APPENDIX 18

Mine Closure and Rehabilitation Strategy

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MINE CLOSURE AND REHABILITATION STRATEGY

Mount Owen Continued Operations Project

FINAL

October 2014

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FINAL

October 2014

Prepared by
Umwelt (Australia) Pty Limited

on behalf of
Mount Owen Pty Limited

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Executive Summary

The purpose of this document is to outline the proposed mine closure and rehabilitation strategy for the Mount Owen Continued Operations Project (the Project), which has been developed in consideration of a number of factors including site opportunities and constraints, ecological and rural land use values and existing strategic land use objectives, including the integration of rehabilitation with the strategies developed for surrounding Glencore operations.

The indicative post mining land use for the Project Area will primarily involve the establishment of woodland areas, specifically a vegetation community consistent with the Central Hunter Ironbark – Spotted Gum – Grey Box Forest. The objective is to create a native vegetation corridor network that promotes regional fauna movements between the Mount Owen Complex, Ravensworth Operations, Liddell Coal Operations and associated offset areas, Lake Liddell and the Ravensworth Operations Hillcrest Offset Area.

A proportion of the site, including the tops of overburden dump areas and flatter portions of the final landform will be revegetated with open grassland that incorporates pockets of native vegetation. Subject to the outcomes of final land use analysis to be completed as part of detailed closure planning process, it is the intent that these areas could be used for sustainable agricultural purposes such as grazing. As such, revegetation may involve the use of suitable pasture species for the establishment of grasslands in these areas. It is proposed that the ecological value of successful post-mining rehabilitation areas will contribute to the overall biodiversity offset strategy for the Project.

In addition, the rehabilitation objective will also be 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 maculatus*). This will include the restoration of spotted-tailed quoll habitat comprising of vegetation communities consistent with the Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC as well as Central Hunter Swamp Oak Forest along Stringybark Creek.

The Stringybark Creek Habitat Corridor will be designed with the objective of providing an effective east to west (and vice versa) linkage from the Mount Owen Complex offset and rehabilitation areas situated to the north of the Project Area through to the rehabilitated former tailings dams, Bowmans Creek (known spotted-tailed quoll den site) and Liddell Coal Operations rehabilitation areas to the north-west. This is a key component of the Biodiversity Offset Strategy for the Project and will include a mixture of tree plantings and habitat structures such as log piles constructed adjacent to the creekline on non-mine disturbed land.

As part of the continuation of coal mining operations, the details regarding mine closure and rehabilitation will be documented within the Mining Operations Plans and Closure Plan for the Project.

TABLE OF CONTENTS

FIGURES

APPENDIX

1.0 Introduction

1.1 Background

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 **Figure 1.1**).

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 Ravensworth East 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.

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 current processing capacity of 17 Mtpa of ROM coal. Processed coal, both semi soft and thermal, are transported via the Main Northern Rail Line to the Port of Newcastle for export, or by conveyor 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 West Pit by 2018 and late 2014 respectively; and Glendell by 2022. 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 an area located in the northern portion of the existing approved Ravensworth East Mine, referred to as 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 area, sequentially followed by the RERR Mining Area.

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 area would 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.

FIGURE 1.1

Locality Plan

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.

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.

An Environmental Impact Statement (EIS) has been prepared for the Project to accompany a Project Application following Department of Planning and Environment (DP&E) issuing Director-General's Requirements (DGRs) for the Project in March 2013. The following Mine Closure and Rehabilitation Strategy was prepared to meet the Director-General's EIS requirements in relation to mine closure and rehabilitation issues for the Project.

The specific DGRs relating to mine closure and rehabilitation that have been addressed within this document are outlined in **Table 1.1**.

Table 1.1 – Mine Closure and Rehabilitation DGR Requirements

Requirement	Section Addressed
General Requirements In addition, the EIS must include a: • detailed description of the development, including: ▪ likely staging of the development – including construction, operational stage/s and rehabilitation; ▪ consideration of opportunities for integration between the development and Xstrata's (now Glencore's) existing, approved and proposed mining operations in the region;	Refer to **Section 1.2** for a summary and Section 2.0 of the Mount Owen Continued Operations EIS (Umwelt 2014a) for a detailed description
Key Issues 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;	**Section 2.6**
• Methodology;	**Sections 4.1** to **4.7**
• Monitoring programs;	**Section 5.0**
• Performance standards and proposed completion criteria;	**Section 2.7**
• Nominated final land uses and landforms (including cross sections), having regard to any relevant strategic land use planning or resource management plans or policies; and	**Section 2.5, Figures 2.1, 4.1** and **4.2**
• The potential for integrating this strategy with any other rehabilitation and/or offset strategies in the region, including the Upper Hunter Strategic Assessment.	**Section 2.2**

1.2 The Project

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.

A key Project design consideration has been to maximise the efficient use of the existing infrastructure and areas previously approved for disturbance and as a result, minimise the overall surface disturbance area required for the Project as far as practicable.

The key features of the Project are outlined in **Table 1.2**. For a detailed description of the existing approved operations and the Project refer to Section 2 of the Environmental Impact Statement.

Table 1.2 – 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.

1.3 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 spoil 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.

Previous and current mine rehabilitation practices on mine spoil has involved direct seeding with canopy species between 1998 and most recently in 2014, with the oldest rehabilitation being 15 years old. Forest topsoil and woody mulch from areas cleared by mining has been used on a large portion of the rehabilitation, and this has provided a valuable seed source for the rehabilitation. In the absence of forest topsoil, pasture topsoil has been used as a replacement and planted with tube stock.

In addition to the above, a range of fauna impact mitigation and management measures have been implemented. These measures have included the installation of nest boxes to compensate for the loss of hollow-bearing trees as a result of approved mining operations; and the construction of green and golden bell frog habitat in two frog conservation zones within Biodiversity Offset Areas and also within mine rehabilitation.

The rehabilitation strategy at the Mount Owen Complex has benefited from extensive research undertaken in partnership with the Centre for Sustainable Ecosystem Restoration (CSER) at the University of Newcastle. An initial goal of the Mount Owen Mine research program was to re-establish sustainable nutrient acquisition and cycling using natural root-microbe associations. This soon expanded to include research into the use of available bulk materials and amelioration techniques for mine rehabilitation when forest topsoil would eventually run out. Since commencement research has continued to develop as part of the Ravensworth State Forest Complex with over 40 experiments and investigations established to date. This has involved the completion of 12 Honours Degrees and four PhDs. Mount Owen is now listed as a 'Highly Commended' site on the Global Restoration Network of the Society for Ecosystem Restoration, International. Mount Owen has also participated in several Australian Coal Association Research Program (ACARP) projects on mine site rehabilitation. In collaboration with the University of Newcastle, Mount Owen has embarked on the Ravensworth State Forest Vegetation Complex Research Program that will lead to the most effective methods to establish dry sclerophyll and other native forest communities on rehabilitated overburden emplacement areas.

A recent assessment of ecological outcomes of mine rehabilitation, regeneration and revegetation at the North Pit (Umwelt 2014b) has indicated that rehabilitation areas sampled are trending very strongly towards the *Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions* EEC. In addition, other key findings included:

- natural recruitment of canopy species is present across the rehabilitation areas;
- rehabilitation communities provide known habitat for a range of threatened fauna species including small terrestrial mammals, birds and micro-bats;

- A wide range of common fauna species have been recorded utilising mine rehabilitation areas within the Mount Owen Complex including the common brushtail possum (*Trichosurus vulpecula*), Australian magpie (*Cracticus tibicen*), eastern rosella (*Platycercus eximius*), welcome swallow (*Hirundo neoxena*), superb fairy wren (*Malurus cyaneus*), olive-backed oriole (*Oriolus sagittatus*), brown-headed honeyeater (*Melithreptus brevirostris*), yellow-faced honeyeater (*Lichenostomus chrysops*) and yellow-rumped thornbill (*Acanthiza chrysorrhoa*). Additionally, a range of threatened species listed under the *Threatened Species Conservation Act 1995* and/or *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) are also known to utilise this habitat including spotted-tailed quoll (*Dasyurus maculatus*), New Holland mouse (*Pseudomys novaehollandiae*), eastern bentwing-bat (*Miniopterus schreibersii oceanensis*) east coast freetail-bat (*Mormopterus norfolkensis*), speckled warbler (*Chthonicola sagittata*) and grey-crowned babbler (*Pomatostomus temporalis temporalis*).

- Areas of derived native grassland in biodiversity offset areas that have been revegetated with canopy species provide high quality fauna habitat (including several threatened fauna species); and

- rehabilitation communities provide appropriate levels of species diversity for the age of vegetation and the majority of target species and groups of fauna species are repeatedly achieving benchmark species diversity values.

However, the assessment report (Umwelt 2014b) also outlines that ongoing management of these sites will be required to continue to improve their condition and function and to ensure long term self-sustainability.

As such the mine closure and rehabilitation strategy as presented in this document has been designed to build off the success of these existing techniques and based on the learning's derived from previous monitoring and research, be adaptive to include new measures aimed at continual improvement.

2.0 Context for Mine Closure and Rehabilitation

2.1 Glencore Coal Mine Closure Planning Process

Glencore has implemented a proactive approach to rehabilitation and mine closure by developing a range of standards that are to be implemented across its business units which includes 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 achieves 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 of rehabilitation and successful mining lease relinquishment. The level of detail required in a closure plan increases as the operation proceeds towards the planned closure date. Specifically, the standard requires that when a mine is within five years of the planned closure date that a detailed closure planning process is to be 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 the execution of the Final Closure Plan. The latter plan will be developed and submitted to the relevant regulatory authorities at a minimum of 2 years prior to the cessation of mining operations.

As part of the ongoing operations of the Mount Owen Complex, the existing Conceptual Closure Plan will be revised as part of the implementation of the Project. As such, this plan will be updated in consideration of the commitments outlined within the EIS (Umwelt 2014a) and will include details regarding final land use objectives and closure criteria, rehabilitation and final void management strategies as detailed in this report.

2.2 Alignment with Strategic Land Use Objectives

The strategic land use objectives for the area, which have been considered as part of the concept closure planning process for the Project, include those within the Singleton Local Environment Plan (LEP) 2013, NSW Trade and Investment - Division of Resources and Energy's (DRE) Synoptic Plan and the recently developed Strategic Regional Land Use Plan for the Upper Hunter (Upper Hunter SRLUP) (Department of Planning and Infrastructure (DP&I) 2012). As required by the DGR's, this document has also been developed to fulfil the key principles of the Strategic Framework for Mine Closure. Discussion of the alignment of the mine closure and rehabilitation strategy for the Project with these strategies is outlined below.

2.2.1 Singleton Local Environmental Plans

The rehabilitation and closure strategy has been developed in consideration of the objectives of the Singleton LEP. Amendments that may occur to the LEP will be evaluated as part of ongoing revisions to the Project's mine closure plan. The Project Area is situated within an area classified as RU1 Primary Production. The objectives of 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; and
- to minimise conflict between land uses within this zone and land uses within adjoining zones.

