LIDDELL COAL OPERATIONS

APPENDIX H

LCO Landscape Management Plan (LCO, 2013)

APPENDICES

LCO SD PLN 0034

LANDSCAPE MANAGEMENT PLAN

1. INTRODUCTION

Liddell Colliery is an open cut coal mine located approximately 25 kilometres north-west of Singleton, NSW, refer **Figure 1.1**. Liddell Colliery is operated by Liddell Coal Operations Pty Ltd (LCO) on behalf of the Liddell Joint Venture between Xstrata Coal Australia Pty. Ltd (Xstrata) and Mitsui Matsushima Australia Pty Ltd (MMA).

LCO operates under NSW development consent (DA 305-11-01) and Environmental Protection Licence (EPL No. 2094) administered under the *Protection of the Environment Operations Act 1997*. Mining operations at LCO are approved until December 2023, with production of up to 8 million tonnes per annum (Mtpa) run-of-mine (ROM) coal from its open cut operations. Existing Mining Operations are displayed in **Figure 1.2**.

1.1 Purpose

The current Liddell Colliery Landscape Management Plan (LMP) has been developed to satisfy schedule 3, conditions 30, 31, 32 and 33 of the LCO development consent (DA 305-11-01). As such, the structure of the document has been designed to incorporate Liddell Coal's strategy for mine closure, rehabilitation and final void management.

The existing LMP for Liddell Colliery was developed and approved by the Director-General of the NSW Department Planning and Infrastructure (DP&I) on 4 February 2009. This document has been developed as a revision of the approved Liddell Colliery LMP.

1.2 Commitments and Statutory Requirements

Appendix 1 outlines relevant development consent conditions 30, 31, 32 and 33, the applicable sections of the Statement of Commitments from the Environmental Assessment (EA) and the relevant section of the LMP which addresses each condition and commitment.

In addition to satisfying the relevant consent conditions, this LMP has been prepared in accordance with the relevant Xstrata Coal New South Wales (XCN) standards (refer to **Section 3.4.6**). In particular, XCN's relevant standards for mine closure planning, closure criteria development and rehabilitation monitoring as well as biodiversity management. The plan also incorporates the requirements for bushfire management.

In accordance with Schedule 5 Condition 4 of Development Consent DA 305-11-01, an Independent Environmental Audit of LCO was undertaken during 2012. While there were no non-conformances recorded for Land Management requirements, several recommendations were made and have been addressed in this revised Landscape Management Plan. The recommendations and the relevant section of the plan where they have been addressed are presented in **Table 1**.

Table 1.2: 2012 Independent Audit Rehabilitation Recommendations

Recommendation	Section where addressed in the LMP
Current vegetation strategy does not reflect the intention of the Synoptic Plan to establish connecting bushland corridors.	**3.35, 5.11, 5.53**
The rehabilitation Completion Criteria need to be refined and integrated into the existing rehabilitation Monitoring programs	**3.6, 5.277, Appendix 3,**
Topsoil management could be improved by shaping topsoil dump east of the Durham pit to gently rounded mounds and sowing a pasture crop. All topsoil dumps should be signposted.	**5.22**
A more systematic clarification of limiting soil characteristics such as pH, EC and ESP across Liddell would be beneficial and will help relate vegetation performance. This in turn will help guide soil amelioration methodology.	**5.23, 5.276**
Improvements to the waterside habitat in reservoir block can be made through the placement of large logs around the perimeter of water storages. Along with tree plantings, this would greatly enhance the habitat value of the Blue-billed duck and other dams.	**5.23, 5.522**
It would be beneficial top add two new weed species (African Olive and Acacia saligna) to the spraying program. The sprayed areas could then be sown with pasture grasses to reduce the potential for the weeds to return.	**5.43**
Other general recommendations include removal of existing rocks, erosion control in the reservoir block, provenance seed collection and aerial fertilisation programs.	**5.251, 5.23, 5.276, 5.42**

