions from combusting diesel during the closure phase. The closure phase is also expected to be associated with approximately 450 tonnes CO_2-e of Scope 3 emissions. Scope 3 emissions will be generated by third parties undertaking activities such as extracting, refining and transporting diesel.

5.11.5 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.

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 gas 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%), terrestrial plants (30%) and the atmosphere (40%) (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 Project's direct emissions are forecast to be approximately 339,000 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 0.00074 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) define 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 GHG 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. Any increase in atmospheric greenhouse gas emissions can therefore generate many different climate change impacts, depending on future greenhouse gas scenarios and regional location.

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 including all major emission sources and sinks. This global response is represented by a number of key policy objectives as discussed further in **Section 5.11.6** below.

Impact on Policy Objectives

The Australian Government has committed to reduce Australia's GHG emissions by 5 per cent from 2000 levels by 2020 irrespective of what other countries do, and by up to 15 or 25 per cent depending on the scale of global action.

If Australia is able to meet the 5 per cent reduction target by 2020, the nation will be generating approximately 525,000,000 t CO_2-e per annum (National Greenhouse Gas Inventory 2011). In year 2020, it is anticipated that the Project will generate approximately 375,000 t CO_2-e of Scope 1 emissions, if emissions are not further mitigated. This will represent approximately 0.071 per cent of Australia's national emissions by 2020. The Project's Scope 2 and 3 emissions are not considered against national objectives, as targets only relate to Scope 1 emissions.

The Project is unlikely to limit the Federal Government achieving its national GHG policy objectives.

5.11.6 Greenhouse Gas and Energy Management

The GHGEA is required by the DGRs to assess reasonable and feasible measures to minimise the Project's GHG emissions. The term reasonable incorporates notions of costs and benefits, whereas the term feasible focuses on the more fundamental practicalities of the mitigation measures, such as engineering considerations and what is practical to build or operate (*Hunter Environment Lobby Inc v Minister for Planning* [2011]).

5.11.6.1 Evaluation of Management Measures

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 25 management measures, which were selected for their applicability to manage fugitive emissions and energy use. The evaluation found that the Project is planning to implement 21 of these measures as they are both technically feasible and likely to be financially reasonable. The detailed evaluation of all measures is provided in **Appendix 15**. Examples of these measures include:

- optimising the design of haul roads including ramp gradients, improving rolling resistance in addition to limiting haul road length;
- sourcing and allocating fuel efficient equipment including haul trucks;
- monitoring and actively managing payload to maintain efficiency;
- installation and maintenance of high efficiency motors and Variable Speed Drives;
- scheduling activities so that equipment and vehicle operation is optimised;
- developing blasting strategies to improve extraction efficiency;
- maximising resource recovery efficiency; and
- preventing unnecessary water ingress.

Many of the management measures planned for implementation are inherent in good mine planning and design. Management measures will also occur as the Project upgrades plant and equipment. Planned measures that will make a significant impact on diesel use efficiency include limiting the length of material haulage routes, optimising ramp gradients and utilising fuel efficient haul trucks.

The Project is planning to utilise many greenhouse gas mitigation measures available for an open cut operation, such as selecting equipment and vehicles that have high energy efficiency ratings and scheduling activities so that equipment and vehicle operation is optimised. High impact mitigation measures such as utilising pre-drained coal seam methane will not be implemented as the Project's North Pit Continuation, BNP and RERR Mining Area, do not generally exhibit high gas levels and accordingly it is considered financially unreasonable for the likely benefit gained.

5.12 Traffic and Transport

The DGRs (refer to **Table 5.12.1**) require a detailed assessment of the potential impacts of the Project on the capacity, efficiency and safety of road and rail movements. A comprehensive road traffic impact assessment has been prepared by Transport and Urban Planning Pty Ltd (TAUP). This report is included in **Appendix 16** and the key findings are outlined in the following sections. An assessment of the potential impacts on rail transport is provided in **Section 5.12.5**.

Table 5.12.1 – Director General's Requirements – Traffic and Transport

Traffic & Transport Requirements	Section of Report
Accurate predictions of the road and rail traffic generated by the development.	**Sections 5.12.3** and **5.12.5**
Justification for the proposed road or rail upgrade works, and a clear description of how the upgraded road / rail operations would be integrated with the existing road / rail network.	**Section 5.12.2**
A detailed assessment of the potential impacts of the development on the capacity, efficiency and safety of the:	
• local and regional rail network, having regard to the strategic objectives and cumulative impacts for the passenger and freight rail network, and the impacts of coal trains on level crossings; and	**Section 5.12.5**
• local and regional road network, with particular regard to a cumulative traffic impact assessment; condition assessment of the existing network; and the operation of the proposed new infrastructure on Hebden Road.	**Section 5.12.2 and 5.12.3**
Details of mine to port or other domestic customer transport movements, train path availability and any required rail infrastructure works on the Main Northern Railway.	**Section 5.12.5**
A detailed description of the measures that would be implemented to maintain and / or improve the capacity, efficiency and safety of the road and rail networks in the surrounding area over the life of the development, including consideration of road maintenance contributions to Singleton Shire Council.	**Sections 5.12.4** and **5.12.5**

5.12.1 Potential Road Traffic Impacts

The Project is not proposing to increase the operational workforce from the current levels, therefore the Project is unlikely to result in traffic related impacts during the operational phase from that currently approved. The primary potential impact is associated with the proposed construction phase of the Project, which is expected to take approximately 18 months. The potential for Project related impacts to the local traffic network are restricted to:

- Traffic due to the construction of:
  - the Main Northern Rail Line Overpass on Hebden Road;
  - the new Bowmans Creek Bridge on Hebden Road;
  - the rail line specifically in relation to construction access via Glennies Creek Road and Forest Road; and
- continuation of existing levels of operational traffic for an additional 12 years at North Pit.

As discussed in **Section 2.3.13.1**, the commencement of construction will start within one year of the continuation of mining beyond the currently approved mining limit in the North Pit. These potential impacts are assessed in detail in the following sections.

5.12.2 Existing Traffic Conditions

The local road network surrounding the Project Area includes the New England Highway, Hebden Road, Antiene Road, Glennies Creek Road, Middle Falbrook Road, Fablbrook Road Pictons Lane and Forest Road (refer to **Figure 5.41**). The Project Area and Glendell Mine is primarily accessed from the New England Highway via Hebden Road, however, some vehicles could also gain access along Antiene Road (refer to **Figure 5.41**). Glennies Creek Road and Forest Road will be used during construction of the proposed rail line, for a period of approximately 18 months. A detailed description of the existing local road network is provided in **Appendix 16**.

As part of the Traffic Impact Assessment for the Project, traffic count data was analysed to characterise existing traffic generation patterns in the vicinity of the Project Area. This included the analysis of traffic count data collected for Glennies Creek Road and counts undertaken in May 2011 on Hebden Road and the Mount Owen Mine Access Road. Manual intersection counts were also undertaken in February 2013 at Glennies Creek Road and the New England Highway intersection (refer to **Figure 5.41**). In October 2013, further traffic counts were undertaken on the New England Highway, Hebden Road and Glennies Creek Road. In addition, intersection counts were undertaken at this time at the intersections of New England Highway / Hebden Road, Hebden Road / Glendell Mine Access Road and Hebden Road / Mount Owen Mine Access Road (refer to **Figure 5.41**). The existing traffic volumes obtained from these traffic count surveys are summarised in **Table 5.12.2**.

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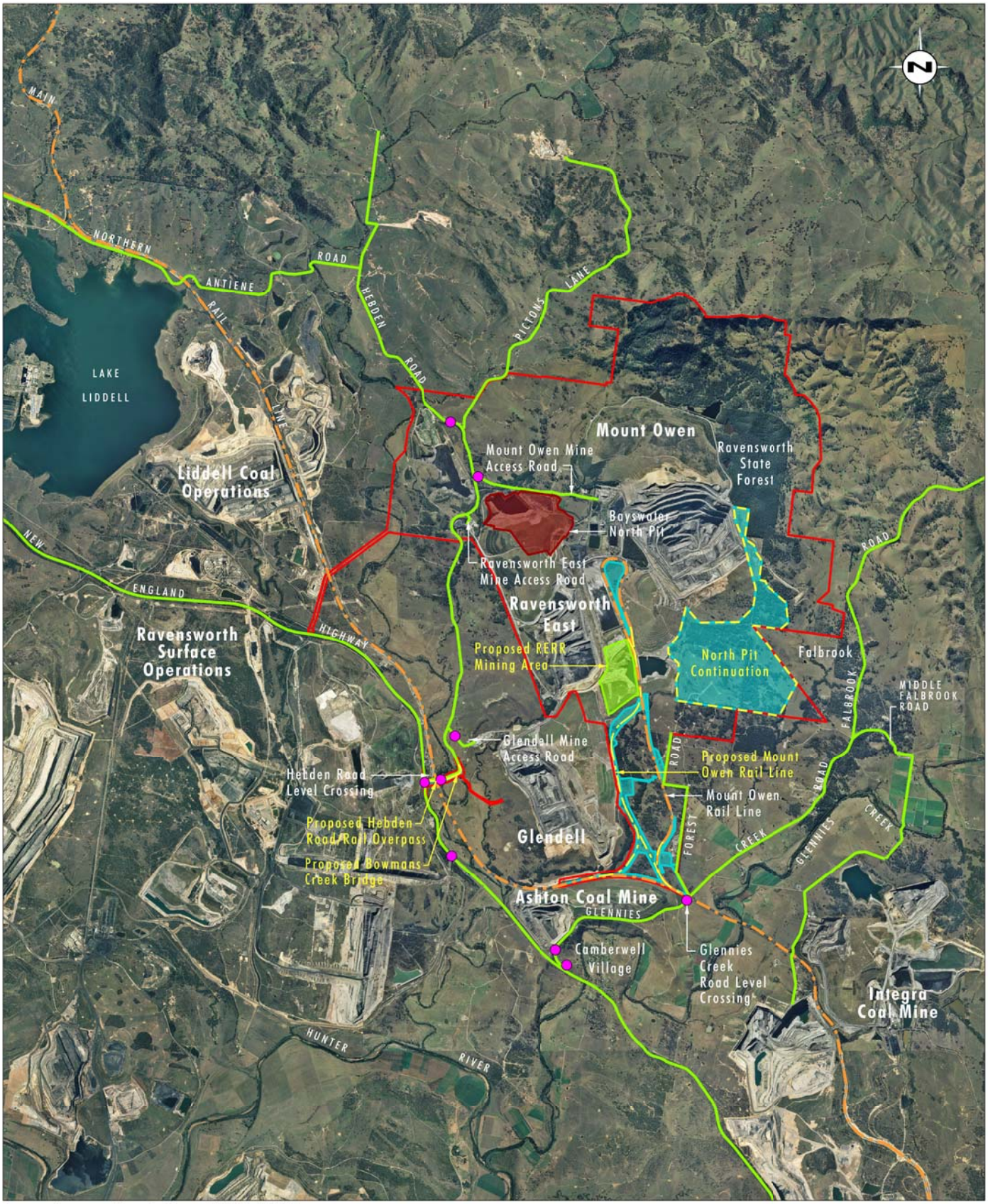

Image Source: Mount Owen (2012-2013)
Data Source: Mount Owen (2014)

0 1.0 2.5 5.0km
1:100 000

Legend

- Project Area
- Proposed Disturbance Area
- Proposed RERR Mining Area
- Bayswater North Pit
- Proposed North Pit Continuation
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Traffic Route
- Main Northern Rail Line
- Traffic Count Location

FIGURE 5.41

Existing Road Network and Traffic Count Locations

File Name (A4): R02/3109_921.dgn
20141008 16.05

Table 5.12.2 – Average 24 Hour (Daily) ADT Traffic Flows Year 2013

Location	Northbound Veh/Day	Southbound Veh/Day	Two Way Veh/Day
Glennies Creek Road at New England Highway	512	511	1023 (15.5% m/vh[1])
Glennies Creek Road at Forest Road	180	180	360 (25% m/hv)
Hebden Road at New England Highway	671	647	1,318 (23% m/vh)
Hebden Road North of Pictons Lane	101	100	201 (11.5% m/vh)
	Eastbound Veh/Day	**Westbound Veh/Day**	**Two Way Veh/Day**
Mount Owen Mine Access Road	370	372	742 (17% m/vh)
Ravensworth East Mine Access Road	10	10	20 (5% m/hv)
Glendell Mine Access Road	279	278	557 (14.5% m/vh)

Note: 1) m/vh = medium to heavy vehicles per hour as derived from the ADT 24 hour counts.

Of the average daily 304 heavy vehicles that utilise Hebden Road at the New England Highway intersection approximately 128 are to / from the Mount Owen Mine and approximately 80 are to / from the Glendell Mine. Existing average daily traffic volumes on both Glennies Creek Road and Hebden Road are considered moderate to low, generally being less than 1,400 vehicles per day, which signifies a peak hour level of service (LOS) B or better traffic conditions for rural roads as defined by the Austroads Roadway Capacity Manual.

The existing local road network experiences peak hour flows in the morning between 6.00 am and 7.00 am (morning peak period) and in the afternoon from 6.00 pm to 7.00 pm (afternoon peak period), except for Glennies Creek Road (at the New England Highway) which has an afternoon peak hour of 4.45 pm to 5.45 pm.

5.12.2.1 Road Conditions

The traffic impact assessment reviewed the existing road environment and conditions (i.e. pavement, shoulders, clearzone hazard signage and delineation) accordance with RMS and Austroads checklist guidelines. Details are provided in **Appendix 16**.

5.12.2.2 Principal Intersections and Current Performance

The existing peak hour operation of the New England Highway / Hebden Road and New England Highway / Glennies Creek Road (refer to **Figure 5.41**) intersections was assessed using the SIDRA intersection modelling software package.

The existing intersections of New England Highway with Hebden and Glennies Creek Roads operate as priority controlled intersections. There is a left turn slip lane and right turn lane provided on the New England Highway to minimise delays from the turning traffic at both locations.

These intersections both operate with ample spare capacity, minimal delays and virtually no queues in peak times. This correlates closely with observations during the peak periods and indicates that both intersections are capable of absorbing moderate levels of increased peak hour traffic flows without significantly affecting the existing favourable traffic service levels.

5.12.2.3 Level Crossing Performance

An assessment of the performance of the rail level crossings on Glennies Creek Road and Hebden Road has been undertaken to ascertain the likely existing delays to traffic waiting to cross the rail line (refer to **Figure 5.41**).

Based on information provided by ARTC (2013), an estimated 100 freight, coal and passenger trains would utilise these level crossings daily, with an estimated peak of up to six trains per hour. Based on existing train lengths and operational speeds of approximately 40 km/hr, an average crossing closure of 110 seconds per train is expected. However a 'worst case' scenario has been considered based on a coal train crossing, with a second coal train also crossing in the opposite direction, affecting the rail crossing for a longer period of up to 10 minutes.

The results of the analysis illustrate that the average delay for traffic is approximately 4 minutes and that the queue length could reach 100 metres for 5 per cent of the time on Hebden Road and 20 metres on Glennies Creek Road in peak hours. These queues are well clear of the New England Highway intersections and are considered acceptable and infrequent.

However, this duration of delay is considered to be significant and in urban situations is a LoS F (this is typical of many urban crossings in Australia). As outlined in **Section 2.3.13**, Mount Owen is proposing to construct a rail overpass over the Main Northern Rail Line on Hebden Road to remove this interaction with the rail level crossing. The detailed design and construction process will be completed in consultation with RMS, Singleton Council and ARTC.

5.12.2.4 Hebden Road Single Lane Bridge Performance

An assessment has been undertaken for the potential delays associated with the single lane bridge across Bowmans Creek on Hebden Road (refer to **Figure 5.41**). The results of the AM peak analysis illustrates that the average delay for southbound traffic (northbound has priority on the bridge) is approximately 18.5 seconds and the queues could reach 28 metres for 5 per cent of the time. This level of delay is widely considered acceptable at LOS B.

Notwithstanding, as outlined in **Section 2.3.13**, Mount Owen proposes to construct a new dual lane bridge over Bowmans Creek on Hebden Road to improve road safety and operation, and therefore any current delays at the bridge will be removed. The detailed design and construction process will be completed in consultation with Singleton Council.

5.12.3 Traffic Impacts

5.12.3.1 Construction Traffic

As outlined in **Section 2.3.17**, the construction phase is scheduled to take approximately 18 months and commence within one year of the continuation of mining beyond the currently approved mining limit. The peak construction period has been assumed to occur during Year 1 of the Project with a peak construction workforce of approximately 330.

Modelling scenarios for the Traffic Impact Assessment were undertaken on the potentially 'worst case' Project scenarios, which included Year 1 and Year 2 of the Project. The Traffic Impact Assessment (refer to **Appendix 16**) utilised a SIDRA model analysis of the key intersections of the New England Highway with Glennies Creek and Hebden Road for the assessment of the impacts of the construction phase of the Project. SIDRA is preferred by the RMS for intersection modelling and was used to provide key indicators for delay, queuing and average speed of the key intersections associated with the Project based on morning and afternoon peak periods. The results of the SIDRA modelling are provided in **Appendix 16**.

The SIDRA analysis indicates that both intersections (New England Highway / Glennies Creek Road and New England Highway / Hebden Road) will operate, during peak traffic demands, at good traffic service levels (LOS A) with minimal delays and queue lengths. These intersections currently operate as LOS A, with ample spare capacity, minimal delays and virtually no queues in peak times. During peak constructions activities, the right turn movements out of Glennies Creek Road and Hebden Road operate as LOS C in the AM peak and LOS B in the PM peaks. These traffic service levels are within acceptable parameters as adopted by RMS for peak hour uncontrolled intersection operations.

During construction of the Hebden Road / rail level crossing, up to 161 inbound and 3 outbound vehicles between 6.00 am to 7.00 am can be expected on Hebden Road at the rail level crossing. A closure of the rail level crossing for a period of up to 10 minutes (as is possible) could result in a queue of up to 20 to 30 cars (180 metres). However, it is noted that if this queue is realised the impact is considered low, as it would not extend back to the New England Highway.

For the rail line construction works, primary access for the 90 construction workers will be via the New England Highway to Glennies Creek / Forest Road. The majority of the Mount Owen rail line construction workforce is expected to commence on-site off Forest Road at 7.00 am, with the busiest construction traffic arrivals anticipated between 6.00 am and 7.00 am Monday to Saturday. The worst case scenario for the construction program for the proposed rail works estimates that traffic movements will occur early in the Project. In this scenario, various construction activities will take place simultaneously. As the additional traffic movements associated with construction will be for a short period of time, it is not expected to impact significantly upon Glennies Creek Road / Forest Road.

5.12.3.2 Operational Traffic Impacts

The Project does not propose to increase permanent staffing levels from current approved levels, hence the traffic associated with ongoing operations will be similar to current traffic levels. Accordingly existing operational traffic demands on Hebden Road, are not expected to adversely impact upon existing acceptable traffic conditions and traffic service levels or at the New England Highway intersection or on Hebden Road.

Approximately 40 existing mine workers (over 2 shifts) will access the BNP at the Ravensworth East MIA, via the Ravensworth East Mine access road. There is existing capacity in the Ravensworth East Mine access road / Hebden Road intersection to accommodate access for approximately 40 employees.

As such, the traffic associated with the Project will be similar to current traffic levels but will continue for an additional 12 years. It is also expected that traffic will continue beyond the mine life for the rehabilitation phase. The volume of traffic is expected to decline as the number of personnel generally required for rehabilitation is substantially less than the operational phase.

5.12.3.3 Road Safety

The Traffic Impact Assessment examined the road safety of the current local traffic network, specifically by referring to the RMS crash data for the key roads and intersections. Two injury type accidents have been recorded on the RMS crash database in the past five years on the New England Highway at 30 metres north and 60 metres south of Hebden Road. No other vehicle accidents have been recorded in the past five years on Hebden Road from New England Highway to Pictons Lane or on Glennies Creek Road / Forest Road.

The overall road safety for other road users should not be compromised by the additional vehicle movements associated with the construction or operation phase of the Project. The level of daily and peak hour construction traffic forecast does not raise LOS levels on either Hebden Road or Glennies Creek Road to an unacceptable LOS.

At both intersections to / from the New England Highway, entry and exit sight distances at Hebden Road and Glennies Creek Road currently meet RMS and Austroad requirements for 90 km/hr and 100 km/hr speed zones respectively. The proposed rail overpass and Bowmans Creek Bridge will improve road safety and reduce risks on Hebden Road for all road users through removing the interactions with rail traffic on the level crossing and removal of the existing single lane bridge.

5.12.4 Road Traffic Management Commitments

Mount Owen provides an ongoing contribution to road maintenance to Singleton Council in accordance with the current Ravensworth East development consent (52-03-99). Mount Owen will consult with Singleton Council regarding the establishment of a Voluntary Planning Agreement (VPA) (including road maintenance requirements) that is commensurate with the local infrastructure impacts associated with the Project.

As outlined above, there are not predicted to be any significant adverse impacts on traffic flows or traffic infrastructure performance as a result of the construction or operation of the Project. The Project's commitment to building a new Bowmans Creek Bridge and rail overpass on Hebden Road will provide a benefit in terms of improving traffic flow and road safety on this road. Mount Owen proposes to prepare and implement Construction Traffic Management Plans (TMPs) in consultation with the RMS and the Singleton Council to proactively manage construction traffic movements on the local road network including Glennies Creek Road, Forest Road and Hebden Road, during the construction period. Specific details on measures to be addressed in the TMPs are provided in the Traffic Impact Assessment (refer to **Appendix 16**).

5.12.5 Rail Infrastructure

5.12.5.1 Mount Owen Load Out Facility, Rail Line and Train Movements

The existing Mount Owen Load Out Facility and Rail Line is located in the southern portion of the Project Area and the associated infrastructure located at Mount Owen Mine includes a rail provisioning facility and train load out system situated on the existing rail loop.

The Mount Owen Complex currently generates approximately 1,000 train movements per year (2.7 movements per day) based on 9,000 to 10,000 tonne trains. As discussed in **Section 2.3.12** the train movements associated with the Project will not increase above what is currently approved.

5.12.5.2 The Existing Rail Network

The Hunter Valley Coal Chain (HVCC) provides the primary transportation for coal extracted from the coal fields within the Hunter Valley region to the Port of Newcastle. The infrastructure used for the HVCC is part of the Main Northern Rail Line which is owned by the State Government and managed by the Australian Rail Track Corporation (ARTC). The Mount Owen Complex Rail Line connects to the Main Northern Rail Line at the Mount Owen Junction.

5.12.5.3 Proposed Rail Works

Mount Owen will continue to utilise the existing Mount Owen Load Out Facility and Rail Line that currently services the Mount Owen Complex. In addition, Mount Owen is seeking approval for the provision of an additional rail line and northern turn-out west of the existing Mount Owen Complex Rail Line (refer to **Figure 2.13**). The construction of the proposed rail line and northern turn-out will allow Glencore trains the ability to turn around and return to Glencore owned mines located to the west. It is planned that the proposed rail line servicing the Mount Owen Complex would become the main connection between the Main Northern Rail Line and the Mount Owen Complex and will be available for the collection and transportation of coal and train turn around for the Glencore-rail trains. The existing Mount Owen Complex Rail Line will be used as a park-up area for Glencore-rail trains. The detailed design and construction of the proposed rail infrastructure will be undertaken in consultation with ARTC.

5.12.5.4 Impact Assessment on Existing Rail Network

Glencore has an ongoing agreement for track access with the ARTC to accommodate haulage of coal from its Hunter Valley mines to the Port of Newcastle. This agreement has a 10 year planning horizon and is rolled forward each year. Under this agreement, Glencore is required annually to forecast its capacity requirements to assist the ARTC with its corridor capacity planning. The additional coal tonnes associated with the Project are included in the current 10 year planning horizon for rail access.

The *2013-2022 Hunter Valley Corridor Capacity Strategy Consultation Draft* (ARTC) includes plans to increase the capacity between Muswellbrook and Hexham along the Main Northern Rail Line, and these works are proposed to provide for the planned increase in terminal capacity at the Port of Newcastle and the predicted increase in coal export to 2021. Whilst year by year there will not be an increase in train movements as a result of the Project, the Project will result in an additional 12 years of coal production and transportation along the Main Northern Rail Line. As discussed in **Section 2.3.12,** the train movements associated with the Project will not increase above what is currently approved due to increased efficiencies of larger train sizes used for coal haulage.

As outlined above, the proposed additional rail line servicing the Mount Owen Complex will allow Glencore-rail trains the ability to turn around within the Mount Owen Complex Rail Line and return to Glencore owned mines to the west. Mount Owen expects that approximately 60 trains per year (0.2 trains per day) would utilise the Mount Owen Complex Rail Line to turn and head west. This would result in a minor reduction in train movements along the Main Northern Rail Line between the Project Area and the Port of Newcastle, thus providing additional train paths. The use of the existing Mount Owen Complex Rail Line for the park up of Glencore-rail trains is also expected to potentially increase capacity along the Main Northern Rail Line.

The proposed rail line will require changes to the existing signal configuration where the proposed northern turnout and Mount Owen Complex Rail Line connects to the Main Northern Rail Line. The proposed amendments to the signal configuration is not expected to impact the capacity or timing of the existing train movements along the Main Northern Rail Line and the detailed design of the proposed signal reconfiguration will be undertaken in consultation with the ARTC.

5.12.5.5 Level Crossings

The DGRs for the Project (refer to **Section 3.2**) require an assessment of the potential impacts of the Project on level crossing operations. A level crossing is 'the intersection of a road or pedestrian walkway and a railway line at the same grade' (Transport for NSW 2014). There are seven public and a number of private level crossings between the Project Area and the Port of Newcastle (Transport for NSW 2014). Coal haulage along the railway and associated train lengths have the potential to cause traffic delays for motorists and emergency services at level crossings and cause access and safety issues for motorists and pedestrians in areas that are divided by the existing railway line (Upper Hunter Strategic Regional Land Use Plan 2012).