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. This fauna corridor will be suitable for a range of threatened fauna species including but not limited to the spotted-tailed quoll (*Dasyurus maculatus*).

The establishment of native vegetation corridor areas does not preclude the ability to re-establish land for sustainable agricultural purposes. As shown in **Figure 2.1**, this includes the establishment of areas in the flatter portion of mine rehabilitation areas for potential future sustainable agricultural purposes such as grazing. However, the ultimate extent and location of these areas will be subject to further detailed closure planning prior to the cessation of mining. Some of the key considerations for the development of these areas will be the suitability of soil, proximity to roads, avoidance of steep areas and access to water resources for stock.

2.2.2 DRE Synoptic Plan

The DRE Synoptic Plan: Integrated landscapes for coal mining rehabilitation in the Hunter Valley of NSW (1999) (the Synoptic Plan) aims to provide a basis for the development of a long term integrated strategy for the rehabilitation of mines sites. The rehabilitation strategy for the Project has been developed to meet the intent of the Synoptic Plan and considers the potential regional outcomes for visual amenity, biodiversity and sustainable post closure use. The final 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.

2.2.3 Upper Hunter Strategic Regional Land Use Plan (DP&I 2012) and Upper Hunter Strategic Assessment

The Upper Hunter SRLUP has been developed to provide a strategic framework for delivering the necessary context for government investment priorities, servicing strategies and local environmental plan making for the Upper Hunter Valley. The stated objective of the Upper Hunter SRLUP is to balance the strong economic growth in Regional NSW with the protection of valuable agricultural land and the sustainable management of natural resources. In particular, the Upper Hunter SRLUP identifies the importance of minimising the land use conflicts arising from the rapid growth of coal mining activities and the recent emergence of the coal seam gas industry.

Amongst the various land use types, the Strategy outlines the importance of the protection of biodiversity through strategic land use planning. It recognises that post mining rehabilitation has the potential to contribute to biodiversity conservation in the longer term 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.

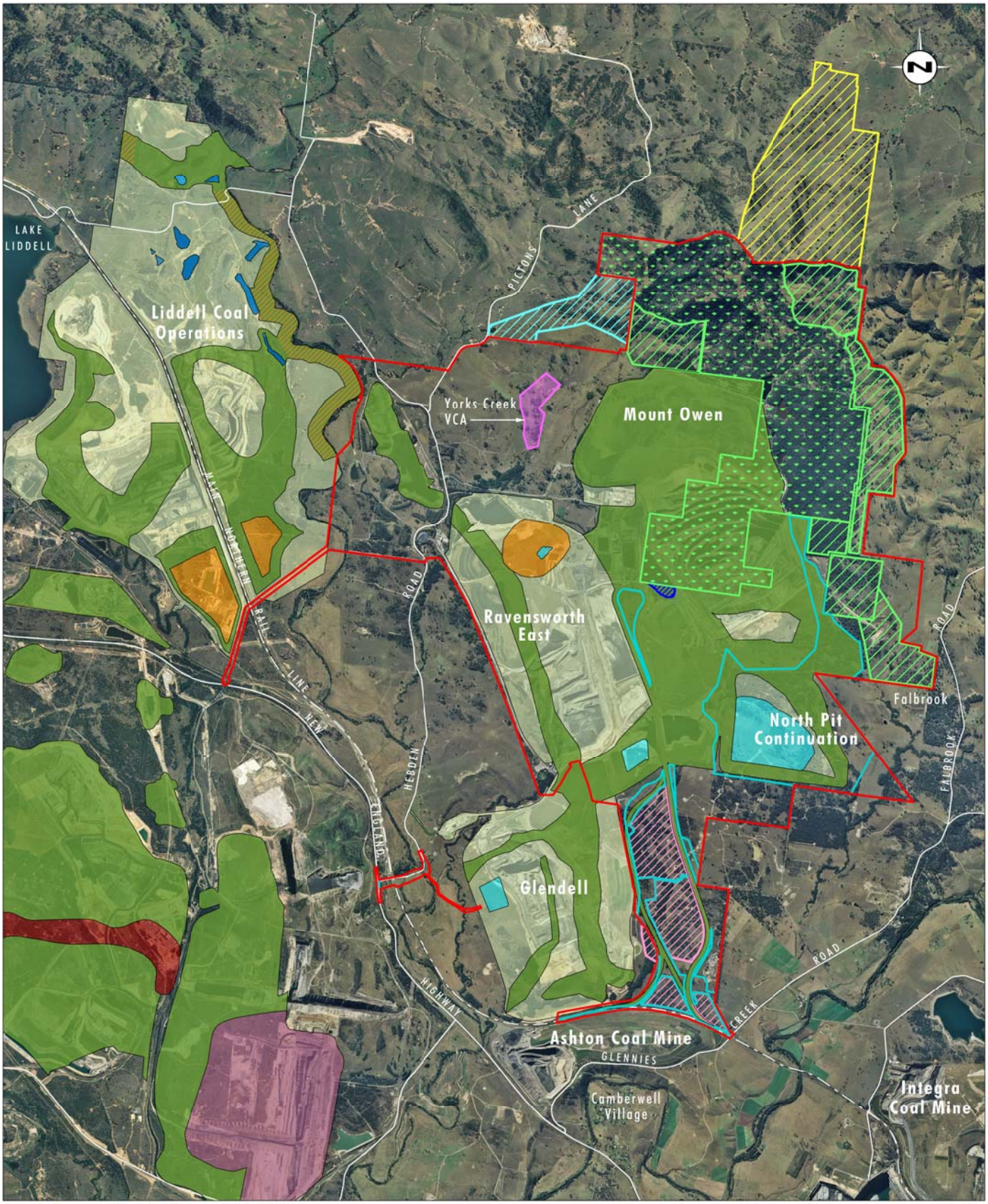

Image Source: Mount Owen (2012-2013)
Data Source: Mount Owen (2014)

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Legend

- Project Area
- Proposed Disturbance Area
- Final Void Water Level
- Final Void
- 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 Operctions)
- Existing Biodiversity Offset Area
- Proposed Cross Creek Biodiversity Offset Area
- Bettys Creek Habitat Management Area
- Southern Remnant Biodiversity Offset Area
- Stringybark Creek Habitat Corridor
- Yorks Creek VCA
- Grazing
- Riparian / Wetland
- Water Storage

FIGURE 2.1

Mount Owen Continued Operations Project Proposed Post Mining Land Use

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It is considered that the proposed final land use within the Project Area will be consistent with this intent. As outlined in **Sections 2.3** and **2.4**, the establishment of vegetation corridors facilitates regional linkages with the biodiversity values of the broader area whilst not precluding opportunities for other post-mining land uses.

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 Commonwealth Department of the Environment. 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.

The development of the Strategic Assessment, to be completed in 2014, is an identified action of the Upper Hunter SRLUP.

As outlined in **Sections 2.5** and **2.6**, the indicative post mining land use for the Project Area will primarily involve the establishment of Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the post-mining landform. 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 biodiversity offset strategy for the Project.

2.2.4 Strategic Framework for Mine Closure

The Strategic Framework for Mine Closure (ANZMEC & MCA 2000) has evolved as a cooperative development between the Australian and New Zealand Minerals and Energy Council (ANZMEC) and the Australian Minerals Industry represented by the Minerals Council of Australia (MCA) that provides a framework of issues to be considered as part of a mine closure plan. The strategy for mine closure as outlined in this document has been developed in consideration of the six key objectives as identified by this framework document. Each of these objectives is outlined in **Table 2.1**, along with the relevant section of this document where they are addressed.

Table 2.1 – Key Objectives from the Strategic Framework for Mine Closure

Key Objectives	Relevant Section of Document
To enable all stakeholders to have their interests considered during the mine closure process.	**Sections 2.3** & **2.4**
To ensure the process of closure occurs in an orderly, cost-effective and timely manner.	**Sections 3.0** & **4.0**
To ensure that the cost of closure is adequately represented in company accounts and that the community is not left with a liability.	**Section 2.8**
To ensure there is clear accountability and adequate resources for the implementation of the closure plan.	**Section 6.0**

Table 2.1 – Key Objectives from the Strategic Framework for Mine Closure (cont.)

Key Objectives	Relevant Section of Document
To establish a set of indicators which will demonstrate the successful completion of the closure process.	**Sections 2.5**, **2.6** & **2.7**
To reach a point where the company has met agreed completion criteria to the satisfaction of the responsible authority.	**Sections 2.7** & **5.4**

2.3 Stakeholder Identification Analysis and Engagement Strategy

Glencore has a public commitment to effective environmental management in all its operations both domestically and internationally. Glencore values include the statement that 'we respect the environment and we work in partnership with our stakeholders to create lasting benefits for the communities and countries in which we live and work'. In line with this value statement, it is Mount Owen's intent to develop a Project that can co-exist within the local setting. Amongst one of the key focus areas for ongoing dialogue with stakeholders will be progress with the mine closure and rehabilitation planning and implementation process. As part of the development of the EIS, Mount Owen has sought stakeholder feedback on the mine closure and rehabilitation aspects of the Project through various forums including meetings with regulatory authorities, community groups and surrounding landowners. In consultation with local landholders, closure options identified included return of the land to afford further agricultural enterprise e.g. dairy farming, cattle grazing, and aqua-culture. Other uses identified included commercial forestry and conservation of the area e.g. national park. Other uses identified by landholders included use of the area for horse events e.g. pony club, riding trails, the establishment of an 18-hole golf course, and development of the final voids as a recreational water area for community use. In a general sense, there was a view that the landform returned should be 'natural looking' and should, as closely as possible, retain the original landform that existed prior to mining through effective rehabilitation practice (Coakes Consulting / Umwelt 2014).

Key processes to enable all stakeholders to have their interests considered during the mine closure process will include but not necessarily be limited to the following:

- ongoing review and update of the Landscape Management Plan (LMP) for the Mount Owen and Ravensworth East Mines, which will provide stakeholders with the opportunity to have input into proposed rehabilitation strategies and methodologies;
- submission of annual reviews and conducting associated meetings with government regulators to seek feedback in relation to the progress with rehabilitation activities;
- Mount Owen Complex Community Consultative Committee (CCC);
- Community meetings and information days;
- Community newsletters; and
- One on one meetings with stakeholders.

2.4 Social Impact Assessment

In addition to the above, a social impact assessment will be required leading up to the development of a detailed mine closure plan (i.e. within five years of end of the life of mine). The issues outlined below may be included as part of the scope of the Social Impact Assessment process:

- Identification of the direct and indirect linkages and associations that exist between Mount Owen's operations and the community to afford the effective prediction of social impacts associated with eventual closure. The following factors are usually considered in this analysis:
  - residential patterns of employees and contractors, by township;
  - household expenditure patterns of the workforce;
  - number of employee/contractor members attending local educational institutions;
  - number of health services accessed by employees/contractors and their respective family members;
  - location of supplier businesses that support the mine's operations;
  - location of supplier employees by township;
  - business expenditure undertaken by suppliers, by township;
  - estimates of suppliers' business reliance on the operations; and
  - review of company contributions to the local community through their social investment program.
- Development of a community profile and identification of relevant growth industries within the Local Government Area that may offer other possible industries of future employment for employees following closure.
- Involvement of key stakeholders in the identification and assessment of relevant closure options. Such a process is important in building community ownership of the closure process and ultimate closure option.
- The social impact assessment should include possible strategies to minimise negative impacts and or maximise positive impacts (e.g. re-training for employees; redundancy packages, building a further skill basis in the community).

2.5 Indicative Post-Mining Land Use

The indicative post mining land use for the Project Area (refer to **Figure 2.1**) will primarily involve the establishment of woodland areas, specifically a vegetation community consistent with the Central Hunter Ironbark – Spotted Gum – Grey Box Forest. The objective is to create a native vegetation corridor network that promotes regional fauna movements between the Mount Owen Complex, Ravensworth Operations, Liddell Coal Operations, Lake Liddell and the Ravensworth Operations Hillcrest Offset Areas.

As outlined by the Agricultural Impact Statement (AIS) (Umwelt 2014c), there is no Biophysical Strategic Agricultural Land (BSAL) land in the Proposed Disturbance Area due to soil fertility constraints. The AIS also outlined that the combination of terrain and soil constraints is expected to restrict Land and Soil Capabilities (LSC) to LSC Classes 6 to 8, other than minor flatter areas, which will be rehabilitated to LSC Class 4 or 5 land. Based on these constraints it is considered that the establishment of native woodland areas across the post mining landform will be the most sustainable land use option for the Project.

Other portions of the Project Area, including the tops of overburden dump areas associated with Ravensworth East, the flatter portion at the base of the North Pit Continuation as well as capped tailings dams (refer to **Figure 2.1**) 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 five years from closure, it is the intent that these areas could be used for sustainable agricultural purposes such as grazing. As such, revegetation may involve the use of both native and suitable exotic pasture species for the establishment of grasslands in these areas. In this instance, pockets of native vegetation may be established as shelter belts to support grazing activities.

In consideration of the proposed operational life of the Project to 2030, the potential for other sustainable and economically productive post-closure land uses will be investigated in light of the local and regional land use strategies that may have further evolved towards the end of the mine life this includes the potential options to utilise voids for either water storage areas or tailings emplacement from other mines. This process will be undertaken as part of the detailed mine closure process and in consultation with relevant stakeholders.

Rehabilitation activities will be undertaken progressively throughout the life of mine to allow maximum opportunities for the development of vegetation prior to mine closure. However, 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. These options may include, potential industrial uses, particularly in consideration of the availability of the rail line as well as the suitability of infrastructure associated with the workshop, office complex and other surface facilities including lay down storage areas, stockpiles and water management structures.

2.6 Rehabilitation Objectives

The proposed rehabilitation strategy for the Project, as discussed in this document and displayed in **Figure 2.1**, 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. 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 Area 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 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 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.

Considering the above and the Ecological Assessment for the Project (Umwelt 2014d), the key assumptions that relate to the proposed post-mining land use and rehabilitation strategy for the Project and the Mount Owen Complex are outlined in the list below.

The restoration of spotted-tailed 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 along Stringybark Creek(refer to **Figure 2.1**). This is a key component of the proposed Biodiversity Offset Strategy for the Project and will include a mixture of tree plantings and habitat structures such as log piles constructed adjacent to the creekline on non-mine disturbed land. The Corridor will be designed to facilitate the movement of the spotted-tailed quoll (*Dasyurus maculatus maculatus*) and 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 will be 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. As shown in **Figure 2.1**, the proposed rehabilitation strategy for Liddell Coal Operations involves the establishment of native corridors in order to provide effective integration with the adjacent Hillcrest Offset Area managed by Glencore's Ravensworth Operations.

Native woodland areas will be generally established across the slopes of overburden spoils and higher portions of the lowwalls associated with the final voids as the steepness of these areas and the nature of the substrate is likely to provide limited potential for sustainable grazing. The location of these woodland areas have been designed to link with the approved native rehabilitation woodland corridor proposed for the Glendell Mine as well as to link to existing and proposed rehabilitated woodland areas associated with the Mount Owen, Ravensworth East and Glendell Mines.

Seeding of native vegetation (canopy, mid-canopy and groundcover) on the highwall benches to improve long term visual amenity of the final voids.

The lower portions of the lowwalls will be established initially with exotic grassland species with the objective to stabilise these areas until they are submerged by surface and groundwater that are predicted to accumulate in the final voids.

Flatter areas on site, including the tops of overburden areas and tailings dams are to be established to open grassland with pockets of native vegetation. Depending on the outcomes of final land use analysis to be completed as part of the detailed closure planning process five years from closure (refer to **Section 2.1**), there is the potential that these flatter areas could be used for sustainable agricultural purposes such as grazing.

Further detail in regards to the rehabilitation criteria and specific revegetation methodology related to the establishment of these areas as outlined above are included in **Sections 2.5** and **4.0** respectively.

2.7 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 are outlined in **Table 2.2**. The 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'.

These completion criteria, which may be subject to refinement as the Project progresses through consultation with the relevant stakeholders, will be utilised to demonstrate achievement of rehabilitation objectives. The achievement of the completion criteria will be monitored and reported within the annual reports submitted to relevant government agencies.

Table 2.2 – 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 made safe through the use of fencing and /or bunding.	• Potential hazards (i.e. electrical, mechanical etc.) have been effectively isolated. • The structural integrity of the infrastructure has been inspected by a suitably qualified engineer and determined to be suitable and safe as part of the intended final land use. • Appropriate security measures have been implemented to minimise the potential for unauthorised access during the period that the site is transitioned to the intended final land use.
	There is no residual soil contamination on site that is incompatible with intended land use or that poses a threat of environmental harm.	• Contamination will be appropriately remediated 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*.

Table 2.2 – Preliminary Project Closure and Rehabilitation Criteria (cont.)

Aspect	Objective	Preliminary Closure Criteria
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 dumps 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 Bayswater North Pit Final Void 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.
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 update to the LMP and subsequent annual reports that are submitted to relevant government agencies and made available to the community. The completion criteria will be finalised as part of the detailed mine closure planning process and presented in the Final Closure Plan for approval by the relevant government agencies.

The gradual achievement (or otherwise) of these completion criteria will be assessed and discussed in the annual report, which will include the identification of any failures of the criteria and measures taken to address any such issues. The proposed rehabilitation monitoring program is discussed in **Section 5.0**.

2.8 Provisions for Mine Closure Cost Liability

To ensure that the community is not left with a potential liability for the cost of mine closure, Mount Owen will implement a mine closure accrual provision in accordance with relevant accounting standards and will submit a rehabilitation security deposit in accordance with DRE's guidelines. Mine closure provisions will be continually revised and updated as part of the operational life of the Project.

3.0 Scope of Mine Closure Decommissioning Works

At the end of the proposed operational life of the Project, with the exception of that which is required for the final land use, Mount Owen proposes to decommission all on site 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 2.7**).

A detailed mine closure plan will be developed for the Project at least two years prior to the anticipated mine closure date (e.g. cessation of mining). During the development of the mine closure plan, consultation with a range of stakeholders including Council, DP&E, DRE, other relevant government agencies and the local community will be undertaken. This plan will specifically address the major aspects of decommissioning and rehabilitation and define future rehabilitation care and maintenance requirements.

A summary of the general decommissioning activities that will be undertaken as part of the closure and decommissioning is outlined in **Table 3.1**.

Table 3.1 – General Approach to Decommissioning Activities

Mine Closure Aspect	General Approach
Site Services	• Electricity services to any remaining infrastructure will be removed prior to the commencement of building demolition works. • Telecommunications, water supply and other services will also be disconnected and removed where practical. • Where services are buried (i.e. pipelines, cables etc.) and their retrieval may lead to further disturbance, the infrastructure may be left *in situ* provided that they don't pose constraints to the post mining land use. In this situation, the location of the services will be surveyed and marked on the site plan and a suitable caveat developed to provide that they are readily identifiable for future land holders.
Buildings and Fixed Plant	• All buildings, fixed plant and other infrastructure which are not required as part of the post-closure land use will be demolished and removed. Where appropriate the materials recovered during demolition will be sold for re-use or recycled. • Concrete footings and pads along with other potential inert building waste will be broken up and buried with overburden in the pit area or used in rehabilitation where appropriate. • Where it does not pose a constraint to the proposed final land use, structures such as footings, underground water pipelines and disconnected power cables may be left *in situ*. This may include where it is not practical to retrieve the structures or where their removal may lead to environmental damage. These remaining structures will be surveyed and recorded on a plan.

Table 3.1 – General Approach to Decommissioning Activities (cont.)

Mine Closure Aspect	General Approach
Rail loop and rail siding (if not required as part of the final land use)	• The management of the rail loop and rail siding at closure will be dependent upon the outcomes of the final land use analysis. • In the event that the rail infrastructure is not required as part of the final land use, the rail lines will be deconstructed and removed. This will involve the removal of all railway sleepers and ballast material, which depending on their condition may be reused or disposed of in accordance with the appropriate waste guidelines. • The rail siding and loop will be reshaped and revegetated as part of rehabilitation activities. • Spillages of potential carbonaceous or contaminated material will be managed as per below.
Removal of Carbonaceous/ Contaminated Material	• Excess coal material remaining at closure will be scraped up and either reprocessed or disposed of within the tailings/coarse reject emplacement areas. • Any remaining carbonaceous material (e.g. coal reject) on the base of the coal stockpile area will be either capped with inert material in accordance with relevant guidelines or scraped up and removed to the tailings/coarse reject emplacement area. • Where there is potential that contamination may have occurred as a result of operational activities (e.g. re-fuelling areas, workshops, etc.), investigations will be undertaken to determine the presence and extent of any contamination. Where identified, contaminated material will be bioremediated on site or managed in accordance with the appropriate waste guidelines.
Equipment Storage Areas	• Any redundant plant or equipment will either be sold for reuse, recycled (i.e. scrap metal) or disposed of at an appropriate landfill facility. • Storage areas will be assessed for potential contamination (e.g. hydrocarbons) and remediation undertaken as required.
Hardstand Areas, Roadways and Car Parks	• Hardstand areas, roadways and car parks will be removed with the waste material (e.g. bitumen, concrete) being placed and capped in the tailings/overburden emplacement areas or incorporated into the final voids.
Hazardous Materials Management	• All remaining hydrocarbons such as diesel and lubricants and other hazardous materials will be either utilised or disposed of via an authorised waste contractor. • The storage tanks will be removed and depending on their condition either sold or disposed of at an authorised facility.
Dangerous Goods	• It is envisaged that the majority of dangerous goods remaining on-site will include gas bottles and cleaning agents, which will be utilised during decommissioning activities or disposed of off-site in accordance with the regulatory arrangements applicable at the time.