With the exception of utilising the proposed rail line as outlined in **Section 5.12.5.3**, the Project will not involve any change to the current product transportation practices. Train movements associated with the Project will not increase above what is currently approved (1,636 annually) due to increased efficiencies of larger train sizes used for coal haulage.

Given that the Project will not increase currently approved train movements, there are not expected to be additional impacts to the current operation of level crossings. Therefore users of the public and private level crossings between the Project Area and the Port of Newcastle are not anticipated to experience any change in the number or duration of train passes as a result of the Project.

The proposed rail overpass over the Main Northern Rail Line on Hebden Road to be constructed as part of the Project will eliminate delays on Hebden Road as a result of the rail crossing and improve traffic safety.

5.12.5.6 Rail Safety

The Project will not involve any change to the current product transportation practices along the Main Northern Rail Line. The construction of the proposed rail line and northern turnout will allow empty Glencore trains the ability to turn around within the Mount Owen Complex Rail Line and return west rather than heading to the Port of Newcastle to turn around. It is considered this will aid capacity along the Main Northern Rail Line between the Project Area and the Port of Newcastle through a reduction in train movements. The provision of a train park-up area on the existing Mount Owen Complex Rail Line for Glencore-rail trains will further reduce congestion along the Main Northern Rail Line.

The proposed rail overpass over the Main Northern Rail Line on Hebden Road will also improve road traffic flow and safety through removal of the existing level crossing. All product coal associated with the Project will be transported to the Port of Newcastle using licensed operators on the ARTC network, which are required to meet all rail safety requirements. Potential air quality and noise impacts associated with rail traffic are addressed in **Sections 5.2** and **5.3**, respectively.

5.13 Visual Amenity

The DGRs required a visual assessment to be undertaken for the Project, as outlined in **Table 5.13.1**:

Table 5.13.1 – Visual Amenity Director-General's Requirements

Visual Amenity Requirements	Section of Report
A detailed assessment of the:	
• changing landforms on the site during the various stages of the development;	**Section 5.13.4**
• potential visual impacts of the development on private landowners in the surrounding area as well as key vantage points in the public domain, including lighting impacts; and	**Section 5.13.4**
• a detailed description of the measures that would be implemented to minimise the visual impacts of the development.	**Section 5.13.5**

5.13.1 Existing Visual Character

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 40 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 both the New England Highway and the Main Northern Rail Line. In the vicinity of the Mount Owen Complex, mined surfaces, 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. Both Liddell and Bayswater Power Stations are dominant structures in the horizon.

As identified in **Section 1.3**, the Mount Owen Complex is located within a rural environment in close proximity to several other mining operations. The predominant land uses in the vicinity of the Project Area include coal mining, State Forest, grazing and rural residential holdings. The character of the immediate visual environment of the Mount Owen Complex is strongly influenced by the existing mining operations.

The Ravensworth State Forest is located within the north-east portion of the Project Area (outside the Proposed Disturbance Area) which provides a large contrast in the existing visual catchment with the vegetated elevated slopes and ridges providing a backdrop (when viewed from the south-east through to the north-west) to the operational areas of the Project Area.

The surrounding rural land contrasts to the mining areas of Mount Owen and surrounding mines in the general Ravensworth area. These various landscape elements (associated with mining) provide contrast in visual amenity from areas with a largely natural or agricultural character.

The night time scenic quality of the local area is not typically rural. As a result of mining operations, power stations and other industries in the area, night light and glow emanating from these activities is common. There is also glow from the nearby villages. The night light glow is exemplified on overcast nights as the night light is reflected by the clouds. Whilst it is not natural, the night glow now adds to the character of the background night environment in the Upper Hunter.

The nightscape of the general Ravensworth area is also characterised by the lights of moving vehicles. These include vehicles travelling along roads, including the New England Highway, vehicles operating in the mines and trains moving along associated rail lines.

5.13.2 Impact of Existing Mining Operation on Visual Character

Views of the existing mining operations at the Mount Owen and Ravensworth East Mines are the most prominent from the east, south-east and south, with views of other existing mining operations, notably Integra Coal Mine, Ashton Coal Mine, Glendell Mine and Ravensworth Surface Operations currently available from the New England Highway, the Main Northern Rail Line, and a number of surrounding properties. The majority of Mount Owen's mining infrastructure and operations are screened from views from the north and east by the existing topography, vegetation and other mining operations including Glendell Mine.

Parts of the existing Mount Owen and Ravensworth East mining operations are visible from Hebden Road, Middle Falbrook Road and Glennies Creek Road, with a portion of the rehabilitated overburden area visible from the New England Highway.

In the Ravensworth East Mine, the overburden emplacement areas (primarily rehabilitated) are the most visible feature from public view points. Views of the Ravensworth East Mine from surrounding private residential properties located to the south-east and east are long range (in excess of 4 kilometres) and are predominately restricted by the existing Ashton Mine overburden emplacement areas and by the north-south ridgeline to the east of Mount Owen. Current views of the Ravensworth East Mine operations from the south on the New England Highway are restricted by the existing Ashton Mine Operations and Glendell, however views of the Ravensworth East Mine particularly of the rehabilitated overburden emplacement areas, are prominent from the west for travellers on the New England Highway.

The existing approved mining operations at the North Pit currently result in a night time glow, which, along with other mining operations, affects the local night time visual amenity. To manage these impacts, Mount Owen has implemented a range of measures to reduce the impact on the scenic quality of the area including directional lighting, as well as management controls for the placement of mobile lighting to reduce impacts.

5.13.3 Visual Amenity Assessment Methodology

To assess the visual impacts of the Project a series of radial analyses, panoramic photographs and visual montages have been completed for potentially impacted locations surrounding the Project Area.

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 average eye height). It should be noted that the radial analyses are topography based only and do not include vegetation which may in fact further screen a portion of a viewshed. Radial analyses were completed using the Project's Year 10 mine profiles as a representation of the maximum height of the constructed landform and the full progression of the proposed mine footprint to gauge the potential visual impact from targeted viewpoints.

The radial analysis confirmed that the progression of mining as part of the Project, is not visible from residences to the north, and east, and Camberwell Village due to screening provided by natural and existing topography, and that the only potential views of the continued mining operations from private residences would be from a limited number of residences in the Middle Falbrook area. For this reason, the detailed visual impact analysis focused on selected private residences in the Middle Falbrook area with highest potential for visual impacts, and the view from public transport routes. Following review of the radial analyses, and based on feedback from residents during consultation, a field program was developed for ground truthing the likely visual impacts from the Project. Six visual locations (refer to **Figure 5.42**) were selected which have the highest potential for visual impact, namely:

1. Residence R088 – Thomas Lane (Viewing Location 1);
2. Residence R093 – Thomas Lane (Viewing Location 2);
3. Residence R095 – Thomas Lane (Viewing Location 3);
4. Residence R111 – Stony Creek Road (Viewing Location 4);
5. Middle Falbrook Road and Glennies Creek Road Intersection (public viewing location) (Viewing Location 5); and
6. Hebden Road and New England Highway Intersection (public viewing location) (Viewing Location 6).

Locations chosen for visual montages were determined based on the results of the radial analysis and observations made during the field assessment. Visual montages are developed using a panoramic photograph (made using a series of individual photos taken at each visual location), 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 that includes the Project and its visual amenity management measures. Visual montages for this assessment included a comparison with the existing operations and the operations at Year 10 of the mine life.

The field program assessment determined that there were two private residences, in addition to transport route views, from which visual impacts exist or are likely to be experienced as a result of the Project, namely:

- Residence R095 (Viewing Location 3);
- Middle Falbrook Road and Glennies Creek Road Intersection (Viewing Location 4);
- Hebden Road and New England Highway Intersection (Viewing Location 5); and
- Residence R111 (Viewing Location 6).

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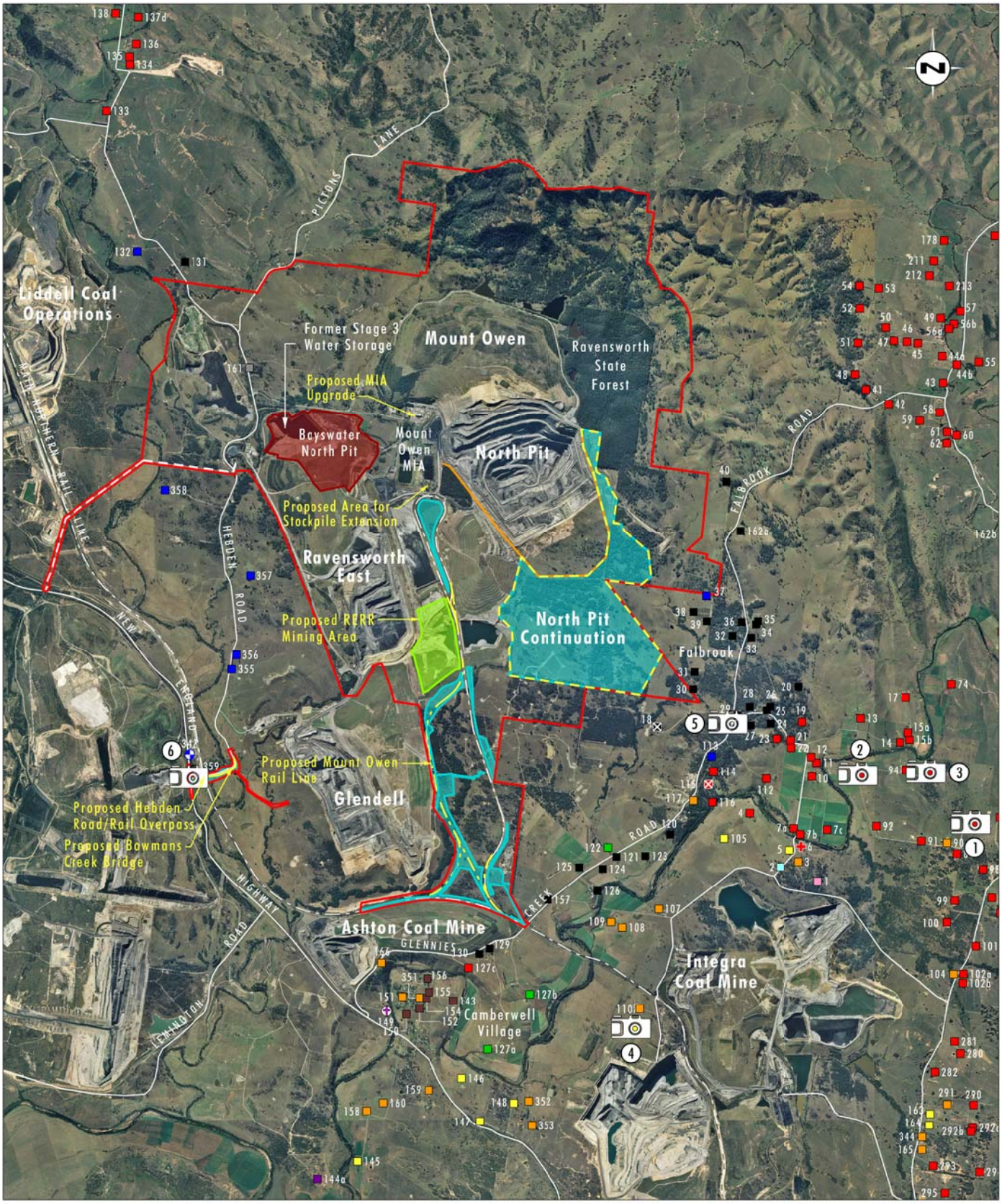

Image Source: Mount Owen (2012-2013)
Data Source: Mount Owen (2014)

0 1.0 2.0 4.0km
1:80 000

Legend

- Project Area
- Proposed Disturbance Area
- Proposed RERR Mining Area
- Bayswater North Pit
- Approved North Pit Mining Extent
- Proposed North Pit Continuation
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Viewing Locations
- Former Hebden Public School
- Daracon Site Office
- Private Residence
- Mine Owned Residence - Glencore
- Mine Owned Residence - Other Mine
- Mine Owned Residence - Derelict
- Mine Owned Residence - Vacant
- Private No Dwelling
- Subject to Acquisition Rights - Glencore No Dwelling
- Private Residence - Currently Subject to Acquisition Rights - Glencore
- Private Residence - Currently Subject to Acquisition Rights - Other Mines
- Currently Subject to Acquisition Rights - Dairy
- SEOC Acquisition - Noise Trigger
- Glennies Creek Fire Brigade
- Church
- Community Hall

FIGURE 5.42

Visual Assessment Viewing Locations

File Name (A4): R02/3109_779.dgn
20141008 16.05

As described further below, the current Mount Owen and Ravensworth East mining operations are also visible from the hill located behind Residence R093 (part of the resident's landholding); however, the operations are not visible from the residence itself. There was no view of the current Mount Owen and Ravensworth East mining operations from Residence R088, nor are there any likely visual amenity impacts as a result of the Project.

5.13.4 Visual Impact Assessment

The visual impact assessments for each of the representative viewpoints listed above in **Section 5.13.3** are discussed below.

In addition to the construction of emplacement areas as part of the Project, other changes to the visual amenity of the area will result from the construction of the following infrastructure:

- Hebden Road Rail overpass;
- Hebden Road bridge over Bowmans Creek; and
- the proposed rail line.

Changes to visual impacts associated with Project infrastructure are also discussed below.

5.13.4.1 Visual Amenity Assessments from Key Viewing Locations

As discussed in **Section 5.13.3** and illustrated on **Figure 5.42**, six visual locations were chosen to be assessed as locations considered representative of localities that have the highest potential for visual impact. Visual amenity assessments for each of these locations are provided below.

Viewing Location 1 - Residence R088

Figure 5.43 illustrates the radial analysis from Residence R088 located on Thomas Lane to the east-south-east of the North Pit Continuation, which clearly demonstrates that the Project is not visible from this location. The viewshed from this location extends from the west-north-west to the south-west. These views are at distances of approximately 5.5 kilometres, 8 kilometres and 10.5 kilometres from the North Pit Continuation, RERR Mining Area and BNP respectively. The orientation of the residence does not have a view of the North Pit Continuation, RERR Mining Area or BNP; with the existing topography shielding any potential views.

Viewing Location 2 - Residence R093

Figure 5.44 illustrates the radial analysis from Residence R093 located on Thomas Lane to the east of the North Pit Continuation, with the viewshed from this location extending from the north-north-west to the south-west. These views are at distances of approximately 3.5 kilometres, 6 kilometres and 8.5 kilometres from the North Pit Continuation, RERR Mining Area and BNP respectively. The current North Pit operations and the North Pit overburden emplacement area, is visible from the hill located behind Residence R093 (part of the resident's landholding); however, it is not visible from the residence itself. There are no views of the existing Ravensworth East operations, with the radial analysis indicating the BNP and RERR Mining Areas will not be visible from Residence R093. **Figure 5.45** provides a panoramic image of the view from the residence facing west illustrating no impact as a result of the Project.

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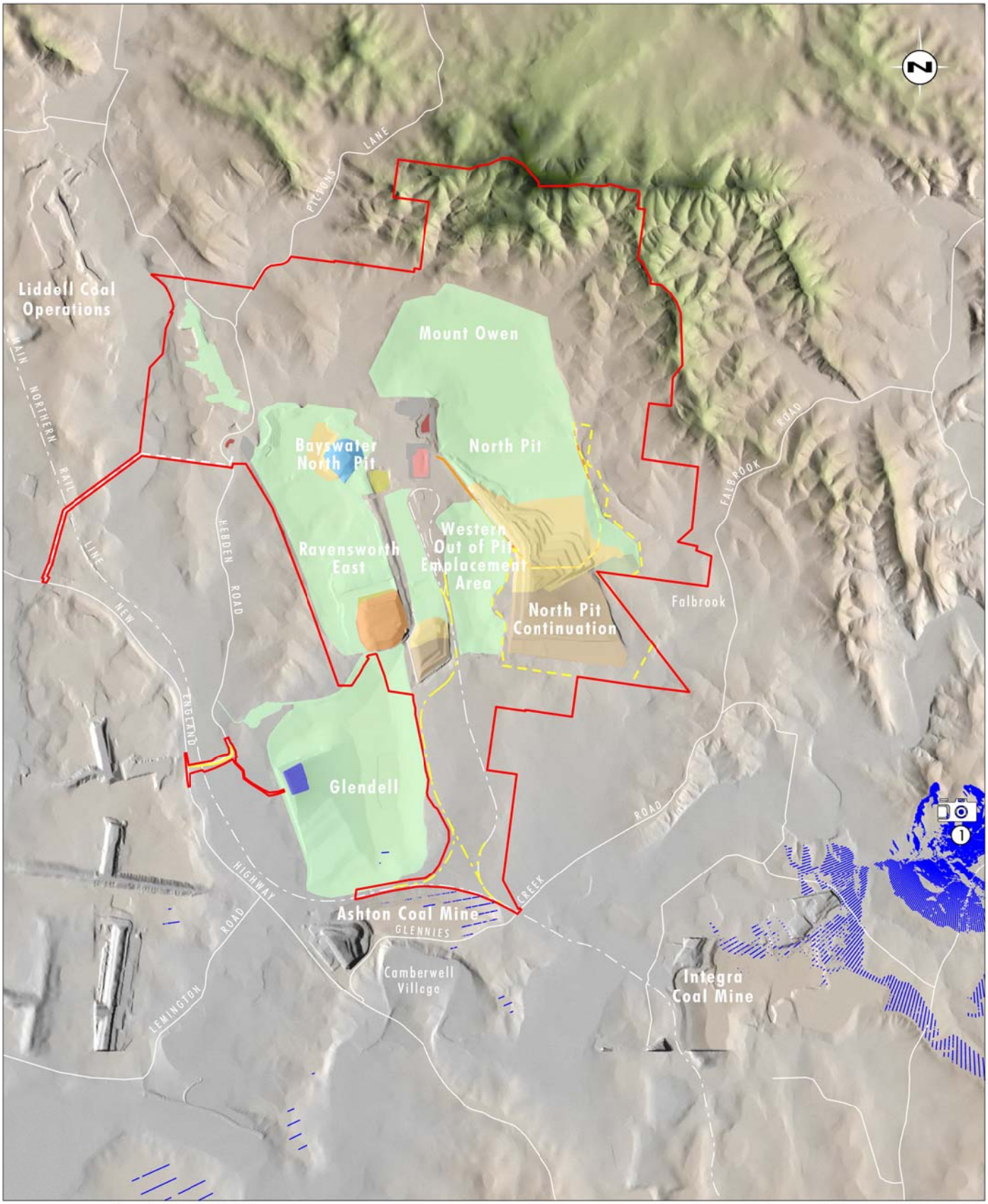

Image Source: Mount Owen (2014)
Data Source: Mount Owen (2014)

0 1.0 2.0 4.0km
1:80 000

Legend

- Project Area
- Approved North Pit Mining Extent
- Proposed North Pit Continuation
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Visible Surface
- Viewing Location
- Active Mining Area
- Active Overburden Emplacement Area
- Coal Stockpile - Product
- Coal Stockpile - ROM
- Infrastructure
- Rehabilitation - Complete
- Rehabilitation - Temporary
- Shaped Not Seeded
- Tailings Placement
- Water Storage Area
- Final Void

FIGURE 5.43

Viewing Location 1
Year 10 - Residence 88
Facing west

File Name (A4): R02/3109_780.dgn
20141024 15.22

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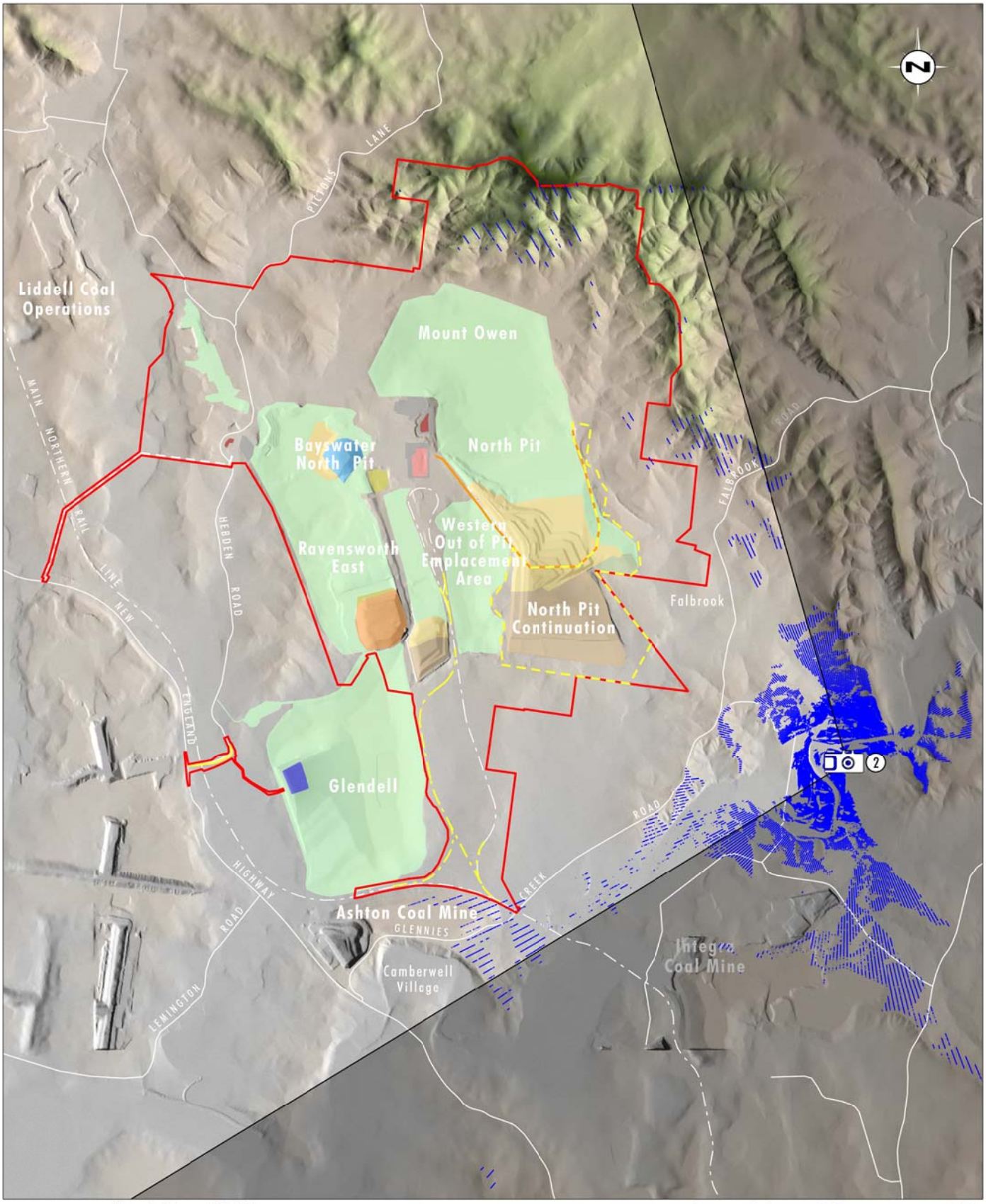

Image Source: Mount Owen (2014)
Data Source: Mount Owen (2014)

0 1.0 2.0 4.0km
1:80 000

Legend

- Project Area
- Approved North Pit Mining Extent
- Proposed North Pit Continuation
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Visible Surface
- Viewing Location
- Active Mining Area
- Active Overburden Emplacement Area
- Coal Stockpile - Product
- Coal Stockpile - ROM
- Infrastructure
- Rehabilitation - Complete
- Rehabilitation - Temporary
- Shaped Not Seeded
- Tailings Placement
- Water Storage Area
- Final Void

FIGURE 5.44

Viewing Location 2
Year 10 - Residence 93
Facing west

File Name (A4): R02/3109_781.dgn
20141024 15.21

FIGURE 5.45

Viewing Location 2
Residence 93
Panoramic view - facing west

File Name (A3): R02/3109_922.dgn
20130910 8.52

Viewing Location 3 - Residence R095

Figure 5.46 illustrates the radial analysis from Residence R095 located on Thomas Lane to the east of the North Pit Continuation, with the viewshed from this location extending from the west to the north. These views are at distances of approximately 4.5 kilometres, 7 kilometres and 9.5 kilometres from the North Pit Continuation, RERR Mining Area and BNP respectively. Residence R095 has views of the existing North Pit and the WOOP emplacement area. Views of the BNP and RERR Mining Area in Ravensworth East from Residence R095 are predominantly shielded by existing topography, although a small area of the Ravensworth East overburden emplacement area is potentially visible; with only a portion of the proposed North Pit Continuation area able to be viewed from the residence.

The visual montage from this location (refer to **Figure 5.47**) covers the viewshed presented in **Figure 5.46** and illustrates the following:

- **Existing View - Photomontage facing north-west** – a portion of the existing North Pit emplacement area is visible and Ravensworth East overburden emplacement area is potentially visible, to the north-west from this residence (approximately 7 kilometres away); however, the section of the emplacement area visible only makes up a very small proportion of the viewshed from this location. There is no Mount Owen Complex infrastructure visible from this residence.
- **Mine Plan Year 10 - Photomontage facing north-west** – the Project's emplacement area will be in the same location within the viewshed as the existing emplacement area. The emplacement area will remain a similar height but will have progressed closer to the residence, and the length will have been extended. It is located approximately 4.5 kilometres from the residence. Whilst the emplacement area profile is visible, altering the current landscape and views, the final landform and rehabilitation will be consistent with the surrounding natural environment as described in **Section 5.19**. By this stage of the Project, a reasonable vegetative cover is expected to exist, assisting in providing an overall low level of visual impact. No surface operations will be visible.

  Views of the North Pit Continuation active mining area will be screened by the existing ridgeline and vegetation. These views would be from a distance of approximately 4.5 kilometres.

Viewing Location 4 – Residence R111

Figure 5.48 illustrates the radial analysis from Residence R111 located on Stoney Creek Road to the south-south-east of the North Pit Continuation, with the viewshed from this location extending from the north to north-west. Residence R111 has views of the existing West Pit, North Pit and the WOOP emplacement area. Views of the BNP and RERR Mining Area in Ravensworth East are potentially visible from Residence R111; however, these views are at distances of approximately 9.2 kilometres and 5.8 kilometres, respectively. Views of the North Pit will likely be shielded by existing topography as mining progresses south into the North Pit Continuation area from Year 1 of the Project. It is noted that this residence has existing planted vegetation that will assist in shielding views of operations at the Mount Owen Complex from the residence and that the residence is located in close proximity to the existing Integra operations and has substantial near field views of the Integra pit.

Viewing Location 5 – Middle Falbrook Road and Glennies Creek Road Intersection (public viewing location)

Figure 5.49 illustrates the radial analysis from the intersection of Middle Falbrook Road and Glennies Creek Road to the east of the North Pit Continuation. The viewshed from this location extends from the west-south-west to the north-north-west illustrating the view from one of two public viewing points in the area surrounding the Project Area. These views are

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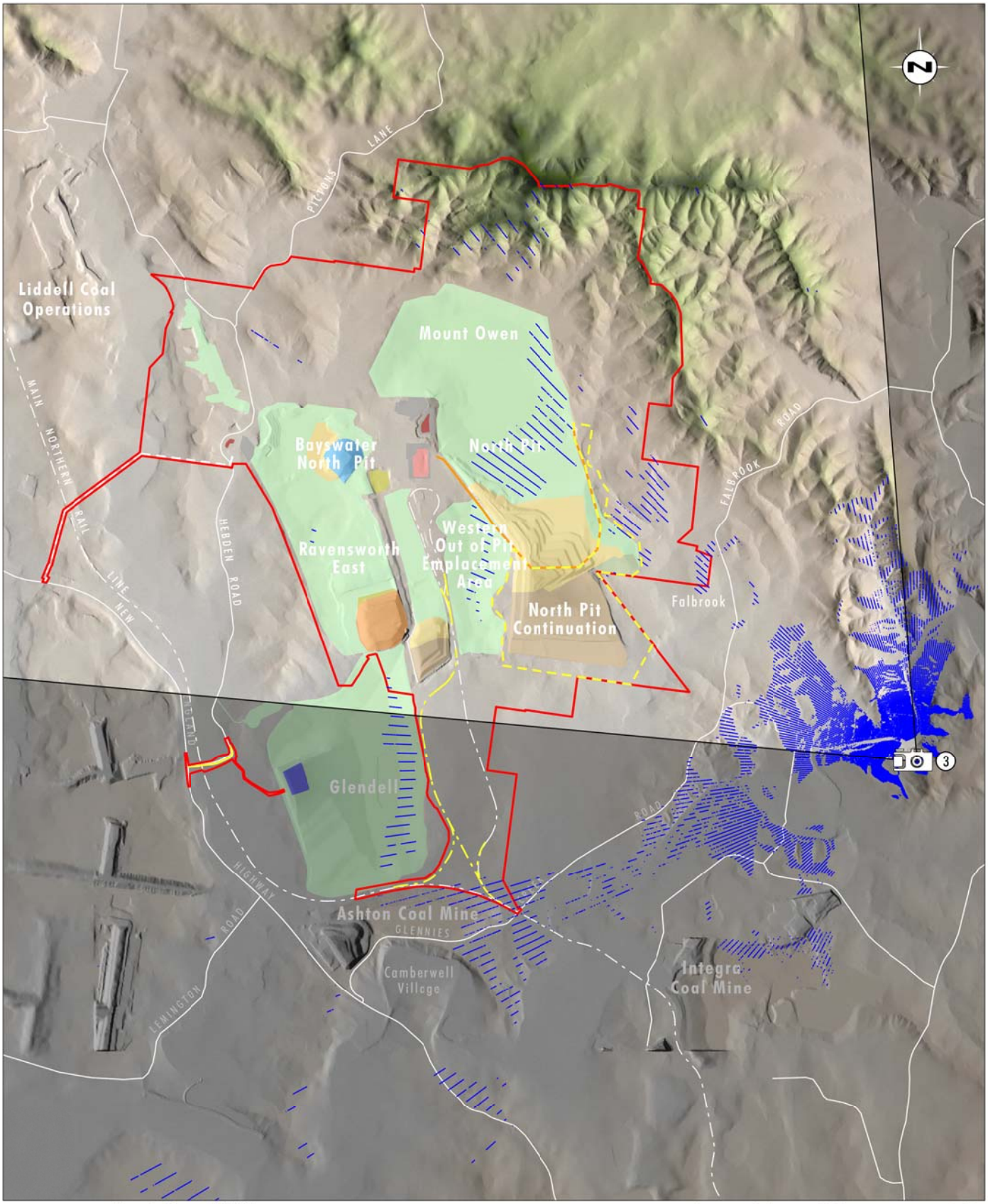

Image Source: Mount Owen (2014)
Data Source: Mount Owen (2014)

0 1.0 2.0 4.0km
1:80 000

Legend

- Project Area
- Approved North Pit Mining Extent
- Proposed North Pit Continuation
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Visible Surface
- Viewing Location
- Active Mining Area
- Active Overburden Emplacement Area
- Coal Stockpile - Product
- Coal Stockpile - ROM
- Infrastructure
- Rehabilitation - Complete
- Rehabilitation - Temporary
- Shaped Not Seeded
- Tailings Placement
- Water Storage Area
- Final Void

FIGURE 5.46

Viewing Location 3
Year 10 - Residence 95
Facing north-west

File Name (A4): R02/3109_782.dgn
20141024 15.19

FIGURE 5.47

Viewing Location 3
Residence 95
Photomontage - Facing north-west

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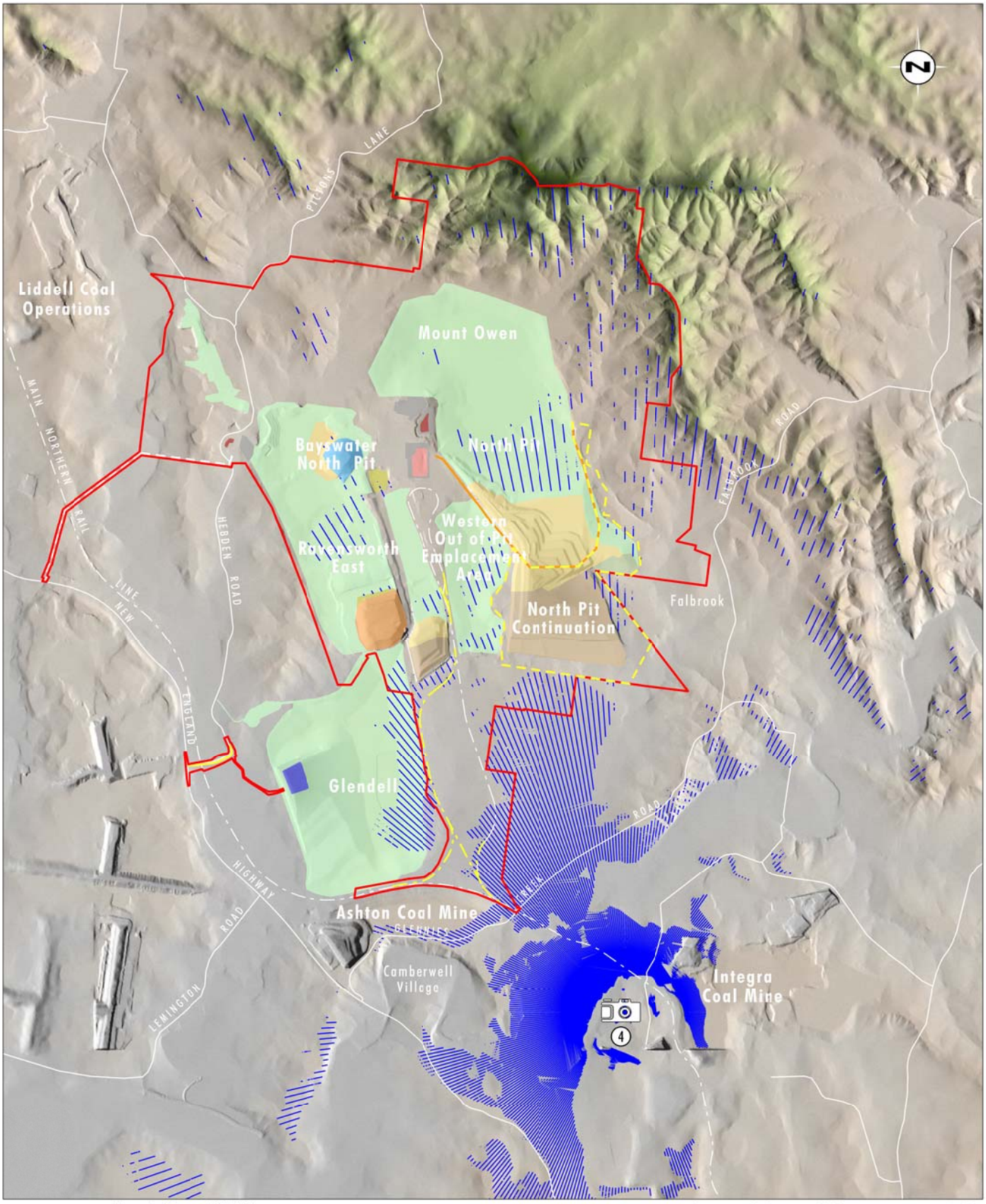

Image Source: Mount Owen (2014)
Data Source: Mount Owen (2014)

0 1.0 2.0 4.0km
1:80 000

Legend

- Project Area
- Approved North Pit Mining Extent
- Proposed North Pit Continuation
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Visible Surface
- Viewing Location
- Active Mining Area
- Active Overburden Emplacement Area
- Coal Stockpile - Product
- Coal Stockpile - ROM
- Infrastructure
- Rehabilitation - Complete
- Rehabilitation - Temporary
- Shaped Not Seeded
- Tailings Placement
- Water Storage Area
- Final Void

FIGURE 5.48

Viewing Location 4 - Year 10
Residence 111
Facing north-west

File Name (A4): R02/3109_965.dgn
20141024 15.18

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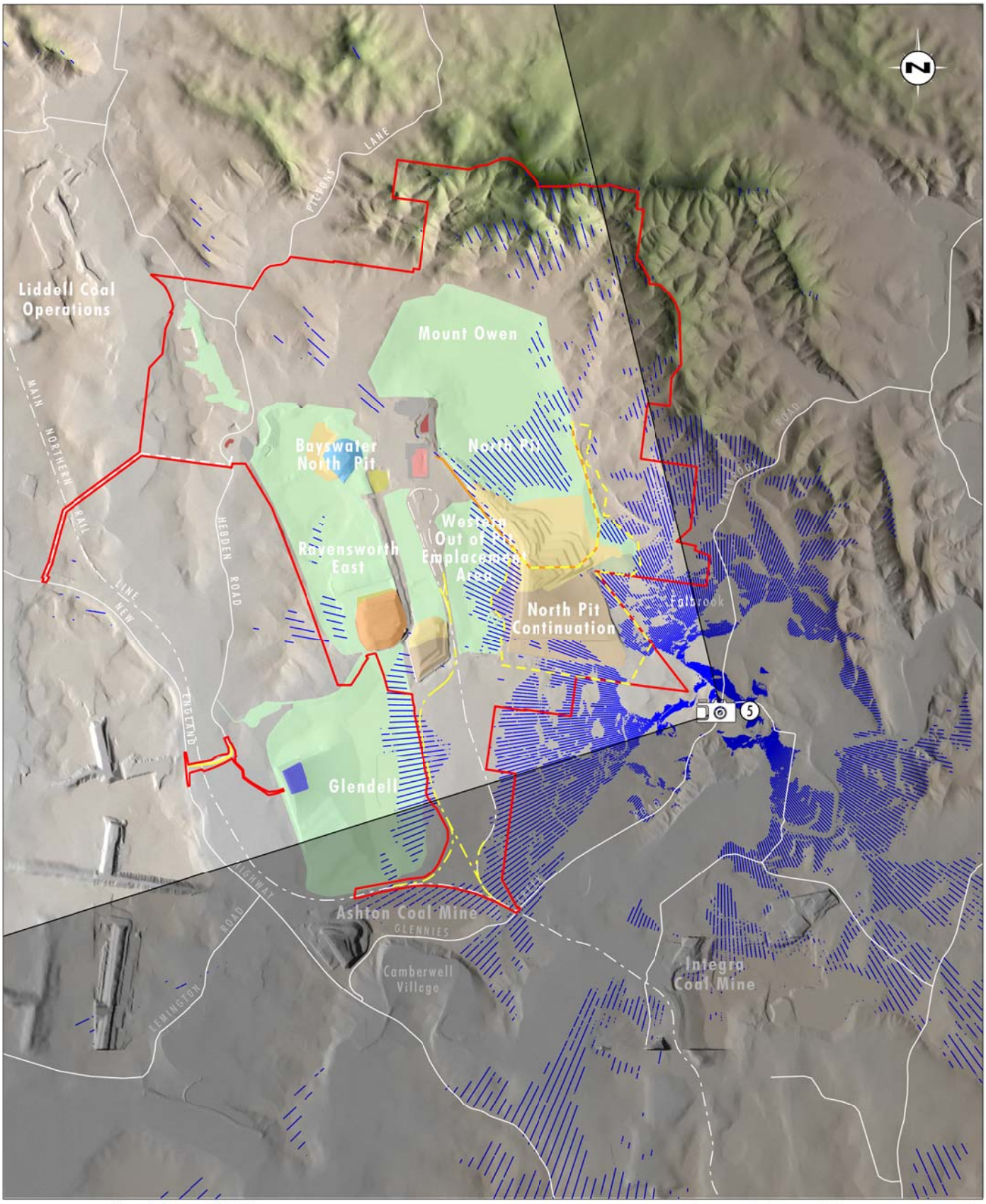

Image Source: Mount Owen (2014)
Data Source: Mount Owen (2014)

0 1.0 2.0 4.0km
1:80 000

Legend

- Project Area
- Approved North Pit Mining Extent
- Proposed North Pit Continuation
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Visible Surface
- Viewing Location
- Active Mining Area
- Active Overburden Emplacement Area
- Coal Stockpile - Product
- Coal Stockpile - ROM
- Infrastructure
- Rehabilitation - Complete
- Rehabilitation - Temporary
- Shaped Not Seeded
- Tailings Placement
- Water Storage Area
- Final Void

FIGURE 5.49

Viewing Location 5 - Year 10
Intersection of Middle Falbrook Road and Glennies Creek Road, Facing west

File Name (A4): R02/3109_783.dgn
20141024 15.16

at distances of approximately 1.5 kilometres, 4 kilometres and 6.5 kilometres from the North Pit Continuation, RERR Mining Area and BNP respectively. The existing North Pit and Ravensworth East mining operations, including the WOOP emplacement area, are visible from this viewing location. **Figure 5.49** indicates that the proposed North Pit Continuation area will be visible from this location; however, views of the BNP and RERR Mining Area in Ravensworth East are shielded by existing topography.

The visual montage from this location (refer to **Figure 5.50**) covers the viewshed presented in **Figure 5.49** and illustrates the following:

- **Existing View – Photomontage facing west** – at present from this location both the WOOP emplacement area and the North Pit emplacement area are visible, however there are no active mining areas or existing mine infrastructure visible from this location. These views are over a distance of 3 to 4 kilometres, however they still create a moderate impact on the visual amenity of this location. The WOOP emplacement area is located in the middle of the viewshed and the North Pit emplacement area to right of centre. The Glendell Mine is also visible in the left of the viewshed. Rehabilitation of the WOOP emplacement area has been largely completed, thereby minimising visual amenity impacts of this particular landform.

- **Mine Plan Year 10 – Photomontage facing west** – at this stage of the Project, two active operational areas will be visible within the viewshed; the active mining and the North Pit continuation overburden emplacement areas – both located within the centre of the viewshed, approximately 2 kilometres away. The majority of these active areas are shielded by topography and vegetation providing a reduction in impacts from this location; despite this, activities have a moderate visual amenity impact.

  By this stage, a reasonable vegetative cover is expected to exist on the North Pit Continuation emplacement areas and WOOP emplacement area with the final landforms and rehabilitation consistent with the surrounding natural environment as described in **Section 5.19**.

  The viewshed at this location will continue to include a mix of grazing and bushland with a minor increase only from the active mining area.

Viewing Location 6 - Hebden Road and New England Highway Intersection (public viewing location)

Figure 5.51 illustrates the radial analysis from the intersection of Hebden Road and the New England Highway to the south-west of the RERR Mining Area. The viewshed from this location extends from the north-east to the east-south-east, illustrating the view of the second of the two public viewing points in the area surrounding the Project Area. These views are at distances of approximately 5 kilometres, 3.5 kilometres and 5 kilometres from the North Pit Continuation, RERR Mining Area and BNP respectively. **Figure 5.51** indicates there are views of the existing Ravensworth East and North Pit operations, including the WOOP emplacement area; however, views of the North Pit Continuation, BNP and RERR Mining Area are shielded by existing topography.

The visual montage from this location (refer to **Figure 5.52**) covers the viewshed presented in **Figure 5.51** and illustrates the following:

- **Existing View – Photomontage facing east** – at present there is no existing view of the Mount Owen and Ravensworth East mining operations or the associated mine infrastructure with all being shielded by the Glendell Mine emplacement area. The existing rail crossing is currently visible in the foreground.

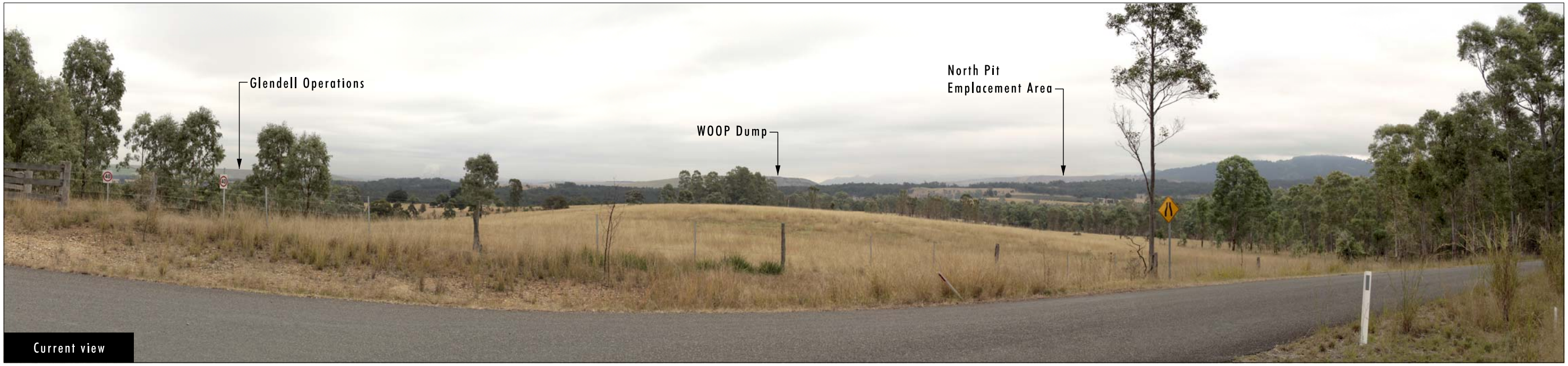

FIGURE 5.50

Viewing Location 5
Middle Falbrook Road and Glennies Creek Road Intersection
Photomontage - Facing west

File Name (A3): R02/3109_924.dgn
20131008 11.20

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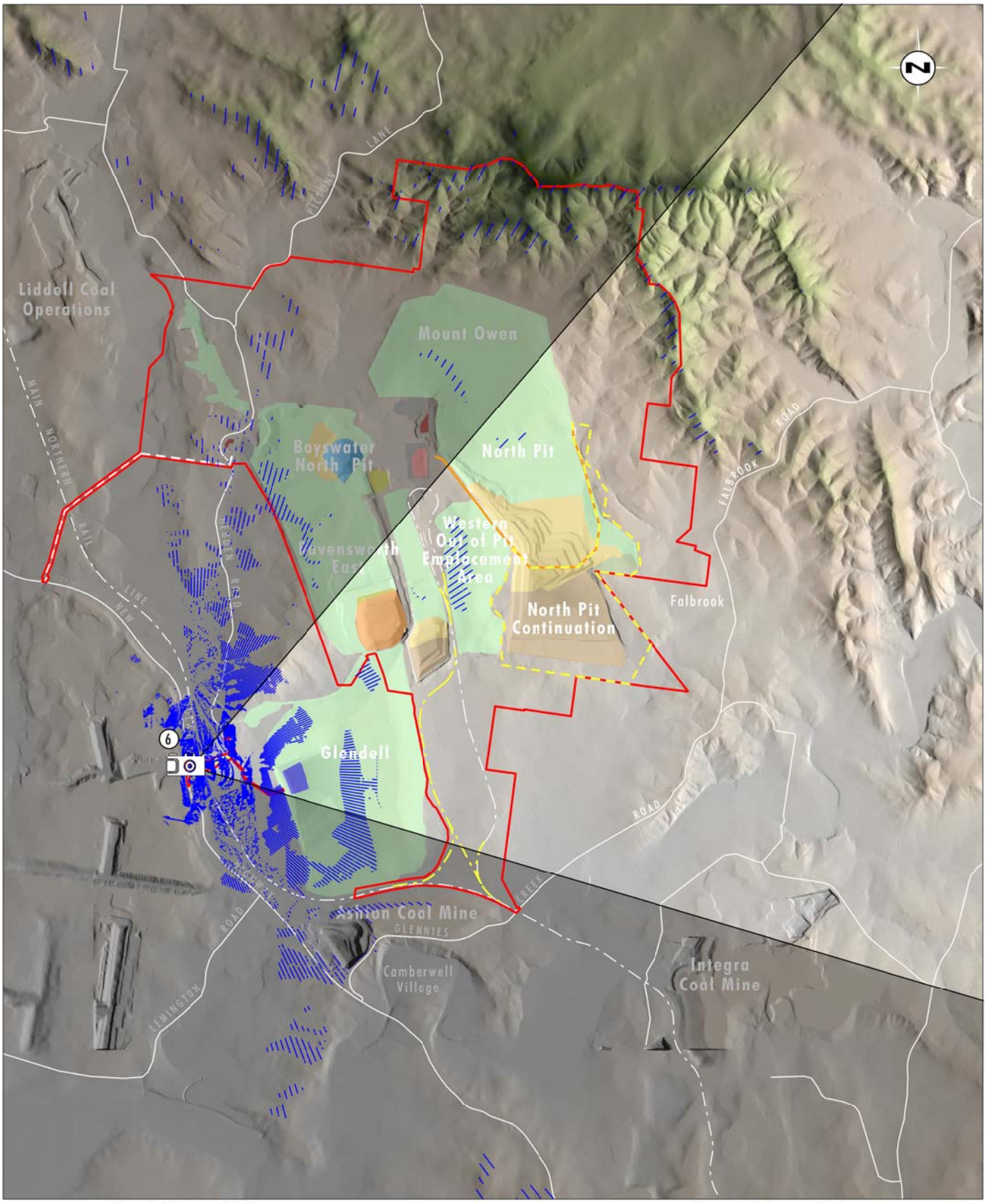


Image Source: Mount Owen (2014)
Data Source: Mount Owen (2014)

0 1.0 2.0 4.0km
1:80 000

Legend

- Project Area
- Approved North Pit Mining Extent
- Proposed North Pit Continuation
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Visible Surface
- Viewing Location
- Active Mining Area
- Active Overburden Emplacement Area
- Coal Stockpile - Product
- Coal Stockpile - ROM
- Infrastructure
- Rehabilitation - Complete
- Rehabilitation - Temporary
- Shaped Not Seeded
- Tailings Placement
- Water Storage Area
- Final Void

FIGURE 5.51

Viewing Location 6 - Year 10
Intersection of Hebden Road and New England Highway, Facing east

File Name (A4): R02/3109_784.dgn
20141024 15.13

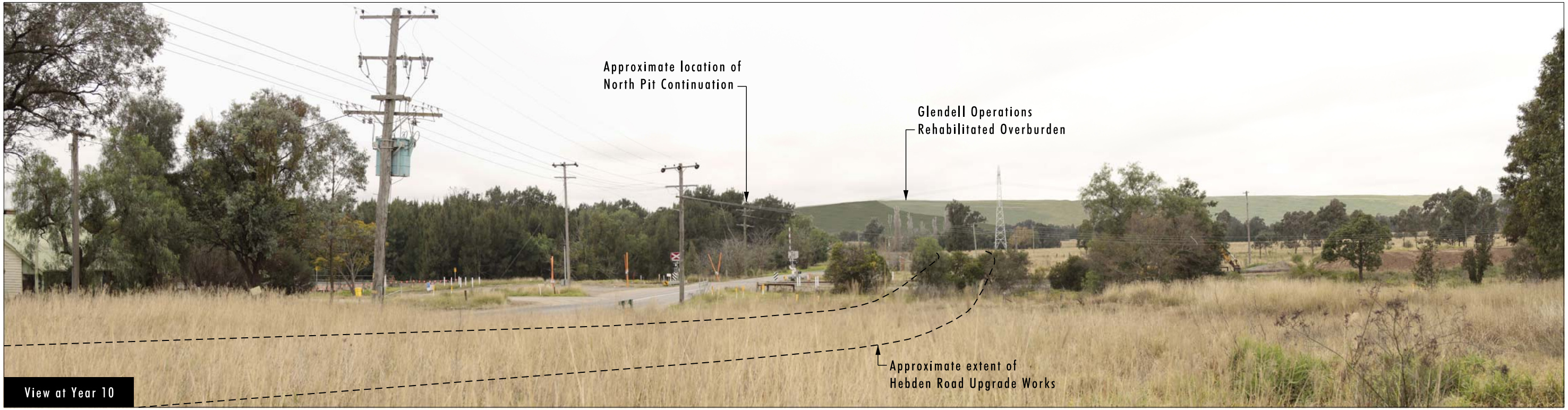


FIGURE 5.52

Viewing Location 6
Hebden Road and New England Highway Intersection
Photomontage - Facing east

File Name (A3): R02/3109_925.dgn
20131008 11.29

- **Mine Plan Year 10 – Photomontage facing east** – at this stage of the Project there will only be very limited views of the North Pit emplacement area. The rail overpass to be constructed as part of the Project will be visible in the foreground.