Table 3.1 – General Approach to Decommissioning Activities (cont.)

Mine Closure Aspect	General Approach
Water Management Infrastructure (e.g. Main Water Storage Dam)	• Depending on the chosen final land use, issues that will be addressed as part of the post-mining water management system will likely include: ▪ the removal of the oily water treatment system following the demolition of the workshop and associated facilities; ▪ removal of excess sediment (i.e. saline sediment) from the surface dams for future use by the subsequent land owner or alternatively filling or removing the dams if they are no longer required; ▪ re-shaping dams (where required) in accordance with their intended use. This may involve re-sizing, facilitating stock access (if required) or reshaping to enhance habitat functionality for specific fauna species; ▪ where dams are to be retained, design drainage structures to capture runoff from sufficient catchment area so that the dam can be utilised for its intended use; and ▪ the installation of appropriate sediment and erosion control measures. • Sediment material extracted from surface dams will be analysed to determine the potential for contamination and, if present, will be appropriately managed.
Final Void Management	• High and Low walls of final voids rehabilitated as per geotechnical recommendations to provide wall stability; • Drainage structures constructed to divert water away from final voids; • Drainage structures constructed as required within final void areas to prevent instability from erosion; • Rehabilitation of high and low walls as defined in the final void management plan; • Monitoring of groundwater impacts and water quality within the final void during the care and maintenance phase of the project; • Option to utilise remaining voids as a future water storage or tailings storage facility for future use in the Greater Ravensworth Area based on future approvals.

4.0 Rehabilitation Strategy

Rehabilitation will be undertaken progressively in accordance with the updated MOP approved by DRE, and the LMP. The update MOP and LMP will be developed in accordance with this mine closure and rehabilitation strategy and will include the detailed measures and schedules for all rehabilitation activities. The ongoing review and refinement of rehabilitation completion criteria (refer to **Section 2.7**) 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 (AR).

Details of the rehabilitation strategy are provided in the sections below.

4.1 Management of Biological Resources for Utilisation in Rehabilitation

4.1.1 Seed Collection and Propagation

Native revegetation activities in rehabilitation areas will preferentially use local provenance seed for direct seeding or tubestock propagation. Mount Owen has developed a seed collection program to maximise the amount of viable seed of local provenance for use in rehabilitation and revegetation activities. The program includes:

- a seed calendar that contains information relating to fruiting and seed collection times for key native species;
- data on seed collection including species, collection location and date of collection;
- seed assessment of native vegetation within the pit shell in order to allow for seed collection prior to or immediately following clearing;
- required volumes of seed to be collected in order to enable adequate supply of native seed for reuse; and
- the utilisation of record sheets and a GIS database to track collection, storage and utilisation of the seed resource.

The seed collection program adopts innovations to industry best practice techniques, where relevant.

Where adverse seasonal conditions (i.e. drought) affect the availability of local provenance seed, supplementation with non-local provenance seed may be required. Alternatively, revegetation works may be delayed until sufficient stocks of local provenance species are available.

4.1.2 Salvage of Tree Hollows, Stags and Timber

The salvage of hollow bearing trees, hollow logs, fallen timber and boulders will be undertaken, where practical, during the clearing process. The relocation of such habitat resources into post-mining rehabilitation areas and offset and conservation areas (where deemed to be appropriate) is aimed at increasing habitat complexity in these areas, in order to make them more habitable for native species, particularly key threatened species.

4.1.3 Soil Characterisation and Topsoil Management

As outlined in the Agricultural Impact Statement (Umwelt 2014c) for the Project, soil survey and soil testing (including soil structure, texture, pH, sodicity, cation exchange capacity and soil fertility) was conducted in the proposed disturbance area, to verify the soil types present and the actual LSC classes of the Project Area. Based on this analysis, the proposed disturbance area contains LSC Classes 4 to 7 which represent moderate through to very low capability land.

In general there will be the opportunity for reuse of soil and subsoil for rehabilitation purposes, however, subject to further characterisation it is expected that ongoing specialist management practices as outlined further below will be required to overcome constraints. Overall it is expected that there will be a topsoil deficit for the Project and it will be the intention that a detailed topsoil balance will be developed to determine the quantity of other alternative substitutes (e.g. organic material) that may need to be imported on site. The outcomes of this process will be detailed within the LMP for the Mount Owen Mine.

Mount Owen has existing topsoil stockpile management procedures to maintain the quality of topsoil for subsequent use in rehabilitation. These procedures will continue to be implemented for the Project. Materials management and monitoring techniques to be adopted in this strategy are outlined below:

- Material characterisation of topsoil and subsoil will be undertaken at an appropriate scale across the proposed disturbance area, prior to pre-stripping activities or the re-handling of long term topsoil stockpiles. Representative samples will be taken to characterise the nature of the soil material (e.g. sodicity, acid-generating potential, etc.) to determine the potential limitations to rehabilitation and sustainable plant growth. The results will be used to determine specific ameliorant techniques that may be applied to the soil material in order to overcome potential limitations and enhance vegetation establishment.

- Wherever practicable, topsoil is to be transferred directly from stripping location to areas that have been reshaped for rehabilitation, eliminating the need for storage and re-handling.

- Where the stockpiling of topsoil is necessary due to the unavailability of shaped areas for direct-return, stockpiles will be generally less than 3 metres high to retain biological activity within the topsoil.

- Stockpiles to be kept longer than 3 months will be sown with a suitable cover crop to minimise soil erosion and the invasion of weed species.

- Topsoil and subsoil stripping activities are to be restricted during adverse weather conditions to minimise the potential for dust generation.

- When stripping topsoil and subsoil a water cart is available to minimise dust emissions during stripping activities.

- Topsoil and subsoil will be stripped using appropriate equipment (e.g. dozer or scraper) to the appropriate depths identified in the Agricultural Impact Assessment (Umwelt 2014c) for the Project or in accordance with the outcomes of further investigations undertaken as required.

- Topsoil and subsoil layers will be assessed and managed so that they can be appropriately re-applied in areas to be rehabilitated.

- Topsoil stockpiles are to be located away from traffic areas and at an appropriate distance from watercourses.
- Appropriate sediment controls will be installed around topsoil stockpiles.
- Where required, machinery used to handle and transport topsoil shall be washed down prior to and at the completion of works to minimise the transfer of weeds.
- Weed growth will be monitored and subsequently controlled if necessary.
- Prior to re-spreading, any weed growth will be scalped from the top of the stockpiles to minimise the transport of weeds into rehabilitated areas.
- Stockpiles will be appropriately identified to minimise the potential for inadvertent use or disturbance.

4.2 Overburden and Interburden Handling

4.2.1 Management of Potential Geochemical Constraints to Rehabilitation

Analysis was undertaken by Environmental Geochemistry International Pty Ltd (EGI) to assess the acid rock drainage (ARD), salinity and elemental solubility (neutral mine drainage (NMD)) and sodicity potential of the materials to be mined, identify any geochemical issues and provide recommendations for materials management and follow up test work.

The study indicated that the bulk of the overburden/interburden materials represented by the samples tested are likely to be non-acid forming (NAF), with a significant excess of acid neutralising capacity and low leachable salinity. Whilst there was the occasional thin zone (0.2 metres) of elevated Sulfur (S) identified close to coal seams, the study concluded that dilution and mixing during mining should be sufficient to mitigate any ARD generation. The final pit floor materials will comprise mainly of the Bayswater Seam and as such, the study outlines that the pit floor and margins of the pits are likely to be NAF with possible portions of low capacity potential acid forming (PAF-LC) materials.

In addition to the above, water extracts from NAF overburden/interburden indicated that neutral mine drainage was unlikely to contain significant metal/metalloid concentrations and that results indicated that there was no potential for alkaline drainage.

Furthermore, EGI outlined that weathered Permian materials (that is, sandstone) represented by the samples tested are likely to be sodic and dispersive. It was also found that finer grained fresh Permian materials may also be partly sodic. As such, this material may be subject to surface crusting and high erosion rates if they are incorporated into the surface of the final rehabilitated landform.

Additional analysis, through monitored overburden / interburden leach columns, was subsequently commenced to verify results of the initial analysis. While this study is ongoing, initial preliminary results indicate that mixing PAF overburden/interburden and NAF Sandstone will provide sufficient buffering and delay acid production. This would suggest that the blended material would be suitable for use in rehabilitation.

4.2.2 Summary of Ongoing Management of Mine Materials

In consideration of the above results, the strategies for mine materials management to address potential geochemical constraints for rehabilitation will be undertaken as outlined below.

Periodic sampling and testing of mine water will be continued as part of the water quality testing program to check for ARD generation. A sampling program will be continued to assess the potential for sodic/dispersive materials and be used to maintain management measures to achieve successful rehabilitation.

Where strongly sodic and dispersive material has been identified within the strata profile, the mine materials management process will avoid the placement of this material where it has the potential to affect the quality of final rehabilitation (e.g. within 3 metres of the surface of the final landform).

The handling of non-sodic material, as identified through sampling and testing of the strata profile, will be preferentially selected over sodic material for placement at the surface of the final landform. Where this material cannot be practically or efficiently accessed for selective handling during the mining process, specific amelioration requirements (i.e. gypsum, lime etc.) may be required where sodic material is used in the plant growing horizon, exposed on dump surfaces or used in engineering structures.

In the event that PAF material is to be used for rehabilitation purposes, it will be mixed with suitable NAF material to provide for sufficient buffering to allow for rehabilitation establishment and prevent generation of acid runoff.

4.2.3 Spontaneous Combustion Management

Based on the history of mining operations at Mount Owen Mine, it is considered that there is a low propensity for spontaneous combustion to occur within coal reject and overburden emplacement areas on site. 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 prone to spontaneous combustion 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 bushfire occurring within the revegetated landscape. General practices designed to minimise oxygen exposure pathways to potentially prone material will include the following:

- the capping of tailings emplacement areas;
- coarse reject material will be co-disposed with overburden material and incorporated at a suitable depth into the final landform; and
- spontaneous combustion prone overburden/interburden material that is identified through the routine sampling program will be selectively handled and buried at depth to prevent exposure of this material.

4.3 Coarse Reject and Tailings Dam Decommissioning

4.3.1 Tailings Dam Decommissioning

The tailings emplacement areas will be filled and shaped to the conceptual final landform plan and subsequently capped. The primary objective of the capping design will be to minimise the potential for exposure of potentially environmentally sensitive tailings material in the rehabilitated landform and prevent the occurrence of spontaneous combustion. Following capping, these areas will be revegetated in accordance with the rehabilitation strategy as outlined in **Sections 4.5** and **4.6**.