  By this stage of the Project, the Hebden Road rail overpass will have been constructed. Currently a rail level crossing exists adjacent to the proposed location of the new bridge crossing, therefore the new crossing, proposed as part of the Project, is unlikely to pose any additional visual impacts as a result of its construction.

5.13.4.2 Visual Amenity Assessments – Ancillary Infrastructure

Proposed Rail Line

The location of the proposed rail line as part of the Project will not be visible from any residence due to shielding by the local topography. Very short duration glimpses of the works will be available to travellers on the Main Northern Rail Line and New England Highway and these are consistent with views experienced by these travellers on this part of the transport route through the Hunter Valley. There will be negligible visual impact from these works, both during the construction and operational phases.

Hebden Road Bridge and Rail Overpass

The proposed Bowmans Creek Bridge on Hebden Road will only be visible to users of Hebden Road, the majority of which are employees of the Mount Owen, Ravensworth East and Glendell Mine, employees of quarries on Hebden Road or local residents. Very short glimpses of the bridge works may be available to travellers on the Main Northern Rail Line and New England Highway. Construction is anticipated to commence within one year of the commencement of mining beyond the currently approved mining limit and will result in short visual amenity impacts for travellers on these transport routes only, i.e. construction will not be visible from any residences. The short term construction impacts in this location are consistent with those regularly experienced by road and rail users during road upgrade works and will have negligible visual impacts.

5.13.4.3 Night-time Scenic Quality

As discussed in **Section 5.13.1**, the existing approved mining operations at Mount Owen and Ravensworth East Mines currently result in 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. To minimise impacts, Mount Owen has implemented a range of measures to reduce the impact on the scenic quality of the area including the use of shields and directional lighting.

As part of the Project, permanent lighting will continue to be required for the MIA, Mount Owen CHPP and other fixed infrastructure areas including coal handling conveyors and stockpiles during night time operations. Mobile lighting will also be required in active mining areas during night time operations. This will be provided by mobile lighting plants and equipment headlights. Generally, mobile lighting plants will be screened from nearby view points by overburden emplacement areas, vegetation or natural topography.

5.13.5 Impact Summary and Visual Mitigation Controls

The visual assessment has indicated that there are only two public viewing locations and two residences in the vicinity of the Project Area that have views of the existing Mount Owen and Ravensworth East Mining operations and would likely have a view of the Project. The visual impacts of the Project will be mitigated through the screening effect of rehabilitation and development of final landform to conform to the surrounding natural environment. This will

minimise views of shaped and unshaped overburden emplacement areas and facilitate the amelioration of nightglow from the operations. With the implementation of ongoing rehabilitation, the visual impacts of the ongoing mining operations will be less than the present impacts.

To assist in minimising the visual impacts of the Project, Mount Owen has committed to the following:

- progressive rehabilitation will be undertaken to reduce the duration of visible soil exposure;
- ongoing management of mobile lighting to reduce the impacts of lighting at night, positioning lights so they are not pointing off site, shielded by walls, overburden emplacement areas and vegetation where practicable and the ongoing implementation of procedures for the appropriate placement of mobile lighting plant to reduce impact to local residents and public roads; and
- 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*.

5.14 Waste Management

The DGRs for the Project identify waste management as an issue for consideration in the EIS. The DGRs for the assessment of waste management are outlined in **Table 5.14.1** below.

Table 5.14.1 – Waste Assessment Director-General's Requirements

Waste Assessment Requirements	Section of Report
Accurate estimates of the quantity and nature of the potential waste streams of the development, including tailings and coarse reject.	**Sections 5.14** and **2.3.10**
A tailings and coarse reject disposal strategy.	**Section 2.3.10**
A description of measures that would be implemented to minimise production of other waste, and ensure that waste is appropriately managed.	**Sections 5.14.1** to **5.14.3**

There are several different types of wastes that will be produced by the Project. **Section 2.3.10** outlines the approach for the ongoing management of reject material and tailings from coal processing, while the management of wastewater from the water management system is discussed in **Section 5.5**. 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.

5.14.1 Waste Management Principles and Processes

As an existing operation, the Mount Owen and Ravensworth East Mines currently have a well developed waste management program. This program is based on 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 management principles include:

- waste avoidance and reduction at the source;
- waste re-use;

- waste recycling; and
- waste removal and disposal (all waste that cannot be re-used with the exception of coal washery rejects and overburden and used tyres which are buried deep in pit in controlled areas tracked by the site survey team).

The underpinning strategies for management of waste are focused on minimisation through cleaner production and the aforementioned principles, as well as the appropriate segregation, storage and disposal of waste generated at Mount Owen and Ravensworth East Mines. The minimisation of waste will be achieved through the following processes:

- establishment of contracts and purchasing of equipment and supplies that consider waste minimisation;
- 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; and
- waste monitoring and inspection regimes.

The waste management program will continue to include:

- methods, schedules and procedures for the management and responsible disposal of each major waste stream;
- methods for monitoring performance against procedures and targets;
- documentation on waste disposal methods, locations and quantities;
- accountabilities for development, monitoring, control and auditing; and
- methods to consider re-use and recycling of products.

5.14.2 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 Australian Dangerous Goods Code (Department of Infrastructure and Regional Development, 2010).
- 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.

5.14.2.1 Construction Waste

The construction of new and modification of existing infrastructure as part of the Project 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 or emplaced within existing overburden emplacement areas. Inert waste such as concrete will be disposed of at appropriate locations on-site. It is estimated that approximately 150 tonnes of steel will be recycled off-site. Other waste associated with construction works within the MIA may include water tanks, water pipelines, fuel / lube pipelines, electrical cabling. These waste materials will be recycled where practicable or disposed of at an appropriate facility.

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. Wastes generated during construction will be classified and disposed of appropriately on-site or disposed of at an off-site waste management facility by an appropriately licensed contractor.

5.14.2.2 Operational Waste

Records of waste disposal from the existing Mount Owen and Ravensworth East Mines since 2006 show that the operations:

- recycles or reuses an average of 390 metric tonne of non-mineral waste per year and 800 kilolitres of waste oil per year;
- recycles on average 120 metric tonnes of other hazardous waste (batteries);
- dispose of an average of 193 tonnes of non-hazardous waste to landfill off-site per year; and
- bury an average of 167 large vehicle / heavy equipment tyres and an average of 354 light vehicle tyres on site each year.

As the Project is a continuation of the existing operations and there are no proposed changes to the currently approved annual rates of production, extending the life of the current operations is not expected to result in an increase in the amount of waste generated each year. The existing onsite waste facilities will be upgraded over the life of the Project if required. The operation will continue to reduce waste where possible.

The key components of operational waste are discussed below.

5.14.2.3 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 stationary and paper from other sources. Other wastes will include cardboard and packaging, toner cartridges from printers, photocopiers and facsimile machines. The majority of these wastes will be recycled in accordance with the waste management principles outlined above; and the remainder will be disposed of appropriately.

5.14.2.4 Domestic Waste

Domestic waste will be generated by employees and contractors 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 the total waste and already largely recycled as part of current Mount Owen and Ravensworth East operations. These wastes will continue to be managed with a focus on recycling, where practicable.

5.14.2.5 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 possible, or disposed of via a licensed landfill facility.

5.14.2.6 Sediment Dams

Sediment from some dams in the mine water management system has the potential to contain elevated levels of hydrocarbons and carbonaceous material as a result of some industrial activities. These dams are regularly cleaned of sediment to maintain their capacity to handle runoff from large rainfall events (refer to **Section 5.5**). 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 emplacement areas or disposed of in-pit. Any identified contaminated sediment material will either be treated and disposed of on-site or will be disposed off-site at an appropriately licensed facility.

5.14.2.7 Ablution Waste

Waste from toilets, bathhouses, kitchen sinks and basins are included as ablution waste with all sewage wastewater managed using the existing treatment facilities. Wastewater from the administration offices, workshop and bath houses is collected and treated on site in a number of aerated wastewater treatment plants around the site, which are licensed by Singleton Council. Treated effluent is used to irrigate a 3 hectare tree-lot. Deactivated sludge from the sewage treatment plant is periodically removed and disposed of by a licensed contractor.

5.14.2.8 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 currently disposed of in controlled areas within the open cut pits, in accordance with relevant EPA guidelines and this practice will continue as part of the Project.

5.14.3 Ongoing Waste Management

To manage waste generated by the Project, Mount Owen will continue to implement its existing waste management program, which is based on the waste management principles described in **Section 5.14.1** and in accordance with the requirements of the existing Mount Owen and Ravensworth East development consents (DA 14-1-2004 and DA 52-03-99, respectively), and Mount Owen's Handling and Disposal of Waste Guideline (Thiess, 2014). Under this system, waste generation will continue to 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.

Ongoing management of waste at the Mount Owen and Ravensworth East Mines will be through the implementation of a waste management program which encompasses the Mount Owen Complex. Specifically, the program 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; and
- accountabilities for waste management.

The waste management program will also continue to detail the methods for monitoring waste volumes and will include measurable indicators and targets for waste reduction across the Mount Owen Complex.

5.15 Hazard

The DGRs for the Project require an assessment of hazards including bushfires and public safety. This section provides an assessment of the potential hazards associated with the storage and use of hazardous substances as part of the Project and addresses public safety. Potential bushfire hazard is addressed in **Section 5.16**.

5.15.1 Hazard

Under *State Environmental Planning Policy 33 – Hazardous Industry and Offensive Development* (SEPP 33) (Department of Planning (DoP) 1992) a 'hazardous industry' is one which when all location, technical, operational and organisational safeguards are employed, continues to pose a significant risk to surrounding land users. Under SEPP 33, an 'offensive industry' is categorised as one which, even when controls are used, has emissions which result in a significant level of offence, such as air quality impacts or noise emissions, which have been assessed as part of this EIS; refer to **Section 5.2** and **Section 5.3** respectively. A project or site cannot be considered either 'hazardous' or 'offensive' until it is identified as such through assessment in accordance with SEPP 33. A Preliminary Hazard Analysis (PHA) is required if a proposed project or site is classified as 'potentially hazardous'.

Under SEPP 33, a preliminary risk screening for the Project is required to determine the need for a PHA. The preliminary screening involves identification and assessment of the storage of specific dangerous goods classes that have the potential for significant off-site effects.

5.15.1.1 Preliminary Screening

Mount Owen currently uses a range of hazardous substances on site for their mining operations and coal processing. This includes the utilisation of various Class 1 explosive materials which are supplied by the Orica Mining Services (Orica) facility located within the Project Area. Orica currently hold the dangerous goods licence for the storage of explosive materials located at Mount Owen Mine. The storage quantities of Class 1 materials will remain unchanged as a result of the Project.

Other hazardous materials stored on site, and managed by Mount Owen include small quantities of flammable gases in cylinders and Class C1 combustible liquids, e.g. diesel and hydraulic oils. Diesel is the only material that is stored in quantities requiring notification to WorkCover NSW (Notification of Dangerous Goods on Premises acknowledgment number NDG029689). As part of the Project, Mount Owen plan to upgrade both the fuel facility and the lubrication facility at the site. The Fuel Facility upgrade may include:

- expansion of the bulk fuel store to provide additional storage capacity of approximately 900 kL (765 tonnes), with provision for an additional 150 kL (127.5 tonnes) of future storage (a total of 7 x 150 kL new storage tanks);
- upgrade concrete bunding in accordance with relevant Australian Standards (including AS 1940-2004 *The storage and handling of flammable and combustible liquids*) and Glencore standards;
- replacement of the existing fuel tanker delivery area;
- replacement and relocation of the existing light vehicle service area;
- installation of flow meters prior to and immediately after direct buried fuel pipe work in accordance with current Australian Standards and Glencore standards;
- installation of new reticulation pipe work within the fuel storage area and to the light vehicle service area; and
- removal of existing reticulation pipe work within the fuel storage area, and relocation of the existing pumps and manifold pipe work.

The lubrication facility upgrade may include:

- upgrade of the reticulation system and flow meters to the existing direct buried pipe work;
- reticulation of all stored lubricants to the new heavy vehicle workshop;
- reticulation of new stored lubricants to the Mine Service Vehicle (MSV) service area and the existing heavy vehicle workshop Bays 4 and 5; and
- installation of flow meters prior to and immediately after direct buried lubricant pipe work in accordance with current Australian Standards and Glencore standards.

Table 5.16.1 presents an inventory of the present stored quantity of diesel fuel and flammable gases and the proposed storage quantities for the Project.

Table 5.16.1 – Dangerous Goods Inventory

Material	Storage Depot	ADG Code Class (PG)	Present Storage Capacity (t)	Proposed Storage Capacity (t)
Diesel	Fuel Facility	C1	782	1,658[1]
LPG	Workshop	2.1	0.225	0.225
Acetylene	Workshop	2.1	0.052	0.052

Note: 1) Includes provisional 150 kL tank.

SEPP 33 does not apply screening thresholds to Class C1 liquids. The SEPP 33 screening threshold for LPG is 10 tonnes for above ground storage[9]. Flammable gas (Class 2.1) screening thresholds are determined by the separation distance between the site boundary and storage depot. To trigger the screening threshold, the 0.277 tonnes flammable gases (aggregate of LPG and acetylene) would need to be located within 30 metres of the site boundary. The flammable gas storage is located at least 2 kilometres from the site boundary; therefore there are no offsite impacts predicted. Transport quantities will also be below the relevant screening threshold for flammable gases.

Based on the above screening results, it can be concluded that the Project is not potentially hazardous with respect to the storage or transport of dangerous goods. Therefore a PHA is not required for the Project.

5.15.1.2 Hazard Management

Mount Owen has several procedures and management plans to enable the safe management of hazardous substances, minimise the potential for hazardous events to occur and manage hazardous situations when they do occur including procedures relating to:

- Action To Be Taken on Discovery of Blasting Products.
- Hazardous Substances.
- Change Management.
- Fire and Explosion Management Plan.

The ongoing implementation of Mount Owen's extensive hazard management system ensures that those current risks posed to surrounding land users are managed. Should any new hazardous substances or dangerous goods be introduced to the site, they will be identified and managed in accordance with the existing procedures and management plans.

5.15.2 Public Safety

Mount Owen is committed to providing a safe environment for the employees, visitors to the site and the surrounding landowners. The Mount Owen Complex is a controlled site with all visitors required to report to the reception areas on arrival and complete an induction process to ensure all safety requirements are addressed. To control unpermitted access to the Mount Owen Complex, access points to controlled areas have boom gates and the remainder of the access points are secure with locked gates and fencing. Additional safety is provided through operational staff or security being present on site at all times as the Mount Owen Complex operates 24 hours a day, 7 days per week.

[9] There is no screening threshold for diesel.

Safe operation of all mining equipment and processes are undertaken in accordance with the existing Mount Owen Complex management plans particularly in relation to the use and storage of hazardous substances and blasting activities which have specific safety requirements and controls to ensure the safety of the employees and the public.

As discussed in **Section 5.15.1.2**, hazardous substances are managed on site to ensure safe handling and storage.

As discussed in **Section 5.4**, blasting activities are undertaken in accordance with the Blast Management Plan which includes the following key safety procedures:

- a minimum blasting exclusion zone of 500 metres from non-mine owned land;
- pre-blast inspections are undertaken to ensure that no persons, property or livestock are at risk from blasting;
- sentries are posted on all access points to ensure that there is no possible access to the blasting exclusion zone;
- notification of the blasting times are provided to the residences located within 3 kilometres of the mine (on request); and
- all personnel undertaking blasting activities are trained and experienced.

Mount Owen also operates a 24 hour emergency response line for the public to report any concerns regarding public safety associated with the Mount Owen Complex.

5.16 Bushfire

The DGRs for the Project require an assessment of hazards (refer to **Section 5.15**) including bushfires. This section provides a bushfire assessment, including a description of existing management practices, assesses potential bushfire hazards and details the proposed bushfire management for the Project.

Mount Owen has a history of safely conducting mining operations within the Project Area including having appropriate procedures in place for managing bushfire risk and responding to fire or other emergencies. Mount Owen also has an established relationship with the Rural Fire Service (RFS) and has consulted with the RFS in relation to both the existing operations and the Project (refer to **Section 4.0**). Further details of Mount Owen's approach to managing bushfire risk are outlined in this section.

There has been substantial vegetation clearing 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 5.53**). It is noted that active operational areas have been excluded from the Bushfire Prone Land Mapping as shown on **Figure 5.53**). The most significant potential bushfire threat to the Project Area is from the north and north-east of the Mount Owen Mine within the Ravensworth State Forest, which supports forest / woodland vegetation and a potentially significant fuel load capable of sustaining and spreading bushfire. Areas of forest / woodland vegetation to the east and south-east of the Project Area also represent potential linkage between vegetated areas within and adjoining the Project Area, which has the potential to support the spread of bushfire.

Image Source: Mount Owen (2012-2013)
Data Source: Mount Owen (2014), Singleton Council (2012)

0 1 2 3 km
1:60 000

Legend

- Project Area
- Proposed North Pit Continuation
- Rail Upgrade Works
- Hebden Road Upgrade Works
- Existing Operational Area
- Bushfire Buffer
- Category 1 Vegetation
- Category 2 Vegetation

FIGURE 5.53

Singleton Council Bushfire Prone Land Map

File Name (A4): R02/3109_890.dgn
20141008 16.07

5.16.1 Existing Bushfire Management

Mount Owen has an existing regulatory obligation to maintain an effective fire response capability and to control fires on its landholdings. All landowners have an obligation to prevent damage to neighbouring properties. In addition to this duty of care, DA 14-1-2004 requires the preparation and implementation of a 'conservation sensitive Bushfire Management Plan'.

The Mount Owen Complex Bushfire Management Plan is implemented for the existing operations across the Mount Owen Complex. The Bushfire Management Plan was developed in consultation with the RFS, neighbouring landholders and the community, the Mount Owen Flora and Fauna Advisory Committee, Singleton Council and Mount Owen operational staff.

The Bushfire Management Plan has been developed with the aim of assessing the bushfire risk across the entire Mount Owen Complex (which includes the Project Area) and to identify practical management strategies to reduce the risk of fire to life, property and the environment.

The objectives of the Bushfire Management Plan are to:

- reduce fire ignition potential;
- prevent the spread of fire within and beyond the Mount Owen Complex;
- protect the flora and fauna within the Mount Owen Complex from unplanned fire events; and
- utilise fire as a management tool to maintain and enhance native ecosystems, where appropriate.

The current Bushfire Management Plan has been developed to be consistent with the relevant requirements of the *Rural Fires Act 1997* and the RFS guideline *Planning for Bushfire Protection 2006* (PBP 2006) (NSW RFS 2006)[10].

The proposed approach to bushfire risk management for the Project is to continue to implement the management procedures developed for the existing Bushfire Management Plan and to review and revise the plan where necessary to reflect the changes to asset and infrastructure locations as the Project progresses.

5.16.2 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 Zone's (APZ's) for the Project as required in accordance with the methods prescribed in PBP 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. While the requirements of the PBP 2006 do not specifically apply to a Project of this nature, the methods in the PBP 2006 for calculating APZ's were used to determine the existing APZ's developed for the current Bushfire Management Plan and have been used as a guide in the assessment for the Project.

[10] *Planning for Bushfire Protection (PBP) 2006* is a NSW RFS publication which outlines the required bushfire measures for development applications located on land designated as bushfire prone.

5.16.2.1 Vegetation Formations

The majority of the Project Area surrounding the existing disturbed mining and infrastructure areas predominately contains open grassland and woodland vegetation formations (refer to **Section 5.7**). The remainder of the Project Area supports predominately forest vegetation associated with the Ravensworth State Forest and undisturbed areas to the south-east which support woodland and forest vegetation. 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 forest vegetation and providing a significant connection between the trees within the canopy.

5.16.2.2 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 flat to gently undulating with 0 to 5 degree slopes, with the exception of the areas of the Project Area associated with the Ravensworth State Forest and those steeper slopes created by the existing mining operations. The proposed mine infrastructure works as part of the Project will be located within the existing Mount Owen MIA. This area and the surrounding land falls within the 0 to 5 degree slope and is surrounded by existing mining areas (refer to **Figure 5.1**). The proposed rail works and the Hebden Road upgrade works are also surrounded by land which has a 0 to 5 degree slope range.

5.16.2.3 Management Zones

Management zones are based on the location of assets, topography, landuse and potential bushfire hazard. Management zones are separated into the following three categories:

- APZs;
- Strategic Fire Advantage Zones (SFAZ); and
- Land Management Zones (LMZ).

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 APZ's 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 Bushfire Management Plan includes APZ's for all existing infrastructure and operational areas within the Project Area based on the methods provided within PBP 2006 to ensure the mining assets are protected from bushfire threat.

The current Bushfire Management Plan recommends the separation distances provided in **Table 5.16.2**.

Table 5.16.2 - Asset Separation Distances

Asset	APZ (metres)
Buildings and dwellings	20
Cattleyards	20
Fences	20
Railway	20
Water Fill Points	20
Powerlines	20
Conveyor Belts	20
Monitoring Sites - Flora and Fauna	20
Monitoring Sites - Other	20
Glennies Creek Vent Shaft	20
Explosives Magazine	30

The existing APZ distances currently applied to infrastructure and operational areas within the Project Area will continue to be implemented as part of the ongoing operations. Given the proposed mine infrastructure will be located within the existing Mount Owen MIA it is considered the existing APZ distances will be appropriate for the Project. The current APZ distance of 20 metres applied to the existing Mount Owen rail line is also considered appropriate for the proposed rail line. The proposed rail overpass and Bowmans Creek Bridge is not considered to require APZ distances given the nature of the construction of this infrastructure, although vegetation levels within the road reserve will be maintained which will reduce the surrounding fuel load and restrict the movement of bushfire across Hebden Road. The Bushfire Management Plan will continue to be reviewed and updated every three years in consultation with the RFS and the community as part of the ongoing operations at the Mount Owen and Ravensworth East Mines to ensure appropriate bushfire management is implemented as mining operations progress.

The remainder of the Project Area is currently maintained at varying levels of bushfire risk management associated with different management zones in accordance with the current Bushfire Management Plan. These levels of bushfire management are described below under the different management zones.

The existing management zones are described in the current Bushfire Management Plan.

The management zones will be updated as required for the Project as part of the review process associated with the Bushfire Management Plan in consultation with the RFS.

Strategic Fire Advantage Zone (SFAZ)

A SFAZ is a fuel reduced area to reduce the potential for large fires to develop, to prevent the spread of fire across a site and to provide a defendable space for assets which are susceptible to fire. The SFAZ relates to pasture areas which are maintained through grazing where practicable and controlled burning if suitable. All operational mining areas are also classified as SFAZ and managed accordingly.

Land Management Zone (LMZ)

LMZs are areas associated with rehabilitation, archaeological sites and Biodiversity Offset Areas in accordance with the Mount Owen Complex Flora and Fauna Management Plan (XMO 2006). These areas have established or rehabilitating vegetation communities with continuous areas of native forest and woodland. These areas are primarily located to the north and east of the existing North Pit within areas associated with the Ravensworth State Forest and existing rehabilitation areas, also within the Bettys Creek HMA located to the west of the existing Mount Owen rail line and the Yorks Creek Voluntary Conservation Area[11] to the north-west. Areas around these zones are maintained as SFAZs where possible in order to prevent the spread of fire into these areas. Fire management works within these areas include the maintenance of fire access trails, areas with reduced fuel load around this zone and controlled burning where appropriate in consultation with the RFS.

5.16.2.4 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. The entire Mount Owen Complex is inspected regularly to determine the requirement of maintenance for existing roads and fire trails. Access across the Project Area will continue to be assessed and maintained as the Project progresses in accordance with the Bushfire Management Plan.

5.16.2.5 Water Supply

The Mount Owen Complex has an extensive network of dams which supply water for the existing mining operations. Further detail regarding the existing water supply system and proposed water management works as part of the Project is provided in **Section 5.5**. The existing water management network supplies water for the mining operations with the dams accessible by water carts provided with fill points. The existing infrastructure areas within the Mount Owen and Ravensworth East Mines are supplied with adequate water supply, fire fighting facilities and equipment in accordance with the Building Code of Australia and all relevant Australian Standards.

5.16.3 Emergency Response

The current Bushfire Management Plan details the emergency response procedure, responsibility for fire management and the monitoring review and reporting of fire incidents. The RFS have Fire Control Centres at Darlington, Goorangoola and Glennies Creek where the response time from each to the Project Area would be approximately 20 to 25 minutes. This would be the primary response with backup response located at Singleton and Muswellbrook. Muswellbrook have resources to respond to a HAZMAT emergency event should it be required.

With the continued implementation of the current bushfire management controls, including the ongoing review of the existing Bushfire Management Plan in consultation with the RFS as operations progress, it is considered that bushfire risk associated with the Project can continue to be appropriately managed in an appropriate and effective manner.

[11] Culturally sensitive area

5.17 Social Impact and Opportunities Assessment

The DGRs for the Project (refer to **Table 5.17.1**) required an assessment of the potential impact on local and regional communities and detailed description of measures that would be implemented to minimise the adverse social and economic impacts of the development. A detailed Social Impact and Opportunities Assessment (SIOA) of the Project was undertaken by Coakes Consulting and Umwelt (refer to **Appendix 5**) and the key findings are outlined below.

Table 5.17.1 – Social Impact Assessment Director-General's Requirements

Social Impact Assessment Requirements	Section of Report
Potential impacts on local and regional communities, including increased demand for local and regional infrastructure and services.	**Sections 5.17.4** and **Appendix 5**
A detailed description of measures that would be implemented to minimise the adverse social and economic impacts of the development, including any infrastructure improvements or contributions and / or voluntary planning agreement or similar mechanisms.	**Sections 5.17.5** and **Appendix 5**

5.17.1 Methodology

SIOA is an approach to assessing and predicting the likely consequences of a project in social terms, and developing options and opportunities to improve social outcomes. SIOAs aim to predict the future effects of a particular project on people. More specifically how the project may affect their way of life (how they live, work and interact with each other), their culture (norms and traditions) and their community (institutions and structures). The SIOA program for the Project was designed to identify, assess and address 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 planning; and
- identify relevant management and enhancement strategies to address relevant social impacts.

A wide range of assessment methods have been used to develop a detailed understanding of current interactions between existing operations, 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 5.17.2**.

Town Resource Cluster Analysis (TRC-Analysis) was used to identify the associations that exist between Mount Owen operations and the wider community, as a means of defining the study area for the SIOA. The TRC-Analysis included a comprehensive profile of Mount Owen Complex employees and found that not only is Mount Owen highly linked to the township and LGA of Singleton, it also has strong connections with other nearby towns such as Maitland and Muswellbrook. It is therefore important to detail the socio-economic profile across different geographical scales, from the local areas immediately surrounding the Project to the broader localities and townships or cities in the wider region. As such, geographic areas of interest for the SIOA include:

- the Project Area;

- the local area or locality;
- Singleton LGA;
- Maitland and Muswellbrook LGA;
- the Upper Hunter region; and
- the state of NSW.

Table 5.17.2 – Summary of Social Impact and Opportunities Assessment and Engagement Methods

Method	Description
Phase 1 – Program Planning	Development of a stakeholder engagement strategy tailored for the Project.
Phase 2 – Community Profiling	Examination of census data, social and community indicators, historical accounts of the region, local media resources, and documentation of the social and economic linkages between Mount Owen and the community. As well as undertaking personal meetings with key stakeholders.
Phase 3 – Scoping of Issues and Opportunities	Review and analysis of historical stakeholder consultation outcomes and complaints data for Mount Owen to obtain an understanding of perceived issues and opportunities. Personal meetings with neighbours of Mount Owen to identify perceived issues and opportunities related to the Project, followed by ranking of perceived issues and opportunities relative to the frequency. Briefings with NGOs, business groups and other interested stakeholders to identify perceived issues and opportunities.
Phase 4 – Assessment of Impacts and Opportunities	Assessment of unmitigated technical and social risks and prediction of social impacts associated with the Project.
Phase 5 – Prediction of Impact and Strategy Development	Plotting of impacts utilising a Consequence and Likelihood framework to prioritise social risk rankings and guide management strategy development. Identification and development of appropriate strategies to address predicted Project impacts.

Community Involvement

Engagement with the community has been a key component of the Project and the various assessment studies (refer to **Section 4.0**). Community involvement has been a key element of the SIOA in order to obtain a comprehensive understanding of the issues and perspectives of neighbouring landholders in proximity to the Mount Owen Complex and other key stakeholders. An extensive program of consultation has been ongoing throughout the Project to inform the SIOA and the broader environmental assessment studies and has involved the participation of over 356 stakeholders.

Specific techniques for consultation used during the Project are detailed below and include:

- personal meetings with near neighbours to outline Project aspects and obtain feedback on perceived issues and opportunities;
- personal meetings with key local and regional stakeholders drawn from community sectors such as local government, 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;
- Community Information Sheets summarising key aspects and progress / outcomes of the environmental and social assessment program, distributed to neighbouring community and relevant stakeholders;
- engagement events hosted on site and at the Mount Pleasant Public School, including exhibition of Project material, tours of the Mount Owen Mine, and an information day and discussions with the Project team;
- Project briefings for the wider community and stakeholders via Community Information Sheets to view EIS findings and ask questions from the Project team (refer to **Section 4.0** for more detail);
- Surveys and regular briefings with Mount Owen employees, contractors and suppliers to identify socio-economic linkages between Mount Owen and the wider community;
- meetings with relevant local, State and Commonwealth government organisations and representatives to provide updates on Project status and discuss approval and other relevant matters; and
- publication of relevant Project information on the Mount Owen Complex website.

5.17.2 Social Context

In order to understand the sensitivity of local and regional communities to changes in mining operations and employment, a Community Capitals analysis of the local area and wider region was undertaken. The Capitals analysis utilises a 'Sustainable Livelihoods' approach to social profiling (Beckley *et al.* 2008; Ellis 2000; Hart 1999) which focuses on five interrelated 'community capitals' or assets – natural, economic, human, physical, and social – which together are seen to make up a holistic profile of a community.

The assessment uses a Community Sensitivity Index (CSI) methodology, developed by Coakes and Sadler (2011) to assess the community's sensitivity and resilience when faced with change. The CSI is a relative measure of community sensitivity, where a wide range of indicators for chosen communities are plotted across a number of key indicators.

The CSI was developed using readily available data from the 2011 census (ABS 2011), and other relevant social and economic indicators. The CSI comprises a number of specific sub-indices based on community capitals that are aggregated to form an additive index that provides a relative measure of the communities' sensitivity or resilience to change.

From the community capital profile and CSI analysis, it is possible to assess key areas of community resilience and risk in the local area surrounding the Mount Owen Complex (i.e. the state suburbs of Camberwell and Bridgman), the Singleton LGA and the broader Upper Hunter region as it relates to the Project. These key findings are summarised in **Table 5.17.3**. Where no specific location is identified, the point refers to the Singleton LGA.

Table 5.17.3 – Areas of Resilience and Risk Across Key Community Capitals

Capital Area	Areas of Resilience	Areas of Risk
Natural	Abundant and diverse natural capital values, including: diversity of natural resources, abundant coal resources, agricultural and conservation lands.	Balancing conflicting land uses.
Economic	Unemployment rates well below NSW averages. Lower than average levels of housing stress. Strong economic support from mining sector.	Shortage of skilled labour. Lack of economic diversity in the region and dominance of mining industry employment and associated occupations.
Human	Significant population growth in the Upper Hunter region. Above average proportion of the population below 34 years old. Increasing number of students completing Year 12 or other certificate courses. High levels of technical skills in the community.	Ageing population. Below average rates of completion of Year 12. Below average levels of post-school education (with the exception of Certificate-level qualifications). Poorer health indicators and outcomes. Limited access to health services.
Physical	Comparatively good provision of utilities, built infrastructure and transport infrastructure for a regional area.	The provision of some public utilities is under strain with an increasing population. Transport options are limited. Hospital / medical services under strain. Lack of diversity in housing stock. Higher than average housing costs.
Social	Higher than average rates of volunteering. Proactive planning regarding business & infrastructure needs.	Rate of volunteerism decreasing 2006-2011. Low cultural diversity. Increased crime rankings for all offences 2007-2011 (excluding liquor offences).

Media Review

A media analysis was undertaken as part of the SIOA to further identify and analyse details about community opinion, political actions, economic and industry development and a range of other regional interests and concerns.

The articles were primarily sourced from local and regional media, including *The Newcastle Herald*, *The Singleton Argus*, *ABC News* and *The Muswellbrook Chronicle*. In addition, a small percentage of articles were drawn from free online specialist publications, such as *Mining Australia* and metropolitan media such as *The Sydney Morning Herald*.

A representative selection of key media items has been summarised from the commencement of 2011 and are present in Appendix D of **Appendix 5** along with tables breaking them into regional values and concerns.

Consultation was undertaken with 58 regional stakeholders drawn from across key community sectors as part of a *Regional Issues Assessment* prepared for Glencore by Coakes Consulting in 2012. The *Regional Issues Assessment* identified a number of community values, issues and opportunities associated with mining in the region that were considered important to residents and stakeholders within the Singleton LGA. Most of the issues and challenges identified in Coakes' *Regional Issues Assessment* were reflected in the local and regional media coverage, with key issues and opportunities associated with mining including:

- balancing the long-term impacts and economic benefits of mining for the region;
- addressing land use conflicts more effectively and developing coordinated approaches to land management and rehabilitation;
- enhancing infrastructure, housing and service provision and improving planning for these for a growing region (e.g. roads / transport; housing accessibility, affordability and mix; health services);
- addressing community sustainability and protecting core community values;
- addressing mining-related health concerns (e.g. air quality and dust, health research and assessments);
- ensuring employment and training opportunities for local people;
- protecting the environment and natural capital of the area;
- improving information sharing with the community by government and industry;
- managing cumulative impacts of mining in the region; and, most recently
- responding to the continued downturn in mining and ongoing mining related job losses in the Upper Hunter.

Perceived Issues and Opportunities

A key component of the SIOA is understanding, from a community perspective, the impacts and opportunities associated with the Project, as well as the broader community values and land uses associated with the assessment area. Consultation analysis regarding people's existing experiences and perceptions of the presence of local mining operations can give insight to the specific social and environmental issues relevant to a Project.

The most common perceived impact themes identified by landholders regarding the current Mount Owen operations, as well as other mining operations in the local area, related to air quality and noise, with about 70 per cent of landholders identifying one or both as a current issue. This theme was followed by economics (60 per cent), land management (58 per cent), blasting (55 per cent) and road infrastructure (51 per cent).

Whilst many of the perceived impacts were raised in terms of direct attribution to Mount Owen, most were also discussed in cumulative terms, with residents reporting difficulties in fully distinguishing issues and impacts associated with individual sites, given their proximity to multiple mining operations i.e. Integra and Ashton Coal operations.

Other important, but less prominent issues related to environmental impacts, such as water and visual amenity, as well as more socially oriented issues such as sense of community, community contribution and community engagement. The latter were discussed mainly in terms of positive impacts or opportunities.

5.17.3 Town Resources Cluster Analysis

TRC-Analysis has been used to identify the associations that exist between the existing operations and the wider community. The TRC-Analysis (Fenton *et al*. 2003) looks at the social and economic linkages that exist between resource operations and communities through direct and indirect contributions (e.g. employment, employee household expenditure, employee use of local services and participation in community, suppliers to the operations etc.). Often these contributions or impacts are experienced in areas some distance away from an operation or project.

The TRC-Analysis for the Project found that not only is Mount Owen highly linked to the township and LGA of Singleton, but it also has strong connections with other nearby towns such as Maitland and Muswellbrook. These locations tend to be where most employees and contractors live and consequently where a significant portion of household expenditure and use of local services occurs.

In summary, the TRC-Analysis found:

- Most employees and contractors of the existing Mount Owen Complex live in Singleton, Maitland, Muswellbrook and Cessnock;
- Singleton and Maitland benefit the most from employees' participation in community groups, households accessing health services, and employees' use of educational institutions;
- Employees report directly contributing almost $60m to the wider economy (63% in Singleton and Maitland); and
- Singleton and Maitland benefit most from Mount Owen workers' contribution to local communities, through the highest household expenditure and use of local suppliers, highest participation in community groups and highest usage of health services and education institutions, although this may also be considered a burden in other ways.

The economic impacts of the Project are discussed in further detail in **Section 5.18**.

5.17.4 Evaluation of Social Impacts

In assessing the social risks, the assessment used a consequence and likelihood framework; with the consequence of a given social impact factor (e.g. catastrophic, major, negligible) assessed against the likelihood that it will occur (e.g. almost certain, likely, possible), to determine the overall risk assessment of the social impact as low, medium or high. **Appendix 5** provides full details of the analysis and an overview of the outcomes is provided below, including perceived stakeholder risk. It is important to note that this discussion focuses on the mitigated technical risk of impact once appropriate assessment and mitigation strategies relative to each impact have been taken into consideration.

It is noted that some consequences due to the Project may be seen as positive impacts to the local, regional or state wide community, and these opportunities have also been assessed.

Population Change Impacts

Changes to population are a fundamental impact within SIOA, given that the size, diversity and behaviours of a community are underpinned by its population and characteristics. Population change is usually described as a first order social impact which has the potential to create a number of second order social impacts such as impact on community infrastructure and services, change in sense of community and social cohesion.

A Project can influence population change by impacts emerging from three main factors:

- an influx of construction workers;
- a change to the current operational workforce; and
- acquisition of residential land in proximity to the operations.

The peak construction workforce is projected to be approximately 330 personnel, with construction anticipated to be early in the Project. Three different potential workforce scenarios have been modelled in order to accommodate the construction workforce. The scenarios assume that different proportions of the workforce are sourced locally versus those that may relocate to the area temporarily during the Project construction phase:

- **Scenario A** is a hypothetical 'worst-case' scenario in which all construction workers temporarily relocate into the area.
- **Scenario B** is an alternate workforce mix, based on an 80:20 (relocated:local) ratio consistent with the standard typically used within SIOA literature, as well as previous SIOA projects undertaken by Coakes Consulting (2013).
- **Scenario C** is an anticipated workforce mix based on the TRC-Analysis conducted for Mount Owen, which found that 46 per cent of employees and contractors at the Mount Owen Complex relocated to the Upper Hunter area for employment.

It is noted that the national construction industry has been in consistent decline up to May 2014, with decline projected to continue into 2015. This decline has been attributed to a fall in employment levels following subdued demand for new projects, including mining projects (The Australian Industry Group, 2014). As such, it is considered likely that there may be surplus construction workers within the region who would not need to relocate in order to undertake the construction of the Project. However, due to the lack of definitive data, this potential surplus of existing construction workers has been excluded from the analysis.

The study considered it most likely that a temporary construction workforce would tend to reside in the Singleton township, or neighbouring areas, in order to be close to the Project Area, with access to a range of temporary accommodation and short term rental options. Assessment of population impacts associated with each scenario indicates that under all scenarios the population change associated with the influx of the Project's construction workforce is low – less than 1.5 per cent of the current Singleton population for the worst case scenario. The perceived stakeholder risk for this factor has been ranked as *low* as there was little concern expressed by neighbouring landholders regarding proposed construction workforce generating local population change.

In regards to population change associated with acquisition, when a property is affected by acquisition rights; it provides the owner of the property with the option to request that Mount Owen purchase their property and binds Mount Owen to enter into negotiations to purchase the property at a fair and reasonable price. It does not mean that these properties must be acquired, or will be automatically acquired in order for the Project to progress. Given that the

population change associated with acquisition is very small (i.e., three rural residential households of the total population of 577 people within the Bridgman and Camberwell State suburb boundaries), the risk of population change, as a result of acquisition, has been categorised as a *low* technical risk. However, it has been ranked a medium risk from a stakeholder perspective.

As there are no proposed additional operational workers associated with the Project, potential impacts on population growth during the operation phase are expected to be negligible.

Impact on Housing and Accommodation Impacts

An analysis of temporary accommodation such as motels and short term housing like rental properties was undertaken to determine the existing capacity within the Singleton area and surrounding region to cater to a temporary construction workforce. Based on the information currently available, should a high proportion of the construction workforce be sourced from outside the local area, such as for Scenario A (100 per cent) or Scenario B (80 per cent), and all workers choose to seek temporary accommodation in the Singleton township only, peak demand for temporary accommodation is predicted to slightly exceed capacity, when calculated using the vacancy rate for Singleton LGA, or the NSW average vacancy rate. The average vacancy rate for NSW is considered more conservative than the vacancy rate for Singleton LGA and consequently was used for the analysis.

Building on the assessment of temporary accommodation in Singleton LGA, a comprehensive analysis incorporating short term rental housing in Singleton and temporary accommodation within other key urban centres within the surrounding region was undertaken. The comprehensive assessment indicates sufficient capacity for all construction workers proposed as part of the Project. Noting that capacity can change rapidly within a region, such as the increase in capacity within temporary accommodation that has occurred with the downturn in the mining industry since mid-2012, it is considered that even under Scenario A (the 'worst case') the impact of the Project on temporary accommodation within the Singleton LGA only will be *minor*, resulting in a *medium* social impact. However, when considering the availability of temporary accommodation and short term rental housing within the nearby settlements in the broader region, the impact is considered most likely to be *low*.

Impact on Community Services and Facilities

A project's impact on community infrastructure and services is often one of the more tangible social impacts of a project and is considered a secondary order impact largely influenced by population change.

Impacts to community infrastructure can occur when there is insufficient capacity within existing relevant health, education, childcare, aged care, youth services, recreational facilities or other community services and facilities to cater for the increased population growth associated with a project. As there are no proposed changes to approved operational staffing levels for the Project, there are nil impacts to community infrastructure due to permanent population increase. Similarly, community demand associated with the continued retention of Mount Owen's existing workforce is not considered a potential impact given the wide geographic scope and small scale of the existing workforce spread, as it is reasonable to assume that a catchment's existing population is already sufficiently catered for within existing local, regional and state population planning.

Local landholders identified a range of general and specific impacts and / or insufficiencies regarding existing road infrastructure in the local area. Landholders also expressed concern regarding increases in local traffic from mine related activities such as employee vehicles or

site trucks. Consequently, this risk has been classed as a *medium* stakeholder perceived risk.

The impact of the temporary construction workforce on local road infrastructure is assessed as a *low* technical risk, which is possible to occur but a minor consequence given the temporary nature of the 18 month construction period.

Balancing this is the positive impact of Project road infrastructure upgrades which is assessed as a 'high' technical impact (positive), due to the certainty of the upgrades occurring and the identified benefits for landholders, commuters and other local and regional (i.e. New England Highway) road users.

Impact on Social Amenity

In terms of impacts on social amenity, while perceived stakeholder risk associated with air quality and noise were rated as '*high'* due to considerable community interest in these issues, the mitigated technical risk resulted in ratings of *medium* for these factors.

Air quality associated with mining operations in the Upper Hunter has emerged as the key concern for local landholders, and many regional stakeholders, with particular focus on the cumulative impacts of mining operations. Cumulative air quality impacts are recognised at a regional level and several studies have sought to explore and address their measurement and mitigation.

Noise was the second most prominent issue raised by local landholders, with the cumulative nature of noise impacts also noted. Neighbouring landholders were concerned about general operational noise and rail noises, with night time and early morning noise of particular concern. Others acknowledged noise as something that they experienced, but felt it was not a major concern.

Amenity impacts associated with blasting and traffic were assessed as a *medium* perceived stakeholder risk and a *low* technical risk, with improvements to road infrastructure noted. Amenity impacts associated with visual change were assessed as *low* in both technical and perceived stakeholder risk rankings.

Community Sustainability

Taking the assessments of community sensitivity at the LGA and township level into consideration, there is not anticipated to be any significant negative consequences regarding community sustainability at the scale of the SI0A study area. Communities within the SI0A study area are considered comparatively resilient, and can incorporate the range of assessed impacts, such as the proposed temporary influx of construction workers, as a result of their existing capital strengths.

Consequently, the technical risk to community sustainability as a result of the Project is considered *low*; however, the perceived stakeholder is ranked as *medium*.

5.17.5 Management and Enhancement Strategies

Existing operational management strategies are discussed in **Appendix 5**. To address the Project impacts identified as part of the SIOA, Mount Owen proposes to implement a number of strategies and programs to mitigate and / or enhance Project impacts, including:

- working with landholders and tenants to meet their needs to maximise opportunities for continued occupancy, where possible;

- provision of a list of accommodation options outside of Singleton township to facilitate the influx of the Project's construction workforce;
- ongoing communication with Council regarding matters of interest to Council, such as social and amenity, traffic, agriculture, water and offsets, as well as construction workforce scheduling, composition housing requirements etc;
- acquisition and / or management of properties predicted to have air quality or noise impacts above relevant regulatory levels, in accordance with requirements of Project approval; development of a program for potential collaboration with neighbouring mines regarding specific residences common to relevant mining operations;
- rainwater tanks to be cleaned at privately-owned properties every three years within a 4 kilometre radius from the approved mining limit;
- wider distribution of the 'Dust and You' fact sheet to include all landholders within a 4 kilometre radius form the approved Project Area;
- further community awareness raising of the air quality monitoring network and location of monitors within the locality and wider region (e.g. through newsletter);
- continued discussion with Singleton Council regarding the establishment of a VPA that is commensurate with the local infrastructure impacts associated with the Project;
- explore opportunities for the development of Mount Pleasant school based programs (with focus on environmental and biodiversity activities) – as part of revised Social Involvement Plan;
- consideration of mechanisms to further involve the community in land management, e.g. working group / CCC involvement;
- ongoing landholder and community engagement program, including regular distribution of newsletter and face to face contact with landholders and stakeholders;
- open days / community function / social events, to be held within the locality, with frequency to be reviewed subject to attendance levels;
- consideration of a workforce participation program to enhance workforce participation in voluntary local community activities e.g. rural bushfire service;
- continued implementation of the Glencore Corporate Community Involvement Plan and Mount Owen Social Involvement Plan;
- continuation of operational economic benefits to local townships and the broader region through employee and supplier expenditure;
- inclusion of weighted consideration regarding competent and capable local / regional companies in procurement process; and
- commitment to recruit regionally, where possible.

Further details on these management strategies are provided in **Appendix 5**.

The existing Mount Owen Social Involvement Plan will be revised to incorporate these strategies and will guide the implementation and evaluation of the social aspects of the Project and other Mount Owen activities.

The Social Involvement Plan will also be revised to include a framework to monitor the effectiveness of the proposed mitigation strategies in mitigating negative social impacts and / or enhancing positive social impact over time. The monitoring program will collect social data on the following areas:

- key areas of predicted Project impact e.g. origin of the proposed construction workforce, intended accommodation of construction workers in the locality / region, use of local services etc;
- 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 SI0A study area;
- social and economic contributions of the operation in the community through recurring implementation of workforce and supplier surveys (i.e. TRC-Analysis);
- actions and investments arising from any VPA for the Project to assess the outcomes of key projects and programs; and
- review of appropriate methods to monitor landholder experiences regarding mine-related impacts (e.g. noise, air quality blasting), with proactive follow-up and monitoring collected by Mount Owen personnel.

5.18 Economic Assessment

To address the DGRs for the Project (refer to **Table 5.18.1**), a detailed Cost Benefit Analysis and Economic Impact Analysis was undertaken by Deloitte Access Economics and is included as **Appendix 17**.

Table 5.18.1 – Economic Impact Assessment Director-General's Requirements

Economic Impact Assessment Requirements	Section of Report
Potential direct and indirect economic benefits of the development for local and regional communities and the State.	**Sections 5.18.2** and **Appendix 17**
A detailed assessment of the costs and benefits of the development as a whole, and whether it would result in a net benefit for the NSW community.	**Sections 5.18.3** and **Appendix 17**

Consideration of the costs and benefits of the Project is done primarily through a Cost Benefit Analysis (CBA). Consideration of whether the Project would result in a net benefit for the NSW community has been undertaken through the use of a Computable General Equilibrium (CGE) model. A detailed description of the CGE modelling is included in **Appendix 17**.

The key findings of the economic assessment are discussed in the following sections.

5.18.1 Cost Benefit Analysis

A CBA is a method of obtaining a consolidated estimate of the net economic value of the Project by identifying the incremental costs and benefits of the Project relative to the base case (i.e. no Project), and placing a quantitative value on these items wherever possible. To carry out this economic assessment, a base case representing business as usual has been compared to a Project case. The base case in the CBA involves production of 25.58 Mt of saleable coal between 2014 and 2018 with rehabilitation activities undertaken upon cessation of mining. The Project case essentially involves undertaking additional capital

investment and operating expenditure to expand the area for mining operations in the North Pit Continuation area, continued mining activity at the BNP and sequential mining in the RERR Mining Area. In the Project case, 77.20 Mt of saleable coal is produced, generating total revenue of $5,579 million in present value terms. The Project case also incorporates a total of $152.9 million in capital investment which has been assumed to be incurred in 2016 and 2017, during the construction phase.

The potential costs and benefits were separated into two categories:

- the costs and benefits that affect the financial outcomes of the proponent (Mount Owen) that can be classified as internal effects of production; and
- externalities, which incorporates the broader implications of the Project for third party stakeholders, such as residents and businesses from the local Singleton community, the broader Hunter and Central Coast region, and beyond, along with the various levels of government, which do not directly affect the financial outcomes of the proponent.

The items included in the CBA as potential costs and benefits are shown in **Table 5.18.2**. It should be noted, some benefits of the Project to the community such as salaries paid to staff (included in operating costs), are considered a cost in the CBA analysis, as they are a cost to the Project.

Table 5.18.2 – Potential Costs and Benefits Considered in CBA for Project

	Costs	**Benefits**
Production	Other onsite revenue forgone Exploration costs Capital investment costs Operating costs excluding taxes Rehabilitation costs Decommissioning costs Residual value of land forgone	Gross mining revenue Residual value of capital
Externalities	Offsite agricultural revenue* Related public expenditure* Groundwater quality* Surface water quality* Air pollution – carbon emissions Air pollution – particulate matter Air pollution – other pollutants* Noise impacts Visual amenity* Biodiversity – flora and fauna Quality of open space* Rural amenity and culture Aboriginal heritage* European heritage* Health*	Net traffic impacts Conservation*

* Item has been considered qualitatively

Note: As the Project involves open-cut mining activity, there are no subsidence impacts which need to be valued in this analysis. Nevertheless, this item is discussed qualitatively in Section 5 of the Cost Benefit Analysis and Economic Impact Analysis of the Mount Owen Continued Operations Project (DAE 2014) in accordance with NSW Government (2012).

When preparing and identifying inputs to the CBA, production costs and benefits are generally well known and included quantitatively. Applying an appropriate value to externalities associated with a project is more difficult and accordingly, various methods are used to value these inputs. In cases where there was a market price available, this price was used. Alternatively, if a standard industry approach was available then this value was used. When neither of these options was available, there were then two alternative possible approaches as detailed below:

- undertake a literature review and apply benefit transfer techniques to the local context if required. Much of the literature on non-market valuation involves using a method called choice modelling which relies on extensive surveys; and

- Hedonic pricing, which relies on analysis of existing non-market values.