To promote the geotechnical stability of these areas and avoid the potential sterilisation of land in the post-mining landform, dewatering strategies will be incorporated into the design of the tailings dam. The aim of the strategy will be to progressively dewater the tailings dams and promote the consolidation of material throughout the tailings profile. Water extracted from the process will be re-utilised for on-site purposes such as the processing of coal or for dust suppression. Dewatering of the tailings dam will be managed to enable finalisation of capping and rehabilitation following the cessation of active mining.

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 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.

4.3.2 Coarse Reject

Coarse reject material will be co-disposed with overburden material and incorporated into the final landform. The coarse reject material will be placed at a suitable depth within the final landform to minimise any potential interference to rehabilitation establishment as well as minimise the potential for spontaneous combustion or ignition of carbonaceous material in the event of bushfire occurring within the revegetated landscape.

As outlined in **Section 4.2.1**, analysis was undertaken by EGI to assess the geochemical constraints and identify potential measures required for materials management and follow-up test work required. As part of the scope of the EGI study included the sampling and testing of coal reject samples from the current Mount Owen CHPP. The results of the samples tested were reported by EGI to be mainly NAF, but may include potentially acid forming (PAF) and PAF-LC portions.

Analysis undertaken by EGI (2013) to assess the ARD potential identified that the vast majority of fine and coarse rejects represented by the samples collected were NAF. However, the Foybrook seam series rejects showed distinctly higher ARD potential than rejects from other seams.

Periodic sampling and testing of mine water will be continued as part of the water quality testing program to identify the potential for ARD generation, assess the performance of management strategies, and determine and/or refine non acid forming/potentially acid forming blending ratios and limestone treatment requirements (if required).

4.4 Final Landform Design

The conceptual final landform, as shown in **Figure 4.1**, has been designed to maintain consistency with the local area and will predominantly consist of an undulating landform generally reflecting the dominant features of the existing environment. Typical cross-sections of the final landform design are shown in **Figure 4.2**. Key features of the final landform are discussed below.

4.4.1 Final Voids and Highwall

Based on the mine design and depth of coal seams, three final voids will remain at the completion of mining. This includes a void within the North Pit Continuation, RERR Mining Area and a void within the BNP. Analysis was undertaken by engineering consultants Pells Sullivan Meynink Consult Pty Limited (PSM) and URS to assess the Life-of-Mine (LOM) geotechnical stability of the North Continuation Pit and BNP respectively.

4.4.1.1 North Pit Continuation Geotechnical Assessment

In summary, the assessment found 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. Other key findings of the assessment included the following:

- the stability of the eastern lowwall is likely to improve with time as the void is filled with ground and surface water. However, drainage on the lowwall may not be effective in the longer term without maintenance;

- subject to the east lowwall performing satisfactorily during the period of mining, it was assessed that the stability would be adequate and would not be adversely impacted with time. Further, it was assessed that a safe perimeter of the pit crest of the east wall could be achieved;

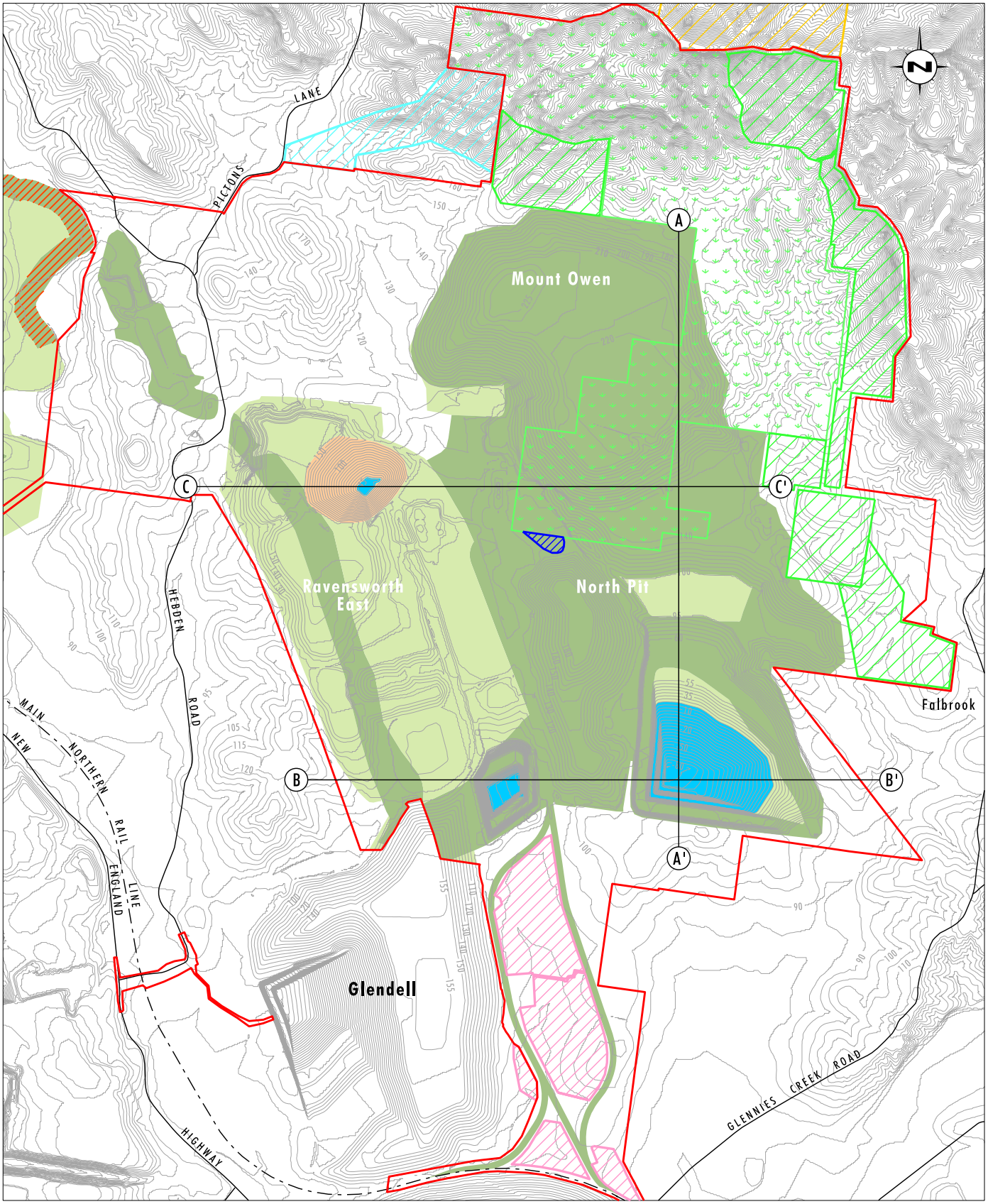
- in regards to the western and southern highwalls, it was assessed that a safe and stable pit wall and safe perimeter of the pit crest could be achieved, subject to the walls performing satisfactorily during the period of mining. In the event that failure was initiated, it was assessed that it was more likely to be in the southern portion where subsidence impacted rock mass is present. However, if such failure was to occur it was considered that it would be slow and more likely to be in the form of excessive deformation rather than global instability; and

- in regards to the western and southern highwalls, it was also assessed that some improvement in stability is expected as the void is filled with ground and surface water over time.

4.4.1.2 BNP Geotechnical Assessment

To improve the FoS and control the risks for the stability of the Northern Highwall some specific design parameters will be included for the BNP. This includes greater standoff, larger catch benches and geotechnical monitoring.

Similar management practices have also been recommended for the Eastern Highwall due to the presence of a number of fractures and bedding associated with the geology of this highwall.



Data Source: Mount Owen (2014)
Note: Contour Interval 5m,
Refer to Figure 4.2 for A-A', B-B' and C-C' cross sections

0 1.0 2.0 2.5km
1:50 000

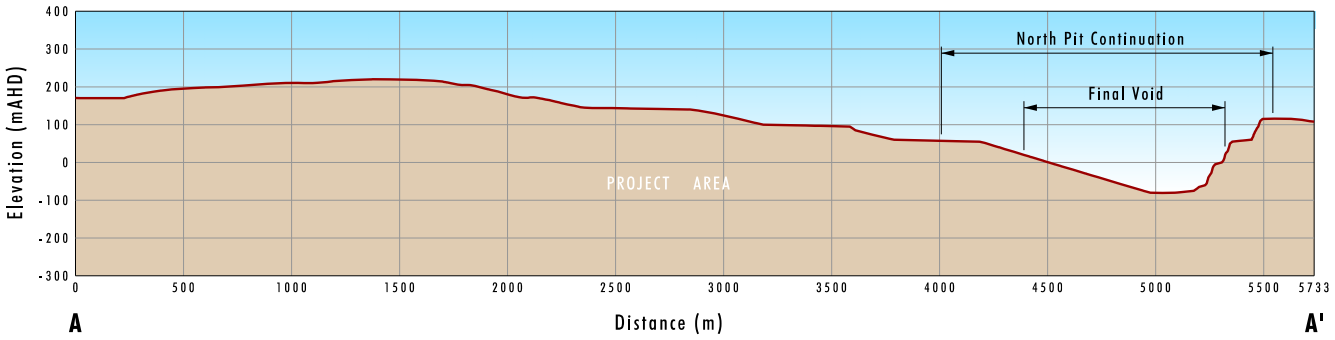
Legend

- Project Area
- Grassland for Stabilisation
- Final Void Water Level
- Native Woodland
- Open Grassland (Potential grazing areas) with pockets of Native Vegetation
- 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
- Section Line