As recommended in CBA guidelines (e.g. NSW Treasury 2007), where it is difficult to place a value on a particular cost or benefit of a project, a qualitative analysis can be undertaken. In most cases the externalities identified in **Table 5.18.2** have been considered qualitatively because there is expected to be no significant difference in outcomes under the baseline and project case (such as offsite agricultural revenue) or because there is no reliable method available to value them in these particular circumstances (such as Aboriginal heritage and visual amenity). The Economic Assessment includes a detailed discussion of the various valuation methods considered, and ultimately used, in the CBA analysis (refer to **Appendix 17**).

The overall finding of the CBA is that the Project, when all potential costs and benefits are considered, is predicted to deliver net economic benefits ($758 million). The CBA calculated a benefit to cost ratio of around 1.30 (based on a 7 per cent discount rate as recommended in NSW Government guidelines). A sensitivity analysis was completed to understand the implications for the Project of different discount rates and cost / benefit inputs (e.g. changes in price of coal).

It should also be noted that the CBA results do not explicitly identify benefits to particular groups (such as tax payments to the NSW government) as these are a transfer payment and do not sit within the scope of a CBA. However, the additional royalties generated by this Project, relative to the base are estimated to be worth around $258 million in NPV terms to the NSW Government (this is equivalent to a total of $461 million in additional revenue over the life of the Project).

In regard to the benefits for the local community, the potential net benefits to the Singleton community (based on the location of mine employees and mine suppliers) is estimated to be a net benefit to the community of around $306 million (NPV terms).

The CBA therefore shows that when all potential costs and benefits are considered, the Project will deliver a substantial net benefit.

5.18.2 Economic Benefits to the Region and State

A CGE model can show how changes in one part of the economy (such as the production of more coal) flow through to other parts of the economy (such as effects on employment levels, exports and labour income).

CGE modelling of the Project has been undertaken for the period 2016 to 2030 for the Hunter Valley and New South Wales economic regions.

The CGE analysis found that, over the life of the Project, the Hunter Region's Gross Regional Product (GRP) is modelled to generate just under $1.3 billion (in NPV terms) while NSW's Gross State Product (GSP) (including the Hunter) increases by around $1.9 billion (in NPV terms) (refer to **Table 5.18.3**).

Table 5.18.3 – GRP and GSP Impacts 2016 to 2030

Regions	GRP/GSP (NPV)
Hunter (GRP $m)	1,288
Rest of NSW (GRP $m)	613
Total NSW (GSP $m)	1,902

The GRP impact to the Hunter region is highest in 2020 at about $260 million (in 2014 prices) to coincide with the peak in mine output.

The CGE analysis also modelled employment impacts. State wide employment peaks in 2020 with approximately 1,200 full time equivalent (FTE) workers taking account of employment generation effects. Of this, about 1,091 are estimated to be employed in the Hunter region. This includes employment at the mine and employment generated elsewhere in the economy. Over the remainder of the period to 2030, employment is projected to remain positive for the Hunter. The employment impacts, when compared to the GSP and mining activity, do trend lower over the period reflecting baseline employment productivity.

Sensitivity Analysis

Given the uncertainty over the coal price during the modelling period of 2016 to 2030, the Economic Analysis completed a sensitivity analysis. The aim of this sensitivity analysis was to understand the potential implications of different coal price trajectories for the Project. The sensitivity analysis included:

- Scenario 1 – Central estimate of coal price forecasts;
- Scenario 2 – Lower price scenario (30 per cent below 2014 central estimates); and
- Scenario 3 – Higher price scenario (30 per cent higher above the 2014 central estimates).

GRP impacts are proportionate to the coal price inputs. In the Hunter region, GRP would be expected to decrease from about $1,288 million in the Central case to about $935 million in the lower price scenario and increase to almost $1,647 million in the higher price scenario.

As with the central case the total regional employment impacts are relatively small over the construction phase of the modelling and peak in 2020.

5.18.3 Net Benefit for the Local and NSW Community

The Cost Benefit Analysis and Economic Impact Analysis 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 continuation of operations at the Mount Owen Complex will have a significant positive economic impact, for the Hunter Valley and the State of NSW. In total, the Project is anticipated to:

- deliver net benefit of around $758 million (in NPV terms) over its life at a benefit cost ratio of approximately 1.30;

- generate royalties of an estimated $258 million in NPV terms to the NSW Government;
- generate a net benefit to the Singleton community of around $306 million (in NPV terms) over the life of the Project;
- increase the Hunter GRP by a projected approximately $1.3 billion in NPV terms, over the life of the Project;
- increase the NSW GSP (including the Hunter) by approximately $1.9 billion (NPV terms); and
- directly and indirectly employ a peak of almost 1,200 FTEs workers. Of this, about 1,091 are estimated to be employed in the Hunter region.

5.19 Mine Closure and Rehabilitation

A detailed mine closure and rehabilitation plan has been developed for the Project (refer to **Appendix 18**). The objectives of the plan include identifying a sustainable post mining landuse. The mine closure and rehabilitation plan has been developed in accordance with the DGRs as outlined in **Table 5.19.1** below.

Table 5.19.1 – Mine Closure and Rehabilitation Director-General's Requirements

Rehabilitation Requirements	Section of Report
Including the proposed rehabilitation strategy for the site, having regard to the key principles in the *Strategic Framework for Mine Closure,* including:	
• rehabilitation objectives, methodology, monitoring programs, performance standards and proposed completion criteria;	**Sections 5.19.1, 5.19.2, 5.19.6 and 5.19.7**
• nominated final land uses and land forms (including cross sections), having regard to any relevant strategic land use planning or resource management plans or policies; and	**Sections 5.19.4 and 5.19.5**
• the potential for integrating this strategy with any other rehabilitation and / or offset strategies in the region, including the *Upper Hunter Strategic Assessment.*	**Section 5.19.3**

5.19.1 Glencore Coal Mine Closure Planning Process

Glencore has implemented a proactive approach to rehabilitation and mine closure by developing a range of standards to be implemented across its business units including the Mount Owen Complex. These standards require that planning for closure is 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 achieve a sustainable post-closure land use.

The Glencore Closure Standard 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 government sign-off on 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 standard requires that when a mine is within five years of the planned closure date that a detailed closure planning process is initiated. The process 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 execution of the Final Closure Plan. The Final Closure Plan will commence within 5 years of the planned cessation of mining and be submitted to the relevant regulatory authorities at a minimum of 2 years prior to the planned cessation of mining operations.

As part of the ongoing operations of the Mount Owen Complex, the existing Conceptual Closure Plan will be revised should the Project be approved. This plan will be updated in consideration of the commitments outlined within this EIS and will include details regarding final land use objectives and closure criteria, rehabilitation and final void management strategies as detailed in the mine closure and rehabilitation strategy for the Project (refer to **Appendix 18**).

5.19.2 Existing Rehabilitation Processes and Performance

Several forms of ecological rehabilitation and restoration have been undertaken to date at the Mount Owen Complex, comprising:

- mine rehabilitation on emplaced overburden material;
- revegetation (active management) of pasture grasslands outside of the mine disturbance areas through plantings; and
- passive regeneration of grasslands outside of the mine disturbance areas where adequate canopy seed sources are located nearby.

In addition, a range of fauna impact mitigation and management measures have been implemented including the installation of nest boxes and the construction of green and golden bell frog habitat in two frog conservation zones within Biodiversity Offset Areas and within mine rehabilitation.

The existing rehabilitation strategy has benefited from extensive research undertaken in partnership with the Centre for Sustainable Ecosystem Restoration (CSER) at the University of Newcastle. Research programs have included re-establishment of sustainable nutrient acquisition and cycling using natural root-microbe associations, which expanded to include research into the use of available bulk materials and amelioration techniques for mine rehabilitation when forest topsoil would eventually run out.

A recent assessment of ecological outcomes of mine rehabilitation, regeneration and revegetation demonstrates the rehabilitation success at the North Pit. Specifically, this assessment has indicated that rehabilitation areas sampled are strongly trending towards the *Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions* EEC. Vegetation communities within this area are providing appropriate levels of species diversity for the age of the vegetation and the majority of target species and groups of fauna species are repeatedly achieving benchmark species diversity values. However the assessment also outlines that ongoing management will be required to continue to improve their condition and function to ensure long term self-sustainability.

The mine closure and rehabilitation strategy for the Project has been designed to build on the success of existing techniques, learnings derived from previous monitoring and research, and to be adaptive to include new measures aimed at continual improvement.

5.19.3 Alignment with Strategic Land Use Objectives

Singleton Local Environmental Plan

The rehabilitation and closure strategy has been developed in consideration of the objectives of the Singleton LEP 2013. The Project Area is situated within an area zoned as RU1 Primary Production. Amendments that may occur to the LEP will be evaluated as part of ongoing revisions to the Project's mine closure planning.

In consideration of the LEP 2013, provision has been included within the rehabilitation strategy to maintain the rural landscape by establishing native vegetation corridors to promote regional fauna movements across the Project Area and surrounding region, where appropriate. The establishment of native vegetation corridor areas does not preclude the ability to re-establish land for sustainable agricultural purposes in some areas.

DRE Synoptic Plan

The DRE Synoptic Plan aims to provide 'a basis for the development of a long term integrated strategy for the rehabilitation of mines sites' (Andrews 1999). 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 proposed final land use aims to provide habitat corridors, which is generally consistent with the intent of the broader regional corridor system outlined within the Synoptic Plan.

Upper Hunter Strategic Regional Land Use Plan and Upper Hunter Strategic Assessment

The Upper Hunter SRLUP (DP&I 2012b) 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 and that the location and design of rehabilitation can be used to maximise its landscape value in the future. Importantly, the plan outlines that effective planning will be required to design a post-mining landscape that will allow a number of different land uses including conservation. It is considered that the proposed final land use within the Mount Owen Complex will be consistent with this intent.

The Upper Hunter SRLUP also supports the development of a Strategic Assessment under Part 10 of the EPBC Act for proposed new coal mines and mine expansions in the Upper Hunter Valley. The Strategic Assessment is being undertaken by OEH, DP&E and the DoE and is due to be completed in 2015. The aims of the Strategic Assessment are to:

- resolve Commonwealth and State threatened species / biodiversity issues in one / upfront process;
- consider the impacts of all mines together and in a regional context;
- consider how rehabilitation can contribute to biodiversity conservation in a regional context;
- improve the process of finding and securing offsets; and
- target offsetting to deliver regional conservation gains.

Based on the intent of the Strategic Assessment, it is proposed that the ecological value of successful post-mining rehabilitation areas will contribute to the overall proposed Biodiversity Offset Strategy for the Project.

Strategic Framework for Mine Closure

The Strategic Framework for Mine Closure (ANZMEC & MCA 2000) provides a framework of issues to be considered as part of a mine closure plan. The strategy for mine closure for the Project has been developed in consideration of the six key objectives of the framework (refer to **Table 5.19.2**).

Table 5.19.2 – Key Objectives from the Strategic Framework for Mine Closure

Key Objectives	Response and Relevant Section of EIS
To enable all stakeholders to have their interests considered during the mine closure process.	Achieved through completion of community consultation and social impact assessment for the Project (refer to **Sections 4.0** and **5.17**).
To ensure the process of closure occurs in an orderly, cost-effective and timely manner.	Mine closure decommissioning activities and their costs have been assessed. Mount Owen will adjust its existing mine closure accrual provision as appropriate in accordance with relevant accounting standards and submit a rehabilitation security deposit in accordance with DRE's guidelines. Mine closure provisions will be regularly revised and updated as part of the operational life of the Project.
To ensure that the cost of closure is adequately represented in company accounts and that the community is not left with a liability.	
To ensure there is clear accountability and adequate resources for the implementation of the closure plan.	Specific responsibilities for the implementation of the mine closure and rehabilitation strategy for the Project will be detailed within the updated Mining Operations Plan (MOP), and Landscape Management Plan. The allocation of responsibilities and resources will be designed to promote the integration of rehabilitation and mine closure within the day to day mine planning process.
To establish a set of indicators, which will demonstrate the successful completion of the closure process.	Indicative post-mining land uses, rehabilitation objectives and rehabilitation completion criteria have been developed for the Project (refer to **Sections 5.19.5, 5.19.6** and **5.19.7**).
To reach a point where the company has met agreed completion criteria to the satisfaction of the responsible authority.	Completion criteria are objective target levels or values assigned to a variety of indicators which can be measured against to demonstrate progress and the ultimate success of rehabilitation (refer to **Section 5.19.7**). As such, they provide a defined end point, at which point in time rehabilitation can be deemed successful. Based on the outcomes of rehabilitation monitoring programs and in consultation with the relevant government agencies Mount Owen intend to seek progressive sign-off of rehabilitated areas once the agreed closure and rehabilitation criteria have been satisfied. The aim will be to achieve consensus on the quality of rehabilitation required as a benchmark for future rehabilitation activities

5.19.4 Proposed Post Mining Landform

5.19.4.1 Final Landform Conceptual Design Considerations

As identified in **Section 4.2.4**, one of the key community issues associated with the Project related to land management and the proposed final landform. Moreover, through detailed consultation with the DRE, final landform design was also identified a key consideration for the Project. Specific feedback received from these stakeholders was for the Project to move away from the 'traditional flat topped' final landform that is evident in the Hunter Valley and investigate conceptual design options that would lead to landforms that are undulating and more natural in appearance.

Subsequently Mount Owen commenced a conceptual design process for final landform options for the Project. This conceptual design process seeks to integrate the planning for new areas with existing areas within the North Pit and Ravensworth East that are currently shaped to their final landform and have been rehabilitated with the Project.

The technical basis for the conceptual design process involved analysis of stable natural landforms formed within weathered materials in a reasonably close proximity to the Mount Owen Complex to determine the key parameters to be used. The approach looked to understand stable landform characteristics that have developed over geological time periods to allow development of similar stable landforms within the rehabilitated area at Mount Owen Mine.

The key components used in the conceptual design include:

- Overburden emplacement areas will include variation in vertical relief in order to prevent extended ponding of surface water as well as create a profile that is commensurate with the natural local topography.

- The final landform will generally be designed to direct runoff away from the final voids and into the Main Creek, Yorks Creek, Bettys Creek and Swamp Creek catchments. This will return catchment flows to Yorks Creek and Main Creek and reinstate some of the natural flows to Bettys Creek and Swamp Creek.

- Drainage structures will be designed to minimise scouring associated with anticipated runoff. Where practicable, drainage lines will be designed to be commensurate with surrounding natural landforms.

The proposal for a 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. Amongst the key principles of the approach include:

- the drainage density of the landform, being the number of drainage lines relative to the overall area, and reflecting the dendritic nature of the drainage;

- 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; and

- 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 conceptual design process for the final landform option for the North Pit Continuation has commenced. It proposed that Mount Owen will continue to consult with the DRE to further develop the conceptual design through the MOP and mine closure planning processes. The success of this approach will need to be verified through ongoing site trials and monitoring programs to determine that it is operationally practical and it complies with the completion criteria. Opportunities to apply this process where feasible to Ravensworth East will also be investigated as part of the detailed mine closure planning process.

The approach proposed both in terms of the design approach and the construction methodology is being implemented at other existing Glencore operations.

It is important to note that the proposed conceptual landform is based on developing a more sustainable long term hydrological solution to the rehabilitation process. As such, the more natural appearance allowing for the establishment of a number of different landform features such as drainage lines, variable slopes and different aspects (such as north or south facing within an area previously intended to be left flat) are secondary but important benefits. These features allow the development of a variable and diverse post mining landform, and are also visually more natural in appearance.

5.19.4.2 Final Voids

As discussed in **Section 2.3.5.1,** the proposed final landform will result in three final voids in the southern area of the North Pit Continuation, BNP and RERR Mining Area (refer to **Figure 5.54** and **Figure 5.55**).

Mount Owen will reviewing a range of options for beneficial re-use of the post mining voids focussing on the BNP and RERR Mining Area (refer to **Section 5.19.5**).

Mount Owen have undertaken detailed analysis to assess the geotechnical stability of the three final voids. This analysis determined that in regards to the stability of the pit walls, the geotechnical risk is low and that the acceptable stability criteria determined a Factor-of-Safety (FoS) greater or equal to 1.2 was achieved for all pit walls under design static scenarios for the North Pit. The key design features and processes associated with the final voids, particularly to minimise impacts to public safety as well as reduce the sterilisation of land available for future post mining land uses, include:

- The highwall will comprise a series of benches of various widths that will be constructed progressively as mining operations progress in the lower seams.

- A trench and / or safety berm will be established along the top of the highwall which is designed to divert surface water runoff and restrict inadvertent access to the highwalls.

- The highwall benches will be seeded with a suitable species mix.

- As part of the establishment of the lowwall, surface drainage network will be developed to minimise the propensity to erosion and create a stable landform.

- The lowwall will be revegetated with a suitable species mix.

umwelt

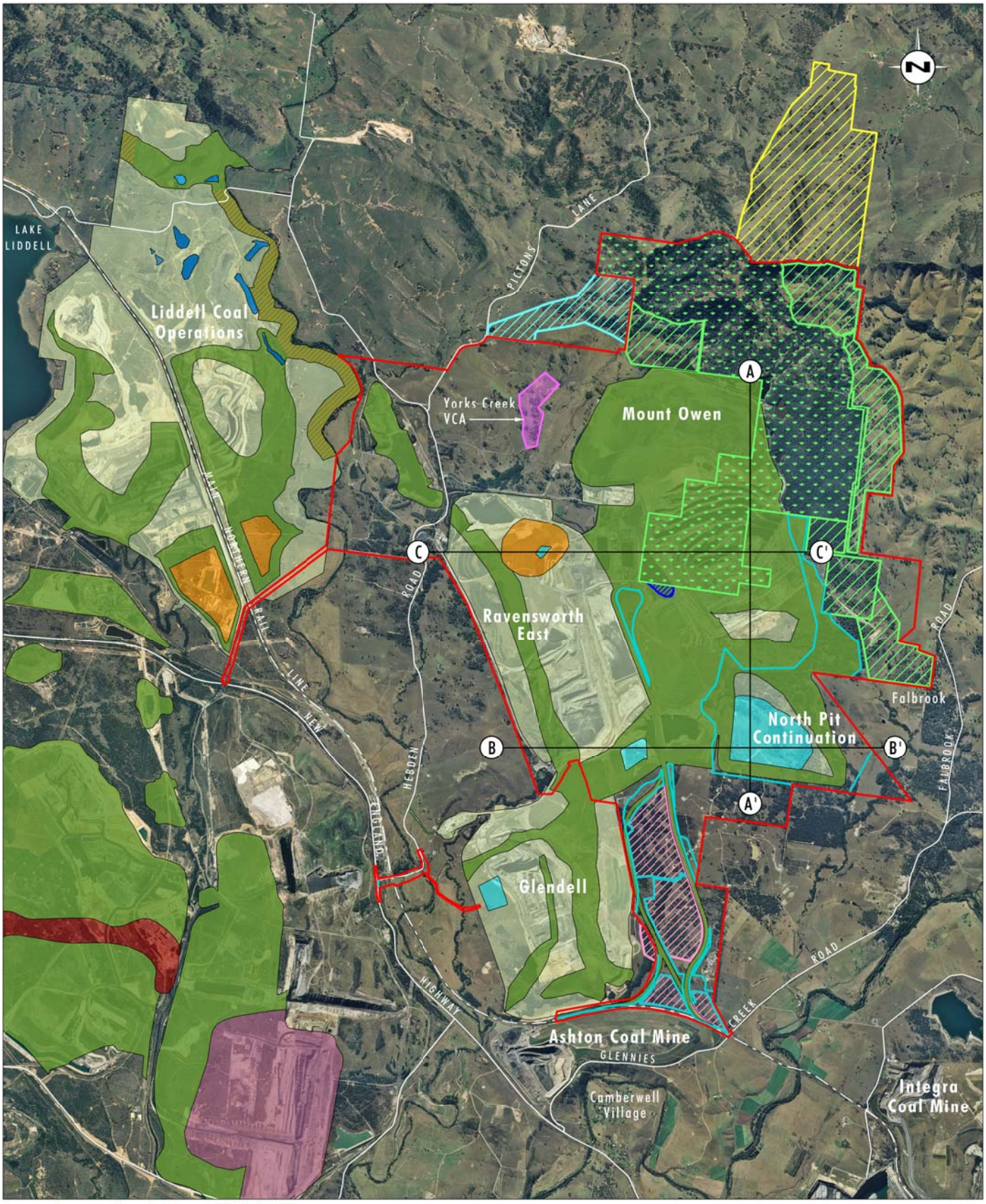


Image Source: Mount Owen (2012-2013)
Data Source: Mount Owen (2014)
Note: Refer to Figure 5.19.2 for A-A', B-B' and C-C' cross sections

0 1.0 2.0 4.0km
1:75 000

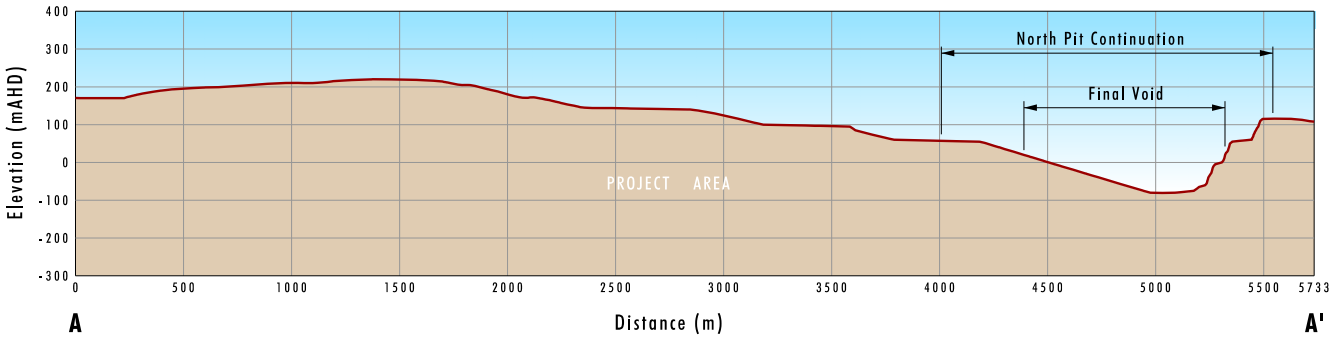
Legend

- Project Area
- Proposed Disturbance Area
- Yorks Creek VCA
- Final Void Water Level
- Native Woodland
- Open Grassland (Potential grazing areas) with pockets of Native Vegetation
- Grassland for Stabilisation
- Ravensworth State Forest
- Proposed Corridor Habitat Enhancement on Non-Mined land (Liddell Coal Operations)
- Existing Biodiversity Offset Area
- Proposed Cross Creek Biodiversity Offset Area
- Bettys Creek Habitat Management Area
- Southern Remnant Biodiversity Offset Area
- Stringybark Creek Habitat Corridor
- Grazing
- Riparian / Wetland
- Water Storage
- Section Line

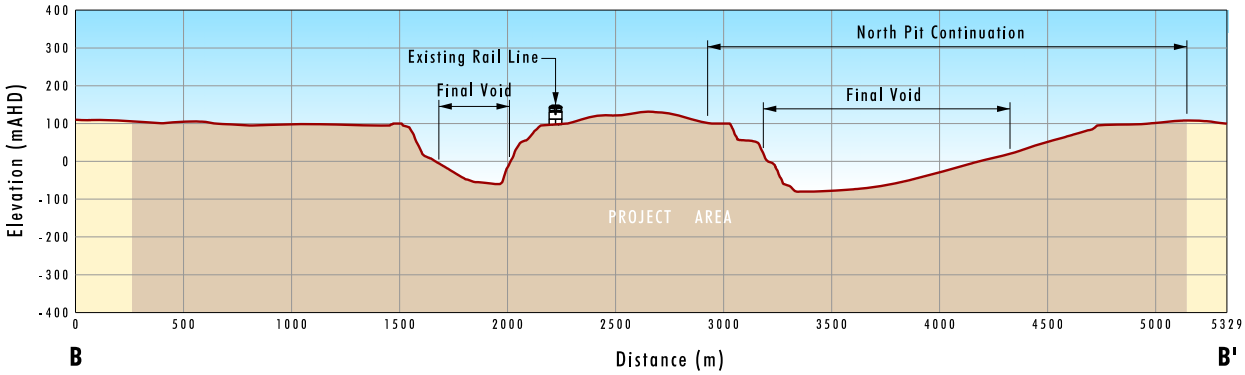
FIGURE 5.54

Mount Owen Continued Operations Project Proposed Post Mining Land Use

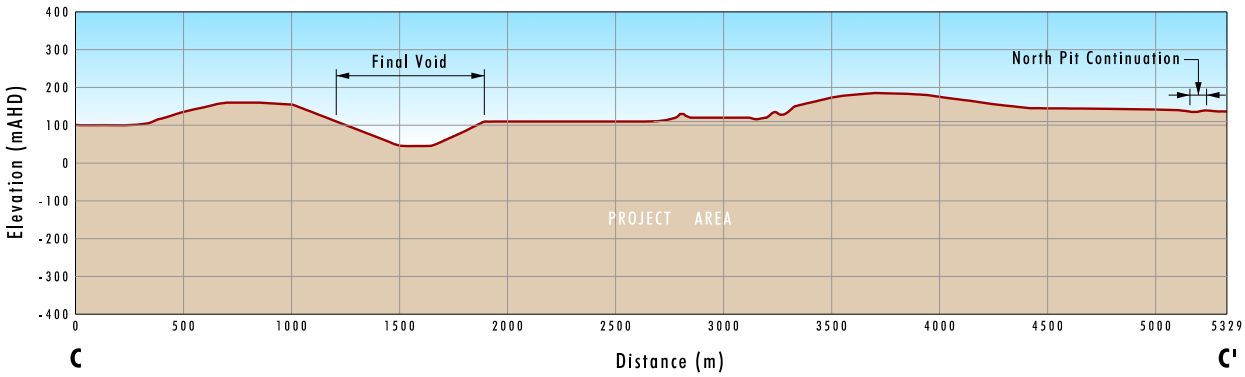
File Name (A4): R02/3109_789.dgn
20141008 16.09



Transect A-A'



Transect B-B'



Transect C-C'

0 0.3 0.6 1.2km
Vertical Scale 1:20 000
0 0.5 1.0 2.0km
Horizontal Scale 1:35 000

FIGURE 5.55

Proposed Final Landform
Transects A-A', B-B' and C-C'

Note: For Section locations refer to Figure 2.12

File Name (A4): R02/3109_733.dgn
20140922 16.06

- A surface drainage network will be established across overburden emplacement areas to divert the bulk of surface water away from the final void so as to maximise replenishment of the local catchment areas.

As outlined in **Appendix 9**, the water level in final void in the North Pit is expected to stabilise at approximately 19 m AHD with the BNP stabilising at approximately 48 m AHD and RERR Mining Area at -8 m AHD.

As outlined in **Appendix 10**, a groundwater assessment of the final landform (at closure) indicates that the void will not discharge to local alluvial aquifers. The final voids at the North Pit and RERR Mining Area will act as long-term sinks for groundwater and the BNP final void is predicted to be a source of water to the local hard rock aquifer. Further detail regarding the design features and proposed processes associated with the final void are provided in the Mine Closure and Rehabilitation Strategy (refer to **Appendix 18**).

5.19.5 Indicative Post-Mining Land Use

The indicative post-mining land use for the Project Area will primarily involve the establishment of woodland areas with the objective of creating a native vegetation corridor network that promotes regional fauna movements between the Mount Owen Complex, Ravensworth Surface Operations, Liddell Coal Operations, Lake Liddell and the Ravensworth Surface Operations Hillcrest Offset Areas (refer to **Figure 5.54**).

Other portions of the Project Area, including the tops of overburden emplacement areas, the flatter portion at the base of the North Pit Continuation as well as capped tailings dams (refer to **Figure 5.54**) will be revegetated with open grassland with pockets of native vegetation. Depending on outcomes of final land use analysis to be completed as part of the detailed closure planning process, it is the intent that these areas could be used for sustainable agricultural purposes such as grazing. The remainder of the Project Area includes both open grassland and native vegetation rehabilitation (refer to **Figure 5.54**).

Alternative post-mining land use options (in addition to sustainable agriculture and native woodland) may still be investigated as part of the detailed mine closure planning process and may include industrial uses.

It is proposed that BNP would be investigated for use for water storage during the operational life of the Project upon completion of mining in that area. As discussed in **Section 5.5.5**, the Project is predicted to operate with a water surplus in the later years, which coincides with the anticipated timing for completion of mining in the BNP. The potential use of the BNP as an ongoing water storage would provide a sustainable post mining use.

The RERR Mining Area, which will be mined in the later stages of the Project, is proposed to be used for tailings emplacement during the final years of the Project to enable the West Pit tailings area to consolidate prior to capping and will have remaining capacity. There is the potential option for the RERR Mining Area to be used for tailings emplacement from other mines. The potential for continued use of this area for tailings emplacement and implications for mine closure, will be considered as part of detailed mine closure planning, initiated five years prior to cessation of mining as part of this Project.

5.19.6 Rehabilitation Objectives

The proposed rehabilitation strategy for the Project (refer to **Figure 5.54**) has been developed in consideration of a number of factors including site opportunities (i.e. proximity to remnant native vegetation areas) and constraints (i.e. slope, substrate quality etc.), ecological and rural land use values and existing strategic land use objectives (refer to **Section 5.19.3**). In particular, the strategy considers the integration of rehabilitation across

the Mount Owen Complex with the strategies developed for Glencore's surrounding mining operations within the Greater Ravensworth Area.

The overall objectives of the proposed post-mining land use design for the Project and the Mount Owen Complex include:

- to establish a vegetation community consistent with the Central Hunter Ironbark – Spotted Gum – Grey Box Forest on the post mining landform;
- to contribute to effective native corridors through the area which promote fauna movements between the Mount Owen Complex, Ravensworth Surface Operations, Liddell Coal Operations, Lake Liddell and the Liddell and Ravensworth Operations Hillcrest Offset Area;
- to maintain and provide additional suitable habitat for a range of threatened fauna species including but not limited to the spotted-tailed quoll (*Dasyurus maculatus*);
- to provide opportunities for future agricultural activities such as sustainable grazing;
- to improve the visual amenity of the area; and
- not to preclude other potential post-mining land use options should they be determined to be viable and preferable as part of the detailed mine closure planning process that will commence at least five years prior to the planned cessation of mining.

Specific objectives include:

- The establishment of the Stringybark Creek Habitat Corridor which includes restoration of spotted-tail quoll habitat including vegetation communities consistent with the Central Hunter Ironbark – Spotted Gum – Grey box Forest EEC as well as Central Hunter swamp Oak forest located along Stringybark Creek. This will include a mixture of tree plantings and habitat structures along the creekline on non-mine disturbed land. The Corridor has been designed with the objective of providing an effective east to west (and vice versa) linkage from the existing Mount Owen Complex Biodiversity Offset and rehabilitation areas situated to the north of the Project Area through to the rehabilitated former tailings dams, Bowmans Creek and Liddell Coal Operations rehabilitation areas to the north-west. The proposed rehabilitation strategy for Liddell Coal Operations involves the establishment of native corridors in order to provide effective integration with the adjacent Ravensworth Operations Hillcrest Offset Area.
- Native woodland areas generally established across the slopes of overburden and higher portions of the lowwalls associated with final voids, the steepness of these areas and the nature of the substrate are likely to provide limited potential for sustainable grazing.
- Seeding of native vegetation (canopy, mid-canopy and groundcover) on the highwall benches to improve long term visual amenity of the final void.
- Lower portions of lowwalls initially seeded with exotic grassland species to stabilise these areas until they are submerged by surface and groundwater in the final void.
- Flatter areas including the tops of overburden areas and capped overburden are to be established to open grassland with pockets of native vegetation, potentially suitable for grazing.

Mount Owen will seek to rehabilitate capped tailings dams to woodland vegetation. However, there are some limitations to the potential success of this including the depth of the capping material. Mount Owen will explore options to realise this objective including selection of appropriate tree species. Further details regarding the rehabilitation objectives and specific revegetation methodology are presented in the Mine Closure and Rehabilitation Strategy (refer to **Appendix 18**).

5.19.7 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 point in time rehabilitation can be deemed successful.

The preliminary closure and rehabilitation completion criteria for the Project include:

- decommissioning;
- landform establishment;
- growing media development;
- ecosystem establishment; and
- ecosystem development.

Criteria have been developed considering specific issues for the Project and objectives, Glencore's standards and the outcomes of the 2005 ACARP study entitled 'Development of Rehabilitation Completion Criteria for Native Ecosystem Establishment on the Coal Mines in the Hunter Valley'. Details of each rehabilitation completion criteria aspect are provided in the Mine Closure and Rehabilitation Strategy (refer to **Appendix 18**) with a summary provided in **Table 5.19.3**.

Table 5.19.3 – Preliminary Project Closure and Rehabilitation Criteria

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 which does not have a potential future use associated with the 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. • Services: removal of all services (power, water, communications), which don't have potential future uses. • Mount Owen CHPP and associated infrastructure: removal of the CHPP and all associated conveyors and structures. • Rail provisioning facility, train loading system and loop: removal of all infrastructure, rail provisioning facility, train loading system and loop, including ballast material, should a suitable alternate future use for the rail infrastructure not be identified. • Office and Workshop: demolition and removal of all offices and workshop related facilities including refuelling facilities. • Pumps, pipes and power: removal of water management infrastructure. Where underground pipelines are to remain *in situ*, the location of the infrastructure has been marked on the final landform plan and a suitable caveat developed to provide that they are readily identifiable for future land holders. • Lay down areas: removal of all plant and equipment.
	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.

Table 5.19.3 – Preliminary Project Closure and Rehabilitation Criteria – cont.

Aspect	Objective	Preliminary Closure Criteria
	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, if required, so that appropriate guidelines for land use are met. • Where practical, exposed carbonaceous material will be removed and co-disposed within the overburden emplacement areas or suitably capped *in situ*.
Landform Establishment	Landform suitable for final land use and compatible with surrounding landscape as sustainable native ecosystem.	• Rehabilitated slopes are generally 10 degrees. However, to allow for the creation of local relief in topography on the top of overburden emplacement areas as well as the creation of alternative stable slope designs (i.e. if concave profiles are utilised), slope angles may exceed this criteria. • 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. • Access to final voids is restricted through the construction of an appropriate barrier to prevent human and animal access. • Tailings and reject emplacement areas will be capped and reshaped and be free draining. • Runoff water quality from rehabilitation areas is within the range of water quality data recorded from analogue sites and does not pose a threat to downstream water quality.

Table 5.19.3 – Preliminary Project Closure and Rehabilitation Criteria – cont.

Aspect	Objective	Preliminary Closure Criteria
Growing Media Development	Growing media is capable of supporting sustainable vegetation growth.	• The rehabilitation surface is a suitable growing medium. • Soil pH to be in the range of analogue sites. • Monitoring demonstrates soil profile development in rehabilitated areas (e.g. development of organic layer, litter layer).
Ecosystem Establishment	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 desired native vegetation communities. • 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 the long term monitoring program. • 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 Development	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.

The preliminary closure criteria will be reviewed and revised throughout the life of the Project through consideration of the results of rehabilitation 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 updated MOP and LMP and subsequent annual reporting. The achievement of the completion criteria will be monitored and reported within the annual reports submitted to relevant government agencies.

5.19.8 Scope of Mine Closure Decommissioning Works

At the end of the operational life of the Project, with the exception of that which is required for the final land use, Mount Owen proposes to decommission all infrastructure and associated facilities as part of the mine closure process. Closure monitoring and maintenance works would continue after mine closure activities are complete until it can be demonstrated that the relevant completion criteria have been met (refer to **Section 5.19.7**). Decommissioning will form part of the Mine Closure Plan.

Decommissioning of the following aspects will be completed following cessation of operational activities:

- site services including electricity and telecommunications;
- buildings and fixed plant (those which are not required as part of post-closure land use);
- rail line and rail siding, dependent on final land use analysis outcomes;
- removal of carbonaceous / contaminated material including excess coal material, coal reject and where potential contamination may have occurred;
- equipment storage areas;
- hardstand areas, roadways and car parks;
- hazardous materials and dangerous goods;
- water and tailings management infrastructure (those which are not required as part of post-closure land use); and
- final void management

Details of the general approach to decommissioning activities are presented in the Mine Closure and Rehabilitation Strategy (refer to **Appendix 18**).

5.19.9 Rehabilitation Strategy

Rehabilitation will be undertaken progressively in accordance with the updated MOP (to be approved by DRE) and LMP (to be approved by DP&E). The updated MOP and LMP will be developed in accordance with the mine closure and rehabilitation strategy for the Project (refer to **Appendix 18**) and will include the detailed measures and schedules for all rehabilitation activities. The ongoing review and refinement of rehabilitation completion criteria (refer to **Section 5.19.7**) will be undertaken as part of the MOP and LMP process and the monitoring of rehabilitation performance against the completion criteria will be reported in the Annual Review. The rehabilitation strategy encompasses the following:

- management of biological resources for utilisation in rehabilitation:
  - seed collection and propagation;

  - salvage of tree hollows, stags and timber; and
  - soil characterisation and topsoil management.
- overburden and interburden handling:
  - management of potential geochemical constraints to rehabilitation.
- spontaneous combustion management; coarse reject and tailings dam decommissioning:
  - tailings dam decommissioning; and
  - coarse reject management.
- final landform design:
  - final voids and highwall;
  - overburden emplacement areas; and
  - drainage.
- substrate preparation:
- revegetation program:
  - native woodland establishment;
  - establishment of grassland / pasture areas; and
  - Stringybark Creek Habitat Corridor.
- revegetation care and maintenance.

Full details of the rehabilitation strategy and its implementation and management are provided in the Mine Closure and Rehabilitation Strategy (refer to **Appendix 18**).

5.19.9.1 Proposed Rehabilitation Sign Off Process

Based on the outcomes of rehabilitation monitoring programs and in consultation with the relevant government agencies, Mount Owen intend to seek progressive sign-off of rehabilitated areas once the agreed closure and rehabilitation criteria have been satisfied. The aim will be to achieve consensus on the quality of rehabilitation required as a benchmark for future rehabilitation activities.

5.19.10 Proposed Rehabilitation Monitoring

Mount Owen will continue to 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; and
- facilitate continuous improvement in rehabilitation practices.

The monitoring program will be continued within rehabilitated and 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.

Proposed rehabilitation monitoring will include the following:

- Active mining records:

  During mining operations, Mount Owen will maintain active records as to mining activities and processes that may impact upon the rehabilitation and closure activities. These records will provide the basis for developing rehabilitation strategies and interpretation of later rehabilitation monitoring outcomes.

- Rehabilitation methodology records:

  Mount Owen will record the details of each rehabilitation campaign so that they are available for later interpretation of rehabilitation monitoring results with the aim of continually improving rehabilitation standards.

- Rehabilitation inspections:

  Following the completion of each rehabilitation campaign, an initial establishment inspection will be conducted within 6 months to determine whether issues have occurred or are emerging, which have the potential to delay revegetation establishment. Where necessary, rehabilitation procedures will be amended accordingly with the aim of continually improving rehabilitation standards.

- Monitoring rehabilitation performance against objectives:

  To complement the rehabilitation inspections, a rehabilitation monitoring program will be continued. The objective of this monitoring program is to evaluate the progress of rehabilitation towards fulfilling long term land use objectives.

Further details on each aspect of monitoring are presented in the Mine Closure and Rehabilitation Strategy (refer to **Appendix 18**).

Outcomes of the long term rehabilitation monitoring program will be used to determine the scope of rehabilitation care and maintenance works for these areas as discussed in **Section 5.19.8** and **Appendix 18**.

6.0 Summary of Environmental Management and Monitoring Measures

The DGRs for the Project require that the EIS include a consolidated summary of all the proposed environmental management and monitoring measures, highlighting commitments included in the EIS.

If development consent is granted under Part 4 of the EP&A Act for the Project, Mount Owen will commit to the following controls.

Hours of Operation

- Mining and associated activities for the Project will be undertaken 24 hours a day, 7 days a week.
- Construction of the Hebden Road upgrade works and the proposed rail line 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 works relating to the Main Northern Rail Line, may be required outside of the standard construction hours, and works will be managed to ensure that total noise emissions will be in compliance with the operational noise criteria for the Project, unless otherwise agreed with affected landowners.
- All other on site construction activities will be undertaken 24 hours per day, 7 days a week.

Air Quality

Mount Owen will continue to implement air quality controls in accordance with the Mount Owen Air Quality and Greenhouse Gas Management Plan which will be updated to include the additional controls proposed for the Project, within 12 months of Project Approval. The controls to be implemented are outlined in **Section 5.2.5** and include the following key measures:

- Continued use of the Mount Owen Complex proactive air quality control system to inform operational dust management.
- Continued use of visual triggers and associated procedures and training for wheel generated dust from unpaved haul roads, bulldozer operations, overburden emplacement, loading trucks and windblown erosion.
- Continued monitoring to demonstrate haul road dust control efficiency achieves the target of 85 per cent.
- Continued implementation of current PRP commitments to monitor and manage dust generation. Control practices may include treatment of permanent unpaved roads, by for example increased watering, application of dust suppressants, or use of select materials for haul road topping.
- Temporarily treat disturbed areas if prompt rehabilitation is not feasible, for example on some topsoil stockpiles.
- Blast management practices will continue to be employed to mitigate exceedances of the NO_2 c1-hour average criterion.

- Managing the risk of spontaneous combustion in accordance with the Mount Owen Spontaneous Combustion Procedure.

Noise

Within 12 months of project approval, Mount Owen will develop and implement a Noise Management Plan (NMP) (to update the current Noise Monitoring Program) in accordance with the Project Approval and EPL. The NMP will detail the continued management and monitoring controls to be utilised to manage potential noise impacts associated with operations, as outlined in **Section 5.3.10.**

Key management commitments include:

- Mount Owen will manage the operation of the RERR Mining Area during periods when the weather conditions enhance the noise impacts, such as inversion conditions during some winter night times.

- Mount Owen will manage other relevant activities during adverse weather conditions, such as when wind or inversion conditions enhance the noise propagation towards sensitive receiver locations, as described in **Section 5.3.10**, in order to meet noise performance requirements.

- Bunds will be included in strategic locations along some haul roads, and where practicable be located along the side of the ramps, shielding trucks and equipment on exposed sections of the ramps.

- In the later years of the Project, the primary coal haul road to the Mount Owen CHPP will be located on the western side of the North Pit Continuation.

- Location and orientation of haul roads will consider prevailing source to receiver winds, where practicable and some key haul roads within the North Pit Continuation will be located below ground surface to maximise topographical shielding to surrounding receiver areas.

- Incorporation of reasonable and feasible noise attenuation on key plant and equipment as detailed in **Appendix 7.**

Mount Owen intends to achieve the predicted noise levels associated with the Project presented in the NIA through the continued implementation of an 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 5.3.10**.

Mount Owen will continue to implement the extensive continuous monitoring network to enable proactive and real time management of operations during noise propagating conditions. The noise monitoring system will comprise:

- continued use of predictive forecasting of adverse weather conditions to identify when and where management measures are likely to be required as a result of an adverse weather event;

- maintenance of the existing continuous noise monitoring network, with refinements as mining progresses, as described in **Section 5.3.10**. This continuous monitoring network consists of fixed and mobile continuous noise monitoring units and two weather stations. In these circumstances where the noise impacts are predicted based on stability class rather than lapse rate, a 10 metre tower is suitable for measuring stability class based on sigma theta. As a result, the current weather stations used by Mount Owen are suitable for assessing the presence of inversion conditions that could lead to the enhancement of noise impacts;
- continued attended noise monitoring, as described in **Section 5.3.10**. The location and frequency of monitoring will be determined on an ongoing risk assessment basis; and
- use of continuous noise monitoring system to identify when noise levels are approaching relevant noise limits in the surrounding area to actively manage operations to minimise potential noise impacts as far as practicable.

Blasting

Blasting activities will continue to be undertaken in accordance with the Blast Management Plan 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:

- blasting will be undertaken in accordance with current approved operations, namely between 9am and 5pm (EST) and 9am and 6pm (DST) Monday to Saturday inclusive with 12 blasts per year between 7am and 9am Monday to Saturday;
- limiting to no more than 2 blasts per day at Mount Owen and 2 blasts per day at Ravensworth East Mine;
- assessing meteorological conditions such as wind speed and direction immediately prior to each blast to identify the blast exclusion arc;
- restricting blasting to suitable atmospheric and meteorological conditions;
- notification of the landowner / occupier of all residences (who register to be notified) within a 3 kilometres radius of proposed mining limit, of the blasting schedule;
- continuation of the blasting hotline and provision of up to date information relating to the blasting schedule for the Mount Owen Complex;
- notification of all landowners within 3 kilometres of the proposed mining limit that they are entitled to a structural property inspection (to be carried out by a suitably qualified, experienced and independent person);
- modification of the existing Mount Owen blast monitoring system to include a monitor to the east and south east of the North Pit Continuation;
- should mining operations within the North Pit Continuation and / or the RERR Mining Area and the Integra Underground Mine overlap, a Blast Management Protocol will be developed prior to any blasting within 500 metres of the currently approved active underground workings in consultation with Integra Underground Mine to manage any potential impacts associated with blasting activities within the North Pit Continuation. As previously noted, Integra announced in mid-2014 that both its underground and open cut operations were entering a period of care and maintenance. Mount Owen will continue to liaise with Integra to clarify the planned extent of the mining progression, once Integra operations recommence, to establish the Blast Management Protocol prior to any blasting within 500 metres of underground workings;

- Mount Owen will coordinate blasting with Liddell Colliery to ensure there is no simultaneous blasting likely to impact beyond relevant criteria at the historic Chain of Ponds Inn; and
- blasting activities within the North Pit Continuation, BNP and RERR Mining Area will not occur simultaneously.

Within 12 months of Project approval, the Blast Management Plan will be updated to reflect the changes associated with the Project.

Surface Water

Mount Owen will continue to manage operations in accordance with the WMP, the EPL and the HRSTS. Within 12 months of Project approval, Mount Owen will revise the WMP to reflect the changes to the surface water catchments and the additional monitoring and management measures required including:

- Additional off-line detention capacity to the Ravensworth East MIA, and flow conveyance at Hebden Road, will be provided by modifying the existing Industrial Dam to provide off line detention storage for flood events above the 10% AEP event.
- Implementation of Construction Management Plans detailing the specific inspection, maintenance and revegetation requirement prior to construction activities within each work area.
- Erosion and sediment controls will be monitored during construction and operation in accordance with the Blue Book (Landcom 2004 and DECC 2008).
- As part of the water balance monitoring for the Mount Owen water management system, water imported to site, water used on site and water discharged from site will be monitored in accordance with Water Reporting Requirements for Mines (NOW undated).
- Monitoring and remediation of erosion within watercourses outside of the active mining and emplacement areas will continue to be managed as set out in the Mount Owen Complex Landscape Management Plan.
- Mount Owen will install a new monitoring point on Main Creek (MC3). Monitoring at MC3 will commence upon Project Approval. In addition, Mount Owen will continue to monitor water quality during HRSTS discharge events as set out in the EPL.
- If required, controlled discharges to Swamp Creek will occur in accordance with the EPL 4460 and the HRSTS.
- Mount Owen will operate the Project in accordance with the *Hunter Regulated River Water Sharing Plan 2004* for extractions from Glennies Creek.
- Mount Owen will continue to provide a summary of the surface water monitoring results as part of the Annual Review.
- Mount Owen proposes to, within 3 years of Project Approval, review the Mount Owen Complex water balance and interactions with the GRWSS including options for storage and transfer of water.

Groundwater

- Mount Owen will continue to undertake groundwater monitoring in accordance with the Mount Owen Complex Groundwater Monitoring Program. The Mount Owen Complex Groundwater Monitoring Program and Surface Water and Groundwater Response Plan will be updated within 12 months of Project Approval to include the additional management requirements identified as part of the Project and any other monitoring locations identified during the Project.
- Mount Owen will continue to extract groundwater from hard rock aquifers that flow into the Mount Owen and Ravensworth East Mines under the existing Part 5 licenses under the *Water Act 1912*.
- The results of the monitoring will be subject to an annual review and reported in the Mount Owen Complex Annual Review. The groundwater model will be periodically updated and refined as additional data and monitoring results become available.

Ecology

Mount Owen will incorporate the relevant strategies from the existing Mount Owen Complex Flora and Fauna Management Plan in the revised and consolidated Landscape Management Plan within 12 months of Project Approval. These strategies will include:

- feral animal and weed control;
- rehabilitation of disturbed areas with species characteristic of extant vegetation communities;
- use of native species in revegetation, and the linkage and integration of rehabilitation areas with existing vegetated areas to improve ecological function and provide appropriate fauna habitat, except in areas identified for improved pasture;
- management of erosion and sedimentation to minimise impacts on adjoining vegetation communities and aquatic systems;
- adaptive management, as required, if a previously unrecorded or assessed threatened species is identified in the Proposed Disturbance Area during operations;
- ongoing monitoring and maintenance of revegetation works and habitat enhancement activities; and
- an adaptive approach to ongoing monitoring of native flora and fauna.

The following fauna re-instatement strategies will be implemented:

- the re-establishment of ground fauna habitat through the relocation of cleared vegetation and rocks in targeted rehabilitation areas, where practicable;
- installation of supplementary arboreal habitat, such as nest boxes, once rehabilitated vegetation communities are of sufficient maturity; and
- the retention or augmentation of dams in the post-mining landform to facilitate the re-colonisation of woodland fauna communities.

Mount Owen will incorporate the existing Tree Felling Procedure into the consolidated Landscape Management Plan, within 12 months of Project approval, to minimise the potential for impacts on native fauna species (including threatened species) as a result of the clearing of hollow-bearing trees.

Biodiversity Offset Strategy

Mount Owen will implement a comprehensive Biodiversity Offset Strategy for the Project which includes the long-term conservation of the following land-based offset areas:

- Cross Creek Biodiversity Offset Area approximately 367 hectares (located adjacent to the existing Mount Owen Biodiversity Offset Areas); and
- Esparanga Biodiversity Offset Area approximately 303 hectares (located in a priority conservation area within the Great Eastern Ranges in the Manobalai Region).

To assist with the persistence of the Spotted-tailed quoll, Mount Owen will implement the following habitat enhancement measures within the proposed Stringybark Creek Habitat Corridor:

- salvage of trees felled during construction works and emplacement within the Stringybark Creek Habitat Corridor as log piles; and
- salvage and placement of large rocks and boulders into piles as further potential denning habitat.

Mount Owen will implement the Stringybark Creek Habitat Corridor regeneration strategy (approximately 97.5 hectares) to provide a link from the existing high quality habitat associated with the Mount Owen Biodiversity Offset Areas and the Ravensworth State Forest with adjacent corridors and proposed conservation areas.

Mount Owen will implement mine rehabilitation which will provide native vegetation communities and fauna habitat augmentation.

Monitoring

As part of the preparation of the consolidated Landscape Management Plan, Mount Owen will review the existing monitoring program to include the proposed Biodiversity Offset Areas. The review of the monitoring program and the preparation of the Landscape Management Plan will be completed within 12 months of Project Approval.

Land Use and Agricultural Impacts

Mount Owen, through Colinta Holdings Pty Ltd (or other lease arrangements), will maintain the agricultural production on non-operational land it currently owns and manages, where consistent with environmental, safety and operational matters on that land.