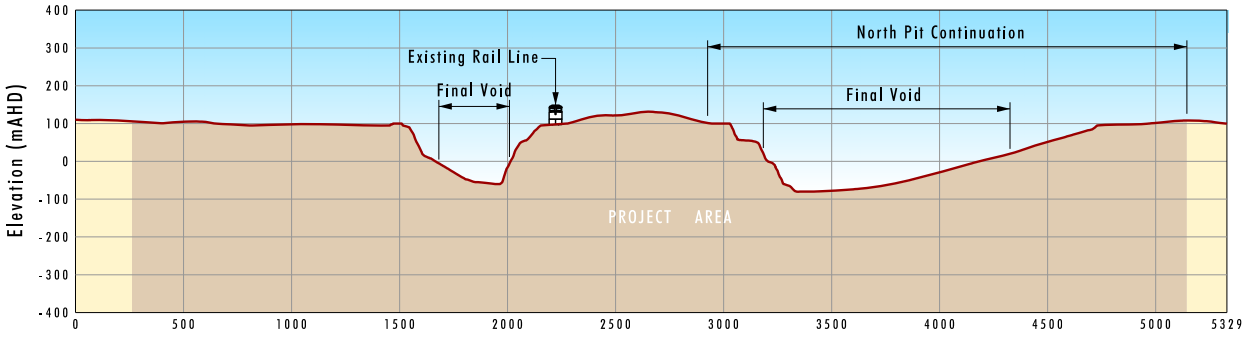
FIGURE 4.1

Proposed Final Landform

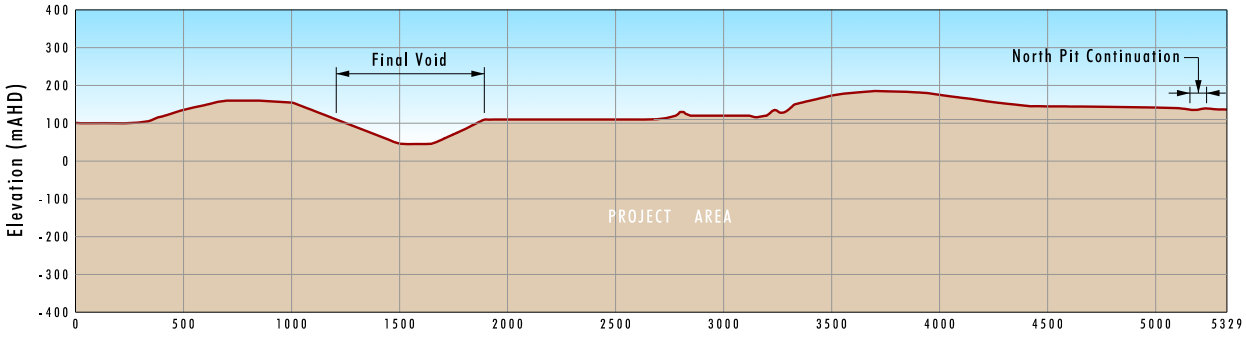
File Name (A4): R10/3109_936.dgn
20141029 13.27



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

Note: For Section locations refer to Figure 4.1

FIGURE 4.2

Proposed Final Landform
Transects A-A', B-B' and C-C'

The Southern Highwall did not have any specific management recommendations regarding stability, however recommendations have been made to continue to monitor this area during excavation to identify potentially unsafe structures.

Groundwater studies have indicated that water storage in the former Stage 3 dam be drained to prevent water over topping or building up behind the highwall.

In consideration of the above for all remaining voids, the key design features and processes associated with the final void, particularly to minimise impacts to public safety as well as reduce the sterilisation of land available for future post mining land uses, are outlined below:

- The highwall will comprise of a series of benches of varying widths that will be constructed progressively as mining operations progress in the lower seams. The stability of the highwall will be assessed on an ongoing basis and appropriate stabilisation measures will be installed (where required) progressively.

- 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 highwall.

- The highwall benches will be seeded with a suitable species mix.

- As part of the establishment of the lowwall, an extensive surface drainage network will be developed to minimise the propensity to erosion and create a stable landform.

- The lowwall will be revegetated with suitable species.

- A surface drainage network *w*ill 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 **Section 5.5** of the Mount Owen Continued Operations EIS (Umwelt 2014a). The need for ongoing post-mining maintenance of drainage structures will be assessed and appropriate measures will be included within the Final Closure Plan.

As outlined in Appendix 9 of the EIS, the North Pit final void is expected to have a long term water level of approximately 19 metres AHD. The BNP and RERR Mining Area is expected to stabilise at approximately 47.5 and -8 metres AHD, respectively, in the long term.

As outlined in Appendix 10 of the EIS, a groundwater assessment of the final landform (at closure) indicates that the void will not discharge to local alluvial aquifers. The final void is predicted to be a source of water to the hard rock aquifer.

As outlined in Section 5.7 of the EIS (Umwelt 2014), Mount Owen has committed to undertake groundwater modelling associated with mine closure to assist in refining the final landform, with this modelling to commence at least 5 years from cessation of mining. This modelling will update groundwater modelling predictions and evaluate the long term pit lake hydrochemistry and water level that will prevail post closure.

As a means to confirm the ongoing management and land use strategy associated with the void, a Final Void Management Plan incorporating the outcomes of the above groundwater assessments will be developed and included in the Final Closure Plan. As outlined in **Section 2.1**, the Final Closure Plan will be submitted to the appropriate regulatory agencies for approval two years prior to cessation of mining.

4.4.2 Overburden Emplacement Areas

Key design considerations associated with the overburden emplacement areas are outlined below:

- Final landform slopes for BNP and Northern Pit Continuation will be generally battered to an average of less than 10 degrees in order to minimise erosion risk. However, as discussed further below and presented in **Figure 4.1**, Mount Owen is currently investigating the development of more natural landform designs for overburden emplacement areas that are aimed at achieving consistency with surrounding natural landforms. As such, concave profiles may be implemented to further enhance stability, which may result in slopes exceeding 10 degrees. However, it is anticipated that steeper profiles will be located within the upper portions of catchment areas where the volume of surface water runoff will be at a minimum.

- 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 re-instigate 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.

Preliminary analysis of the natural landform approach by Mount Owen indicates that it is potentially feasible to integrate the alternative design as part of current mining practices. As such it is Mount Owen's intention to utilise this or similar approach to landform design and construction for the Project. However, 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 that it complies with the overall completion criteria. In regards to the Project, it will be the intention of Mount Owen to continue with this approach for the North Pit Continuation as well as southern parts of the Ravensworth East mine with the objective of

implementing a more natural landform design as shown in **Figure 4.1**. Specific details will be included within the Mount Owen Complex LMP for approval by DRE.

Progress with the natural landform design trials will be further reported within the Mount Owen Annual Review. Where potential issues with the execution of the design are identified as part of the monitoring and evaluation process, suitable mitigation strategies will be developed in consultation with the relevant regulatory authorities, including DRE. This may involve minor to moderate modifications that whilst being consistent with the key design considerations as outlined above, will be different to the landform design as shown in **Figure 4.1**.

4.5 Substrate Preparation

Surface preparation activities for rehabilitated areas will commence as soon as practicable following the completion of mining activities. The general surface preparation activities to be undertaken within the Project Area include:

- prior to the commencement of rehabilitation of the shaped overburden surface, representative samples will be taken to characterise the nature of the spoil material (e.g. sodicity, acid-generating potential, etc.) to determine the potential limitations to rehabilitation and sustainable plant growth. Results from this process will be used to determine specific amelioration techniques (e.g. addition of gypsum, lime, organic matter etc.) that may be required for spoil to overcome potential limitations for landform stability, vegetation establishment and growth;

- soil ameliorants will be applied where appropriate;

- in areas to be returned for future agricultural use, measures such as additional soil amelioration works or further application of topsoil (or suitable alternative) may be required;

- suitable erosion control measures will be implemented to minimise soil loss from areas undergoing rehabilitation;

- where appropriate and practical, structures such as tree hollows, logs and other woody debris will be incorporated into the final landform to augment the habitat value of the proposed vegetated corridors; and

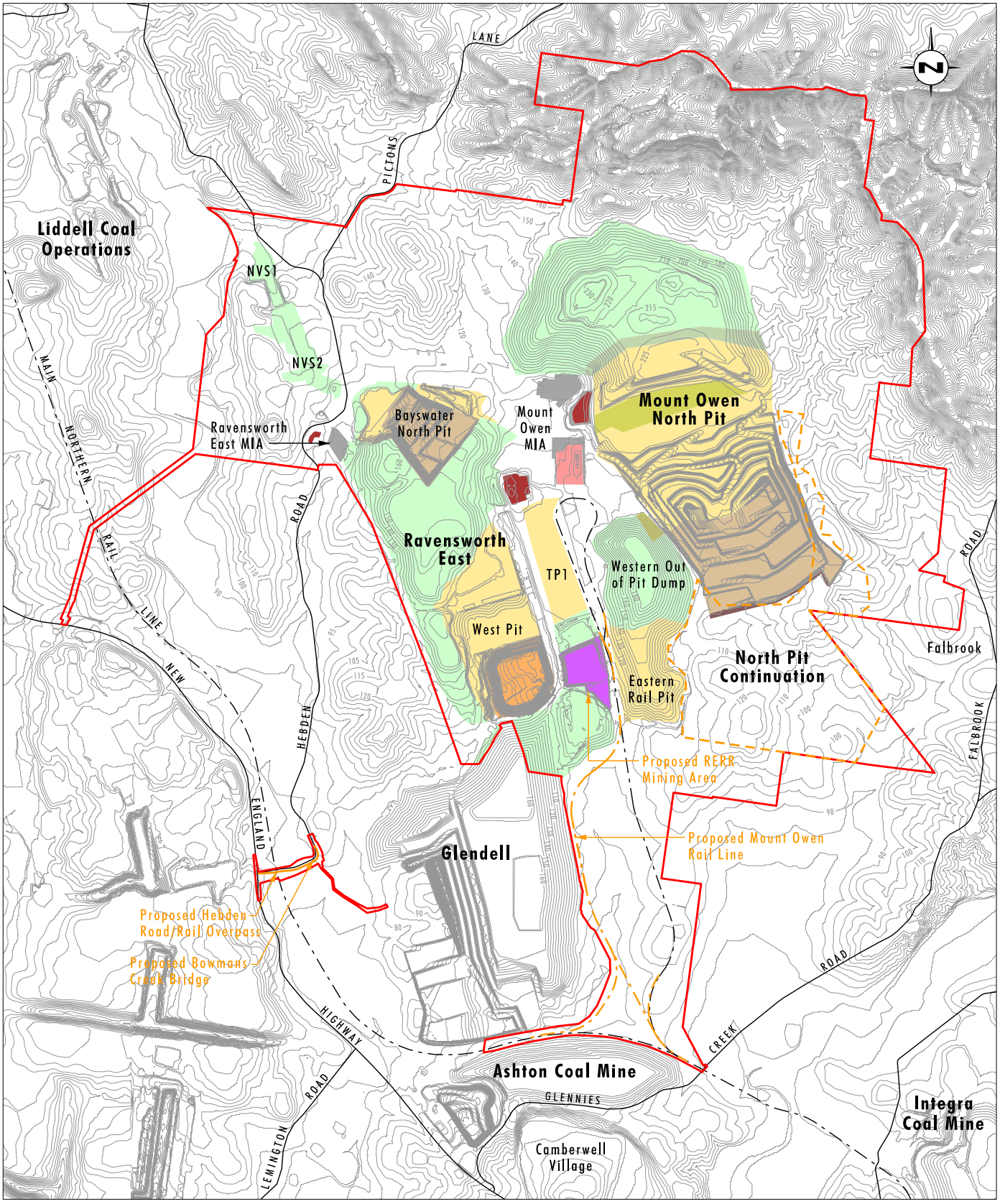
- the installation of appropriate habitat structures (e.g. ponds) will be undertaken where practical.

4.6 Revegetation Program

Rehabilitation of post-mining areas will be completed as soon as practicable after shaped areas become available. The indicative sequence for progressive rehabilitation and final landform design is shown in **Figure 4.1** and **Figures 4.3** to **4.5**. Whilst it is intended to maximise opportunities for progressive rehabilitation and reduce the disturbance footprint, potential deviations from the indicative schedule may occur due to:

- changes or delays in the mining schedule; and

- postponement of rehabilitation activities to avoid seeding and planting in conditions, which may lead to poor quality rehabilitation or failure.



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

0 1 2 3km
1:60 000

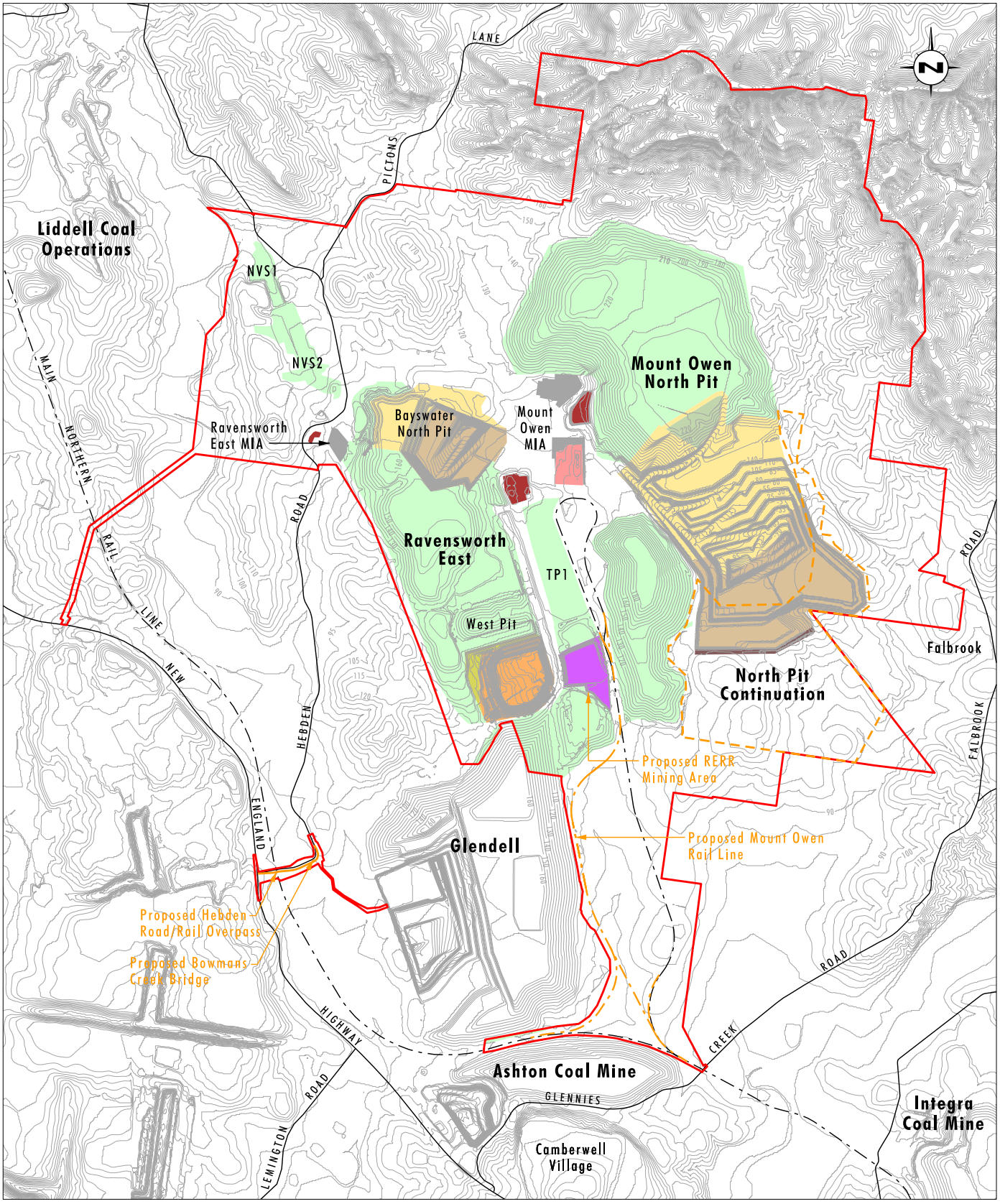
Legend

- 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 4.3

Proposed Mount Owen Conceptual Mine Plan Year 1

File Name (A4): R10/3109_937.dgn
20141008 17.03



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

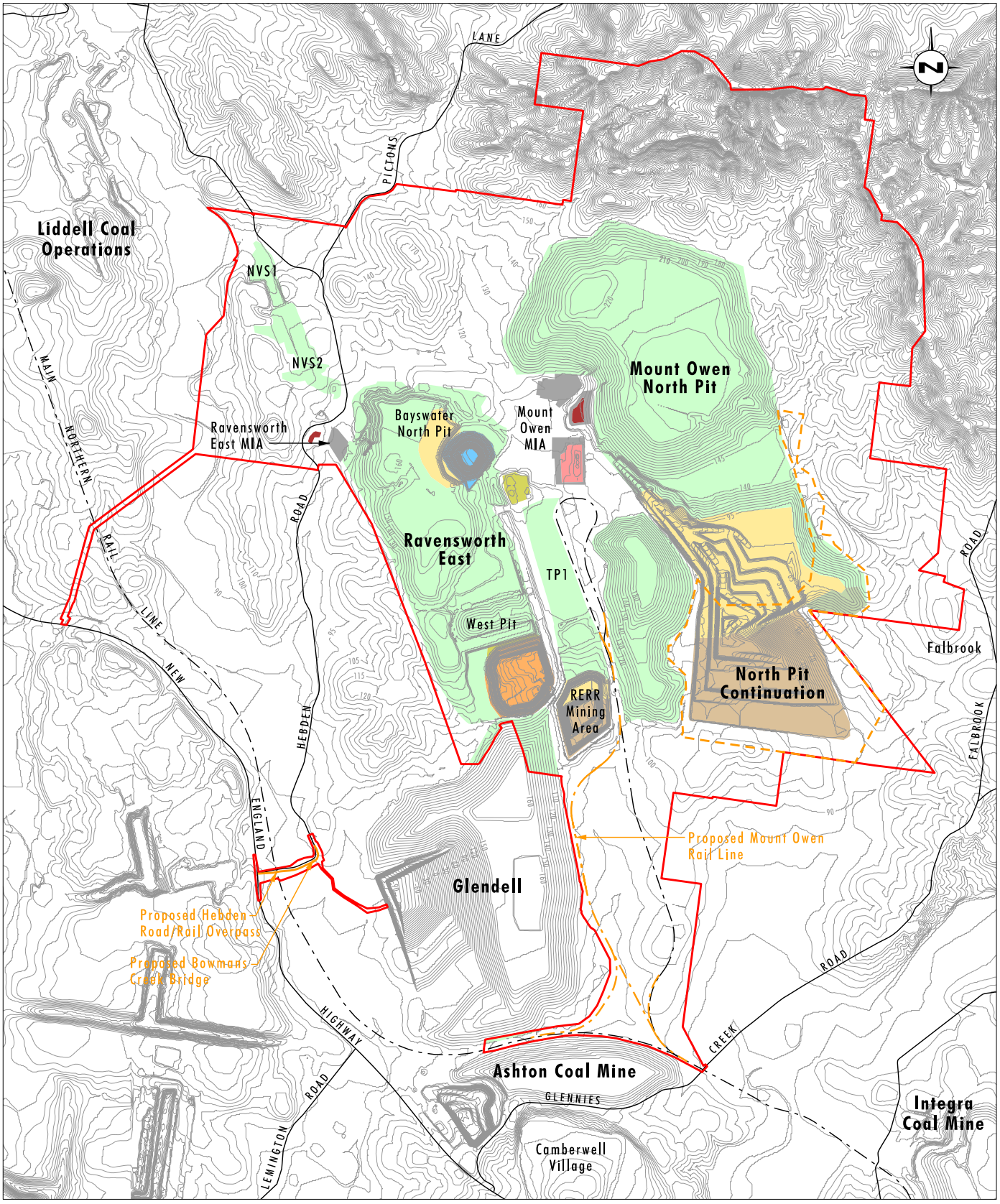
Legend

- 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 4.4

Proposed Mount Owen Conceptual Mine Plan Year 5

File Name (A4): R10/3109_938.dgn
20141008 17.05



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

0 1 2 3 km
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 4.5

Proposed Mount Owen Conceptual Mine Plan Year 10

File Name (A4): R10/3109_939.dgn
20141008 17.05

Where rehabilitation is delayed due to the above scenarios, overburden areas will be shaped to final landform as close as reasonably practicable behind the active mining operation and suitable cover crops applied on exposed areas to minimise dust generation and erosion.

Temporary revegetation will also be undertaken on unshaped overburden dumps and other disturbed areas that are planned to be inactive for one to two years. Temporary revegetation of these areas will improve both visual amenity and the control of dust emissions.

Revegetation techniques will be continually developed and refined over the life of the Project through a continual process of research, trialling, monitoring and improvement. An outline of the proposed revegetation techniques for the establishment of both native woodland and agricultural areas are discussed below.

As discussed in **Section 2.4** the rehabilitation strategy will primarily involve the establishment of native vegetation corridors to promote regional fauna movements between the Mount Owen Complex, Ravensworth Operations, Liddell Coal Operations, Lake Liddell and the Ravensworth Operations Hillcrest Offset Area (refer to **Figure 2.1**). In addition, areas of grassland with pockets of native vegetation will also be established for potential future agricultural activities such as grazing (refer to **Section 4.6.2**).

Final void slope areas will be revegetated where practical as outlined in the detailed mine closure planning documentation. An appropriate seed mix will be determined to assist in providing stability for the rehabilitation areas.

In addition to the rehabilitation of post-mining areas, the establishment and restoration of the Mount Owen Stringybark Creek Habitat Corridor in the northwest portion of the Project Area will be designed to augment habitat for the spotted-tailed quoll (refer to **Section 4.6.3**). The area has been designed to provide a native corridor between the Project Area and Liddell Coal Operation's rehabilitation and offset areas.

4.6.1 Native Woodland Establishment

Rehabilitated woodland areas will be created to contain flora species assemblages characteristic of the dominant vegetation communities impacted by the Project. Revegetation of the post-mining landscape, including native woodland areas will focus on establishing vegetation that is predominantly consistent with the Central Hunter Ironbark – Spotted Gum Grey Box Forest vegetation community.

A list of the key species to be utilised in the revegetation mix for target vegetation communities is contained in **Appendix A**. Due to seasonal variability, it is not realistic for the direct seeding mix or tube stock composition to include all of the species, however, the species composition for revegetation should be selected from the species listed. A seed collection and handling program aimed at maximising the viability and diversity of local seed in the revegetation mix will be implemented as part of the rehabilitation program. As a priority, revegetation will involve the use of local provenance seed that will either be utilised for direct seeding or for the propagation of tubestock for planting. However, where adverse seasonal conditions (i.e. drought) or other factors may affect the availability of local provenance seed, supplementation with non-local provenance seed may be required.