The proposed closure plan, final landform and final landuse will include rehabilitation of land to ensure sustainable post mining land use options including some areas suitable for sustaining potential future agricultural activities such as grazing, as outlined in **Section 5.8.5**.

Aboriginal Cultural Heritage

Mount Owen will prepare and implement an Aboriginal Cultural Heritage Management Plan (ACHMP) for the Project within 12 months of Project Approval. Mount Owen will also seek to establish an Aboriginal Cultural Heritage Working Group within six months of project approval to include representatives of the Knowledge Holder groups, the RAPs and the Wanaruah LALC. The updated Plan will be prepared in consultation with the Working Group

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 **Section 5.9.7** and **Appendices 13a** and **13b**. Key commitments include:

- The revised ACHMP will include a staged approach to research and salvage works to ensure that areas required for construction are completed as a priority.

- Mount Owen will consult with the Working Group on matters raised in the ACHA, in order to better understand where there may be changes or improvements to existing cultural heritage management mechanisms and protocols for consideration in the revised Mount Owen ACHMP.

- Mount Owen will revise its onsite induction program to include material to raise awareness of Aboriginal cultural values of the Project Area and local area more generally. The induction material will positively message the Aboriginal Cultural Heritage Values of the area. The induction materials and content will be developed in consultation with the Working Group.

- Mount Owen will undertake salvage (excavation, analysis and collection) as per the recommendations of the Archaeological Values Assessment Report for the salvage of the 34 sites to be harmed within the Proposed Disturbance Area (refer to **Appendix 13b**).

- Mount Owen will revise the ACHMP to include the new sites identified in the Aboriginal Archaeological Values Assessment Report completed for the Project. Sites identified in the Mount Owen ACHA have been recorded on site cards and submitted to OEH.

- Mount Owen will develop care and control management measures and include 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.

- Mount Owen will construct a suitable fit for purpose artefact storage facility to store cultural heritage artefacts recovered during previous research and salvage programs, and for items recovered for the Project, within 2 years of approval for the Project.

- During construction there will be protective fencing of the sites outside the Project Disturbance Area that were identified by the Aboriginal Archaeological Values Assessment.

- Mount Owen will support funding of a memorial story board or other suitable marker, located in an appropriate location, to provide information on Aboriginal occupation of the area, and the conflicts that occurred in region in the early European settlement period. The wording of any plaque shall be developed through the Working Group.

- Mount Owen will consult with the RAPs and other stakeholders including Singleton Council in the naming of infrastructure works on Hebden Road and Bowmans Creek.

- Mount Owen will provide funding toward the development of an educational DVD or reference material to record the cultural knowledge as identified in the ACHA including the cultural context and relationship to significant Creation story sites, song lines, and other significant sites in the local area.

- During the life of the Project, Mount Owen will offer assistance towards three trainee scholarships (up to three years in duration) to be undertaken in culture related training areas. The training and education opportunity will include opportunities which may arise from vocational based learning including graduate and postgraduate studies.

Historic Heritage

Mount Owen will manage potential impacts to the Historic Heritage as described in **Sections 5.10.4** and **5.10.5**. The key management measures are outlined below.

Former Ravensworth Public School

- Prior to the commencement of works for the construction of the Hebden Road upgrade works and if any physical or sub-surface impacts are proposed in the area to the north of Hebden Road, the area will be surface surveyed to identify, or confirm the absence of, the potential for items or remains that may be associated with the listed former Ravensworth Public School.

- If any potential items or remains are identified, management measures will be developed by Mount Owen in consultation with the Heritage Division, OEH to ensure the items or remains are protected or, if appropriate, mitigated.

Ravensworth Village

- Prior to the commencement of works for the construction for the proposed Hebden Road upgrade works, on-site archaeological investigation of the associated portion of the Proposed Disturbance Area will be undertaken, in the manner described in **Section 5.10.4**.

Greenhouse Gas and Energy

Mount Owen will continue to implement the existing energy management controls. This will include the incorporation of the reasonable and feasible management controls identified in **Section 5.11.6** and **Appendix 15**.

At an operational level, Mount Owen will continue to develop and implement mitigation and management measures to improve energy efficiency and reduce greenhouse gas emissions including:

- limiting the length of material haulage routes (where feasible), minimising transport distances and associated fuel consumption;

- consideration of energy efficiency in the selection of equipment and vehicles; and

- scheduling activities so that equipment and vehicle operation is optimised.

Traffic and Transport

Mount Owen will prepare and implement Construction Traffic Management Plans (TMPs) in consultation with Singleton Council to proactively manage construction traffic movements on the local road network including Glennies Creek Road, Forest Road and Hebden Road during the construction phase of the Project, refer to **Section 5.12.4**.

Visual Amenity

Mount Owen will undertake the following measures to reduce the potential impact on visual amenity (refer to **Section 5.13.5**):

- progressive rehabilitation will be undertaken to reduce the duration of visible soil exposure;
- ongoing management of mobile lighting to reduce the impacts of lighting at night, where practical, positioning lights so they are shielded by walls, overburden emplacement areas and vegetation and the ongoing implementation of procedures for the appropriate placement of mobile lighting plant; and
- all 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*.

Waste Management

- No waste will be disposed of onsite except for inert wastes permissible under applicable legislation and waste tyres buried deep in pit. 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.

Hazards and Bushfire

<u>Hazards</u>

- The handling and storage of hazardous substances will continue to be managed in accordance with the existing hazard management system.
- Should any new hazardous substances or dangerous goods be introduced, they will be identified and managed in accordance with the existing hazard management system.

<u>Bushfire</u>

- The Asset Protection Zone distances specified in the existing Bushfire Management Plan will continue to be applied to all relevant existing infrastructure and proposed infrastructure as part of the Project.
- Bushfire threat will continue to be managed in accordance with the bushfire management controls included in the Bushfire Management Plan, and the Bushfire Management Plan will be reviewed and updated within 12 months of Project approval and as required, in consultation with the RFS.

Social

- The existing Mount Owen Social Involvement Plan will be revised within 12 months of Project approval to incorporate the Project mitigation strategies identified in **Section 5.17.5**. This will include a framework to monitor the effectiveness of the proposed mitigation strategies in mitigating negative social impacts and / or enhancing positive social impacts over time.

Closure and Rehabilitation

- The existing Landscape Management Plan for Mount Owen will be revised to reflect the Project and be submitted to the DP&E within 12 months of approval being granted.
- The revised Landscape Management Plan will include a Rehabilitation and Offset Management Plan for the Project developed in consultation with DRE, DP&E, OEH and Singleton Council which will include:
  - 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;
  - a Conceptual Closure Plan;
  - completion criteria, determined in consultation with relevant agencies, that will be utilised to demonstrate achievement of rehabilitation objectives. The achievement of the completion criteria will be monitored and reported within the Annual Review; and
  - monitoring of rehabilitated areas on at least an annual basis over the life of the Project. The monitoring findings and resulting actions will be reported in the Annual Review.

Mount Owen will commence development of a detailed Mine Closure Plan at least five years prior to the anticipated mine closure date (i.e. cessation of mining).

7.0 Conclusion and Justification for the Project

This section provides a conclusion discussing the justification for the Project, taking into consideration the environmental 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 **Sections 2.3** and **2.5**.

7.1 Environmental Impacts

As detailed in **Section 5.0**, the environmental impacts of the Project have been identified and are the subject of a detailed environmental assessment based on:

- assessment of the site characteristics (existing environment);
- focused consultation with all relevant government agencies;
- extensive engagement with local community and other stakeholders;
- application of the principles of ecologically sustainable development, including the precautionary principle, inter-generational equity and conservation of biological diversity and ecological integrity; and
- expert technical assessment.

The key issues identified, including those specified in the DGRs, were the subject of the comprehensive specialist assessments of the potential impacts of the Project on the existing environment, as detailed in **Section 5.0** and the appendices to this EIS.

The impacts of the Project have been kept to a minimum through:

- obtaining a detailed understanding of the issues and impacts by extensive scientific evaluation and stakeholder engagement;
- a comprehensive 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. Importantly, the mine has been designed around the mitigation of potential amenity impacts, particularly noise, air quality and visual impacts as these are recognised as key stakeholder concerns; and
- commitment to proactive and appropriate strategies to avoid, minimise, mitigate, offset or manage a range of potential environmental impacts (refer to **Sections 5.0** and **6.0**).

7.2 Suitability of the Site

The Project is located in an area historically characterised by coal mining and includes a number of existing mining operations, both within the Mount Owen Complex and the broader Ravensworth Area. Mount Owen and Ravensworth East mines are well established mining operations in the Upper Hunter Valley, which is the largest coal-producing region in NSW.

The Mount Owen mine has been operating since 1993 during which time has provided substantial economic benefits to the local, State and national economies. Moreover, Ravensworth East Mine was originally operated as Swamp Creek mine dating back to the 1960's which provided a substantial amount of coal to the domestic markets and more recently the export markets. The approved operations at both Mount Owen and Ravensworth East mines will continue to provide substantial economic benefits until the existing approved resource is extracted (approximately 2018 and 2021 respectively).

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. Land uses within the vicinity of the Project Area are described in **Section 5.1** and include extensive mining operations and associated buffer land in addition to other industries (quarrying and power) and rural residential land holdings. 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. Additionally, there is no BSAL within the Project Area and no CICs within 10 kilometres of the Project Area.

Mount Owen has actively and comprehensively engaged with stakeholders including the local community, to seek to understand the key concerns and issues associated with the Project and to assist Mount Owen with managing these issues through appropriate location and design.

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 5.7** and **5.19**, the approach to rehabilitation and the extensive revegetation and conservation program is consistent with the strategic land use objectives for the area. Additionally, the conceptual final land use has been prepared considering strategic long term land use planning options within the greater Ravensworth area and seeks integration with other Glencore operations. This includes the use of the GRWSS to share water across Glencore operations and reducing the need to obtain licensed water entitlements. The final land use plan also integrates rehabilitation at the surrounding Glencore mines which builds on the previous rehabilitation and offsetting commitments.

As discussed in **Section 5.8**, the existing land classes within the Proposed Disturbance Area are predominately of 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.

7.3 Ecologically Sustainable Development

An objective of the EP&A Act is to encourage Ecologically Sustainable Development (ESD) within NSW. As outlined in **Section 3.0**, the Project requires approval from the Minister for Planning and Environment under 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; and
- 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.

7.3.1 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, this EIS has undertaken 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 5.0**), 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 extensively consulted during EIS preparation (refer to **Section 4.0**). This enabled comment and discussion regarding potential environmental impacts and proposed environmental management procedures.
2. The community has been comprehensively engaged throughout the development and assessment of the Project through a range of mechanisms including face to face meetings, presentations, open days and community newsletters to inform Project design and management of key issues (refer to **Section 4.0**) which provided stakeholders with both information and the opportunity to influence Project outcomes.
3. Mount Owen has designed and implemented a comprehensive suite of environmental management plans and related environmental management programs, that seek to implement best practice management. The Project will incorporate the practices implemented and demonstrated to be effective and the existing management plans will be revised to incorporate the additional controls outlined in this 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 monitoring program has also been proposed to measure predicted against actual impacts of the Project (refer to **Section 6.0**), 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 ongoing management strategy for Mount Owen 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 Mount Owen and Ravensworth East mines by independent auditors.

7.3.2 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:

- the continued operation of the Mount Owen and Ravensworth East Mines with a focus on:
  - maximising resource recovery from within the existing Glencore mining tenements;
  - optimising the use of existing infrastructure;
- maintaining the economic life of the Mount Owen and the Ravensworth East Mines and providing ongoing employment for the existing workforce;
- further development of the existing environmental mitigation and management strategies, expanding the existing commitments to mitigate and manage the predicted impacts associated with the Project;
- maximising the use of previously disturbed areas and existing mining infrastructure, thereby minimising the overall Proposed Disturbance Area as far as practicable;
- avoidance of any existing biodiversity offset areas and the Ravensworth State Forest;
- continuing to actively engage and consult with the surrounding community; and
- establishing a final landform that is safe and stable and provides sustainable post mining land use options.

Further to the Project objectives, a range of environmental management measures discussed in **Sections 5.0** and **6.0** 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.

7.3.3 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 5.7** and **Appendix 11**). Potential impacts are also outlined in the EIS (refer to **Section 5.7**) and measures to ameliorate any negative impact are outlined in **Section 6.0**.

A key objective of the Project is to utilise the existing approved disturbance areas within the Mount Owen Complex and accordingly reduce the magnitude of additional disturbance areas. Additionally, Mount Owen has designed the Project such that impact to the extant areas of Ravensworth State Forest and the existing biodiversity offset areas will be avoided.

Notwithstanding design measures to reduce the extent of impacts to significant ecological features of the Project Area, the Project results in significant and potentially significant ecological impacts. Mount Owen has committed to a package of extensive measures that aim to further mitigate the identified ecological impacts, including a comprehensive Biodiversity Offset Strategy for the Project.

The Biodiversity Offset Strategy consists of a number of key components designed to address the impacts on EECs and threatened species identified in the Project Area. The key components of the Biodiversity Offset Strategy include:

- establishment, protection and enhancement of the Cross Creek and Esparanga Biodiversity Offset Sites which will provide for the long term conservation of a range of significant ecological features including:
  - allowing for the conservation of large areas of existing native woodland and grassland vegetation (approximately 670 hectares) including a range of EECs and regionally significant vegetation;
  - enable direct offsetting of the impact of the Project on a number of threatened fauna species;
- establishment, protection and enhancement of the Stringybark Creek Habitat Corridor (97.5 hectares) to facilitate movement of the spotted-tailed quoll;
- development and implementation of a biodiversity enhancement strategy for the proposed offset areas that aims to enhance the ecological value of these areas through enhancement of existing vegetation, habitat for threatened species, and the improvement of the biodiversity of the region;
- development of a comprehensive rehabilitation strategy for the Proposed Disturbance Area and existing disturbed areas within the Project Area, to maximise the ecological value of rehabilitated areas (approximately 518 hectares of additional native woodland); and
- the development of an appropriate ecological monitoring program to assess the success of the Biodiversity Offset and Rehabilitation Strategy in counterbalancing the impacts of the Project on ecological values (refer to **Section 5.7**).

Mount Owen has also made a substantial commitment to the effective rehabilitation of the Project area as part of the mining process, with approximately 518 hectares of native woodland and forest vegetation in addition to rehabilitation commitments resulting from previous approvals to be established. The total area of post mining rehabilitation for the Project will be approximately 1,900 hectares. In the long term, in combination with existing biodiversity offsets, this will result in approximately 2,418 hectares of additional woodland and forest, once the

currently proposed mining is completed, compared to when mining first commenced at Mount Owen Mine in 1993, (refer to **Section 5.7.6**).

7.3.4 Valuation and Pricing of 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,
> (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 5.5**). 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 coal processing and transportation facilities to wash coal and to transport product coal to existing markets; and
- 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.

7.4 Conclusion

As outlined in **Section 7.3**, the Project has been assessed against the principles of ESD as required by the EP&A Act. This assessment has indicated that the Project is consistent with the principles of ecologically sustainable development.

The Cost Benefit Analysis and Economic Impact Analysis (refer to **Appendix 17**) 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 the existing workforce of approximately 660 full time equivalent positions and the Mount Owen Mine and up to 260 at the Ravensworth East Mine;

- creation of approximately 330 additional construction jobs (peak) over the anticipated 18 month construction phase;
- the total employment attributable to Project related construction activities including both direct and indirect employment is predicted to be 1,200 full time equivalent positions;
- an estimated benefit to the Singleton community of approximately $306 million; and
- a total increase in the undiscounted royalty revenue stream flowing to the NSW government estimated to be $461 million over the life of the Project ($258 million in NPV terms).

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 under$1.3 billion in NPV terms. NSW's Gross State Product (including the Hunter) increases by around $1.9 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 $758 million in NPV terms over the life of the Project (refer to **Section 5.18**). 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.

On this basis, it would be reasonable to consider that with the implementation of the management, mitigation and offset measures proposed by Mount Owen, the Project will result in a substantial net benefit to the NSW community.

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9.0 Abbreviations and Glossary

9.1 Abbreviations

A	Exploration Authorisation
ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
ACARP	Australian Coal Association Research Program
ACHA	Aboriginal Cultural Heritage Assessment
ACHM	Australian Cultural Heritage Management Pty Limited
ACHMP	Aboriginal Cultural Heritage Management Plan
ADT	Annual Daily Traffic
AEMR	Annual Environmental Management Report
AEP	Annual Exceedance Probability
AGO	Australian Greenhouse Office
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
AIS	Agriculture Impact Statement
AIP	NSW Aquifer Interference Policy
ARI	Average Recurrence Interval
APZ	Asset Protection Zone
AQGG	Air Quality and Greenhouse Gas
AR	Annual Review
ARTC	Australian Rail Track Corporation
ARS	Advisory Reporting Standards
ASC	Australian Soil Classification
BNP	Bayswater North Pit
BoM	Bureau of Meteorology
BSAL	Biophysical Strategic Agricultural Land

CBA	Cost Benefit Analysis
CCC	Community Consultative Committee
CEC	Cation Exchange Capacity
CGE	Computable General Equilibrium
CIC	Critical Industry Clusters
CHPP	Coal Handling and Preparation Plant
CL	Coal Lease
CMHS ACT	Coal Mine Health and Safety Act 2002
Crown Lands Act	Crown Lands Act 1989
CPSS	Certified Professional Soil Scientist
CSI	Community Sensitivity Index
CSER	Centre for Sustainable Ecosystem Restoration
CTMP	Construction Traffic Management Plan
DA	Development Application
Dams Safety Act	Dams Safety Act 1978
dB(A)	A-weighted Decibels
dB(C)	C-weighted Decibels
DEC	Former Department of Environment and Conservation (now OEH)
DECC	Former Department of Environment and Climate Change (now OEH)
DECCW	former Department of Climate Change and Water (now OEH)
DGRs	Director-General's Requirements
DNG	Derived Native Grasslands
DoE	Commonwealth Department of Environment
DIPNR	Former Department of Infrastructure, Planning and Natural Resources (now DP&E)
DP	Deposited Plan
DPI	Department of Primary Industries
DP&I	Former Department of Planning and Infrastructure (now DP&E)

DP&E	Department of Planning and Environment
DRE	Department of Resources and Energy
DSC	Dams Safety Committee
DST	Daylight Savings Time
DSEWPC	Former Department of Sustainability, Environment, Water, Population and Communities (now Department of Environment)
DTIRIS	Department of Trade and Investment, Regional Infrastructure and Services
EC	Electrical Conductivity
EDST	Eastern Daylight Savings Time
EEC	Endangered Ecological Community
EHC Act	*Environmentally Hazardous Chemicals Act 1985*
EIS	Environmental Impact Statement
EPA	Environmental 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	*Environmental Protection and Biodiversity Conservation Act 1999* (Commonwealth)
	Environment Protection Licence
EMP	Endangered Populations
	Environmental Management Plan
EMS	Environmental Management System
ENM	Environmental Noise Model
EPs	Endangered Populations
EPL	Environment Protection Licence
ERP	Eastern Rail Pit
ESAP Program	Energy Savings Action Plan Program

ESC	Enviro Strata Consulting
ESCP	Erosion and Sediment Control Plan
ESD	Ecologically Sustainable Development
ESP	Exchangeable Sodium Percentage
EST	Eastern Standard Time
Explosives Act	Explosives Act 2003
FDI	Fire Danger Index
FM Act	Fisheries Management Act 1994
FoS	Factor of Safety
FSL	Full Supply Level
FTE	Full-time equivalents
GDE	Groundwater-Dependent Ecosystems
GHG	Greenhouse gas
GHGEA	Greenhouse Gas and Energy Assessment
GIS	Geographical Information System
GJ	Gigajoules
GL	Gigalitre
GRP	Gross Regional Product
GRWSS	Greater Ravensworth Water Sharing Scheme
GSP	Gross State Product
Ha	Hectares
HMA	Habitat Management Area
HRSTS	Hunter River Salinity Trading Scheme
HVAS	High Volume Air Sampler

HVCC	Hunter Valley Coal Chain Pty Limited
HVO	Hunter Valley Operations
HVRF	Hunter Valley Research Foundation
ICNG	Interim Construction Noise Guideline
IEA	International Energy Agency
INP	Industrial Noise Policy
IPCC	Intergovernmental Panel on Climate Change
kg	Kilogram
kg/y	Kilogram per year
kL	Kilolitre
kV	Kilovolt (1000 volts)
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan
LGA	Local Government Area
LHPA	Livestock Health and Pest Authority
LLS	Local Land Services
LMP	Landscape Management Plan
LMZ	Land Management Zone
LOM	Life of Mine
LOS	Level of Service
LSC	Land and Soil Capability
m	metres
m/s	metres per second
MGA	Map Grid of Australia

MIA	Mine Infrastructure Area
Mining Act	Mining Act 1992
MIC	Maximum Instantaneous Charge
MJ	Megajoules
ML	Mining Lease
µm	micrometres
µg/m3	micrometers per cubic metre
mm/sec	millimetres per second
MNES	Matters of National Environmental Significance
MOCO	Mount Owen Continued Operations
MOP	Mining Operations Plan
Mount Owen	Mount Owen Pty Limited
MSB	Mine Subsidence Board
MSC Act	Mine Subsidence Compensation Act 1961
MSV	Mine Service Vehicle
Mt	million tonnes
Mtpa	million tonnes per annum
NAF	Non-acid Forming
NEFA	North East Forest Alliance
NEPM	National Environment Protection Measures for Ambient Air Quality
NGA	National Greenhouse Accounts
NGERS	National Greenhouse and Energy Reporting Scheme
NH&MRC	National Health and Medical Research Council
NIA	Noise Impact Assessment
NMP	Noise Management Plan
NO	Nitric Oxide

NOW	NSW Office of Water
NOx	Nitrogen Oxide
NO2	Nitrogen Dioxide
NPV	Net Present Value
NPZ	Nested Peizometer
NSW	New South Wales
NVS1	North Void Stage 1
NVS2	North Void Stage 2
OC	Open Cut
OEH	Office of Environment and Heritage
OH&S Act	*Occupational Health and Safety Act 2000*
PAC	Planning Assessment Commission
PCWP	Plains Clans of the Wonnarua People
PHA	Preliminary Hazard Analysis
PM	Particulate Matter
PM_{10}	particulate matter less than 10 micro metres in diameter
$PM_{2.5}$	Particulate matter less than 2.5 micro metres in diameter
PoEO Act	*Protection of the Environment Operations Act 1997*
PSNL	Project Specific Noise Levels
PVP	Peak Particle Velocity
PRP	Pollution Reduction Program
RAPs	Registered Aboriginal Parties
RBL	Rated Background Level
RCT	Ravensworth Coal Terminal
RERR	Ravensworth East Resource Recovery
REMP	Rehabilitation and Environmental Management Plan
RFS	Rural Fire Service
RL	Relative level

RMS	Roads and Maritime Services
RNE	Register of National Estate
RNP	Road Noise Policy
Roads Act	Roads Act 1993
ROM	Run-of-mine
RSF	Ravensworth State Forest
RTA	Road and Traffic AuthorityRavensworth Underground Mine
RUM	
RW	Raw Water
SCMP	Spontaneous Combustion Management Plan
SDP	Sustainable Development Policy
SEOC	South East Open Cut
SEPP	State Environmental Planning Policy
SES	State Emergency Service
SFAZ	Strategic Fire Advantage Zone
SHR	State Heritage Register
SIOA	Social Impact & Opportunities Assessment
SRD	State Significant Development
SRLUP	Strategic Regional Land Use Plan
SWL	Sound Power Levels
T	Tonne
TAUP	Transport and Urban Planning Pty Limited
tCO_2-e	tonnes of CO_2 equivalent

TDS	Total Dissolved Solids
TECs	Threatened Ecological Communities
TEOM	Tapered Element Oscillating Microbalance Instrument
t/m3	Metric ton per cubic metre
TMP	Traffic Management Plan
TP1	Tailings Pit 1
TP2	Tailings Pit 2
TRC	Town Resources Cluster
TSC Act	*Threatened Species Conservation Act 1997*
TSP	total suspended particulate matter, usually in the size range of zero to 50 micrometres
TSR	Travelling Stock Reserve
TSS	Total Suspended Solids
UG	Underground
VCA	Voluntary Conservation Area
VKT	Vehicle Kilometres Travelled
Water Act	*Water Act 1912*
WBCSD	World Business Council for Sustainable Development
WM Act	*Water Management Act 2000*
WMP	Water Management Plan
WMS	Water Management System
WNAC	Wonnarua Nation Aboriginal Corporation
WOOP	Western out of Pit Overburden Emplacement Area
WRI	World Resources Institute
WSP	Water Sharing Plan
WTC	Wonnarua Traditional Custodians
Xstrata	Xstrata Coal Pty Limited (now Glencore Coal Pty Limited)
^{o}C	Degrees Celsius
^{o}C/100 m	Degrees Celsius per one hundred metres

µg	micrograms
µm	micrometres
%	per cent

9.2 Glossary

Acid Rock Drainage: Drainage of acidic water from rock material.

Alluvium: Sediment deposited by a flowing stream, e.g., clay, silt, sand, etc.

Amenities: Lunch room, showers, toilets.

Amenity: An agreeable feature, facility or service which makes for a comfortable and pleasant life.

Aquifer: A water-bearing rock 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.
L_{A1} Noise Level:	The noise level exceeded for one per cent of the time. It is used in assessment of sleep disturbance.
L_{A90} 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 L_{90} level is often referred to as the 'background' noise level and is commonly used to determine noise criteria for assessment purposes.
L_{Aeq} Noise Level:	The equivalent continuous noise level, measured in dB(A), during a measurement period.
L_{AMax} 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 assessing groundwater characteristics.

Protection of the Environment Operations Act 1997: NSW legislation administered by OEH 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 ($\mu g/m^3$) for air.

Woodland: Land covered by trees that do not form a closed canopy.

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