Revegetation will primarily involve direct seeding of native species along with a suitable cover crop or other organic material (e.g. mulch, brush matting or organic growth medium etc.) as required to prevent soil loss and add biomass to the profile. A range of other techniques including the planting of tubestock may also be utilised where appropriate over isolated areas associated with steep slopes.

4.6.2 Establishment of Sustainable Agricultural Areas

Areas that may be established as open grassland or for potential viable and sustainable agricultural use have been identified in the flatter portions of the proposed final landform as shown in **Figure 2.1**. Revegetation may involve the use of both native and suitable exotic pasture species for the establishment of grasslands in these areas with pockets of native vegetation, which may ultimately be utilised as shelter for livestock.

In regards to the establishment of grazing areas, revegetation techniques will be consistent with local agricultural practices and are likely to involve sowing with grasses and legumes appropriate to the district and recognised as suitable for grazing. A similar mix may also be used in areas with steeper slopes to prevent scouring and subsequent soil loss.

4.6.3 Mount Owen Stringybark Creek Habitat Corridor

In regards to establishment and restoration of the Mount Owen Stringybark Creek Habitat Corridor, restoration activities should target the establishment of a linear riparian strip along Stringybark Creek that is predominantly consistent with the River-flat Eucalypt Forest vegetation community. Outside of the riparian strip, the remainder of this corridor should focus on restoration of the Central Hunter Ironbark – Spotted Gum – Grey Box Forest vegetation community.

These native vegetation communities are all likely to provide suitable habitat for the spotted-tailed quoll. Measures such as the establishment of log piles/boulder piles for potential denning habitat will also be undertaken to further enhance the habitat for this species.

4.7 Revegetation Care and Maintenance

Based on the outcomes of the rehabilitation monitoring program as outlined in **Section 5.0**, a care and maintenance program will be implemented to facilitate that rehabilitation is sustainable for the long term. The scope of this program will include as a minimum the following:

- weed and feral animal control of rehabilitation;
- erosion and drainage control works;
- re-seeding/planting of rehabilitation areas that may have failed (e.g. lack of germination, high plant mortality rate etc.);
- maintenance fertilising; and
- repair of fence lines, access tracks and other general related land management activities.

It is envisaged that this program will be continued as required until it can be demonstrated that the rehabilitation of the Project Area has satisfied the closure criteria.

Where areas have been identified as being capable of being returned to sustainable agricultural use, it will be the intention to manage these areas in accordance with their intended use as soon as practical after rehabilitation has become established. For example, following the incorporation of infrastructure such as farm dams and fencing into the rehabilitated landform, cattle grazing at low stocking rates may be introduced intermittently until the soil profile and species diversity has developed sufficiently to support more intensive sustainable grazing.

4.8 Proposed Rehabilitation Sign-Off Process

Based on the outcomes of the 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.

5.0 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 as well as non-mined areas until it can be demonstrated that rehabilitation has satisfied the closure criteria. Information from this monitoring program will also be used to refine closure criteria as required. Further details on the proposed rehabilitation monitoring are outlined below.

5.1 Active Mining Records

During active mining operations, Mount Owen will maintain active records as to mining activities and processes that may impact upon the rehabilitation and closure of the site. These records will provide the basis for developing rehabilitation strategies and interpretation of later rehabilitation monitoring outcomes. The types of records to be maintained include, but are not necessarily limited to the following:

- detailed rehabilitation procedures;
- register of contaminated sites including bioremediation areas;
- records of production wastes and other waste streams and where they are located, including where adverse overburden material layers are buried;
- environmental monitoring records, including surface and groundwater quality and results of past remediation programs;
- a register of topsoil and or soil substitute stockpiles (e.g. biosolids), which includes information such as the date in which they were formed and maintenance works undertaken (e.g. weed control, planting with native legumes to maintain microbes etc.); and
- environmental incident records.

5.2 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. Amongst the key monitoring parameters to be included in the program relate to the following:

- landform design details;
- drainage design details;

- substrate characterisation;
- site preparation techniques (e.g. topsoil and source, time of sowing, soil ameliorants used etc.);
- revegetation methodologies (e.g. rate and type of fertiliser, cover crop and rate, seed viability including watering and weed management);
- weather conditions;
- photographic records; and
- initial follow-up care and maintenance works (including watering and weed management).

5.3 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. Such issues may include erosion that has occurred due to storm events, failure of drainage structures and a lack of germination or establishment of ground cover etc. The objective of this process will be to identify potential issues early in order to minimise the extent of areas affected as well as develop mitigation strategies in a timely and cost effective manner.

As a minimum, annual inspections of rehabilitated areas will be undertaken over the life of the Project to assess soil conditions and erosion, drainage and sediment control structures, runoff water quality, revegetation germination rates, plant health and weed infestation. Outcomes of the annual rehabilitation inspection will be recorded and any required management actions that are identified as part of the inspection implemented as soon as practical as part of the rehabilitation care and maintenance program (refer to **Section 4.7**). Where necessary, rehabilitation procedures will be amended accordingly with the aim of continually improving rehabilitation standards.

5.4 Monitoring Rehabilitation Performance against Objectives and Criteria

To complement the annual 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. The monitoring program will also include non-mined areas for reference (analogue) sites. The monitoring results will provide the basis to measure the success of the rehabilitation against the closure criteria. Information from this monitoring program will also be used to refine closure criteria as required.

The monitoring program for areas being rehabilitated back to native ecosystems may not commence until revegetation has demonstrated satisfactory growth, which may take a number of years (i.e. >3 years). The exact scope of the long term rehabilitation monitoring program will be included as part of the revegetation strategy, which will be developed in consultation with DP&E, OEH and DRE. Broadly, the long term rehabilitation monitoring program will include vegetation monitoring, habitat assessment and fauna monitoring. Whilst the program will be designed to be comparable between monitoring periods, the program will also be flexible to enable the incorporation of a range of industry accepted techniques that will enable sites to be tracked against meeting the closure criteria.

As outlined in **Section 2.5**, the proposed post mining land use is primarily native ecosystem establishment. Although, subject to future feasibility studies as part of the development of the detailed mine closure plan there have been areas identified as having potential for agricultural use (refer to **Figure 2.1**). If it is confirmed that these areas or parts thereof will be returned to agricultural use, a rehabilitation program will be developed to assess performance against appropriate objectives and criteria. Such rehabilitation monitoring programs may include surveys to assess the quality and health of soils and pasture species.

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 4.7**.

6.0 Accountabilities for Implementation of the Strategy

Specific responsibilities and appropriate resources for the implementation of the mine closure and rehabilitation strategy for the Project will be detailed within the LMP. The allocation of responsibilities will be designed to promote the integration of rehabilitation and mine closure within the day to day mine planning process.

7.0 References

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APPENDIX A

Native Revegetation Species Mixes

Appendix A – Native Revegetation Species Mixes

Typical Native Revegetation Species Mix for Central Hunter Ironbark – Spotted Gum – Grey Box Forest

Family/Subfamily	Scientific Name	Common Name	Plant Form
Myrtaceae	*Eucalyptus blakelyi*	Blakely's red gum	tree
Myrtaceae	*Eucalyptus crebra*	narrow-leaved ironbark	tree
Myrtaceae	*Eucalyptus moluccana*	grey box	tree
Myrtaceae	*Corymbia maculata*	spotted gum	tree
Asteraceae	*Cassinia quinquefaria*	sifton bush	shrub
Asteraceae	*Olearia elliptica*	sticky daisy bush	shrub
Asteraceae	*Ozothamnus diosmifolius*	white dogwood	shrub
Fabaceae (Faboideae)	*Hardenbergia violacea*	false sarsaparilla	climber
Fabaceae (Faboideae)	*Daviesia ulicifolia*	gorse bitter pea	shrub
Fabaceae (Faboideae)	*Pultenaea spinosa*	spiny bush-pea	shrub
Fabaceae (Mimosoideae)	*Acacia falcata*	sickle wattle	shrub
Fabaceae (Mimosoideae)	*Acacia parvipinnula*	silver-stemmed wattle	shrub
Malvaceae	*Sida corrugata/subspicata*	sida	shrub
Pittosporaceae	*Bursaria spinosa* subsp. *spinosa*	blackthorn	shrub
Sapindaceae	*Dodonaea viscosa*	sticky hop-bush	shrub
Asteraceae	*Calotis cuneifolia*	purple burr-daisy	ground cover
Asteraceae	*Chrysocephalum apiculatum/semipapposum*	yellow buttons	ground cover
Asteraceae	*Vernonia cinerea*	-	ground cover
Asteraceae	*Vittadinia cervicularis/cuneata/sulcata*	fuzzweed	ground cover
Campanulaceae	*Wahlenbergia communis/gracilis*	bluebell	ground cover
Chenopodiaceae	*Einadia hastata/nutans*	saltbush	ground cover
Convolvulaceae	*Dichondra repens*	kidney weed	ground cover
Cyperaceae	*Lepidosperma laterale*	variable saw-sedge	ground cover
Fabaceae (Faboideae)	*Desmodium varians*	slender tick-trefoil	ground cover
Fabaceae (Faboideae)	*Hardenbergia violacea*	false sarsaparilla	ground cover
Lomandraceae	*Lomandra filiformis* subsp. *filiformis*	wattle matt-rush	ground cover
Lomandraceae	*Lomandra multiflora* subsp. *multiflora*	many-flowered mat-rush	ground cover
Myoporaceae	*Eremophila debilis*	amulla	ground cover
Phormiaceae	*Dianella caerulea* var. *caerulea*	blue-flax-lily	ground cover
Poaceae	*Aristida ramosa/vagans*	wiregrass	ground cover
Poaceae	*Austrostipa scabra* var. *scabra*	speargrass	ground cover
Poaceae	*Austrodanthonia fulva/richardsonii*	wallaby grass	ground cover

Family/Subfamily	Scientific Name	Common Name	Plant Form
Poaceae	*Bothriochloa decipiens/macra*	redgrass	ground cover
Poaceae	*Chloris ventricosa/truncata*	chloris	ground cover
Poaceae	*Cymbopogon refractus*	barbed wire grass	ground cover
Poaceae	*Cynodon dactylon*	common couch	ground cover
Poaceae	*Dichanthium sericeum*	Queensland bluegrass	ground cover
Poaceae	*Digitaria diffusa*	open summer-grass	ground cover
Poaceae	*Echinopogon caespitosus*	bushy hedgehog-grass	ground cover
Poaceae	*Entolasia stricta*	wiry panic	ground cover
Poaceae	*Eragrostis brownii/leptostachya*	lovegrass	ground cover
Poaceae	*Sporobolus creber*	slender rats tail grass	ground cover
Poaceae	*Themeda australis*	kangaroo grass	ground cover

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