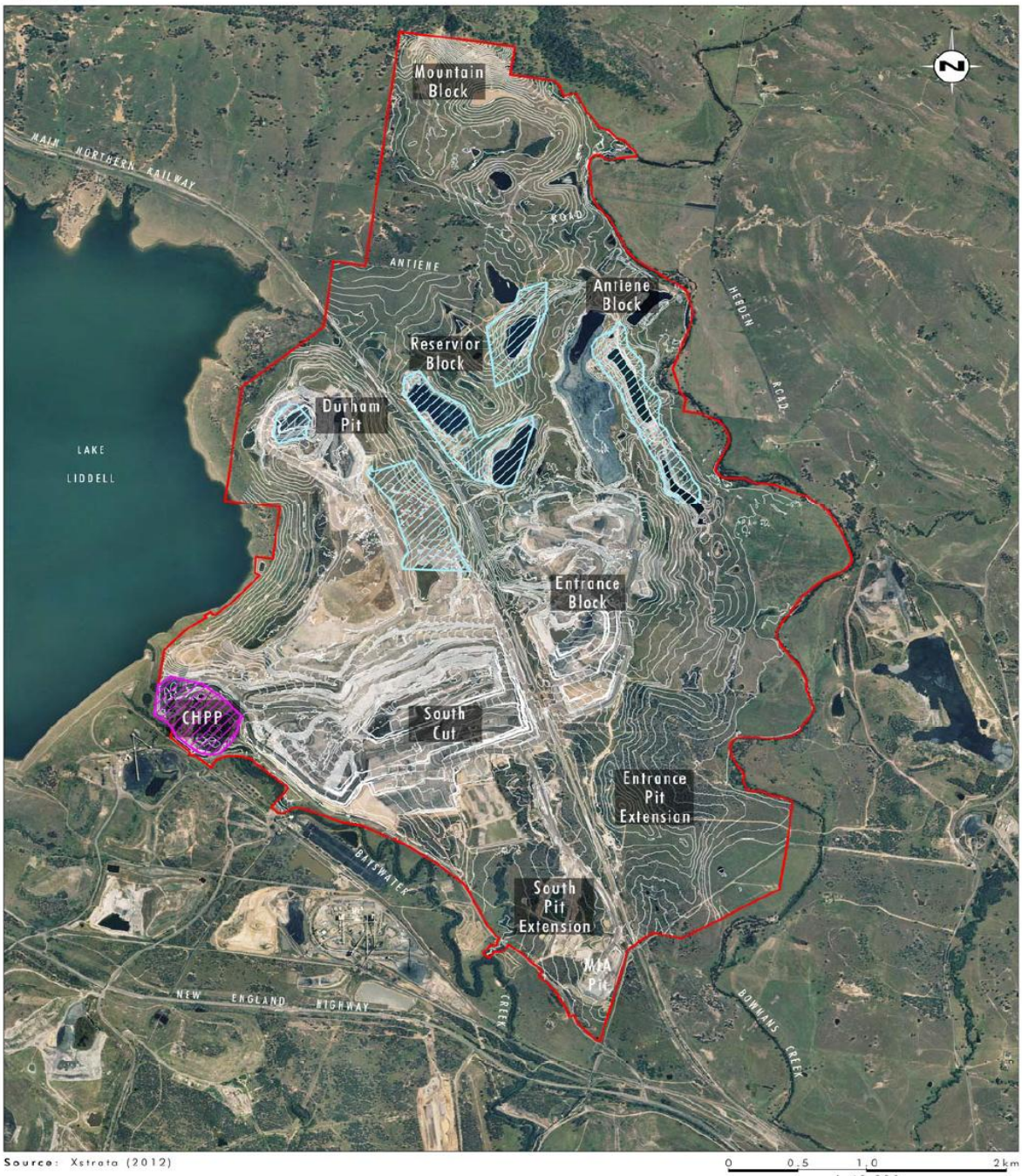
1.3 Authority Consultation

In accordance with schedule 3, condition 30 (c) this management plan has been developed in consultation with Department of Resources and Energy (DRE), NSW Office of Water (NOW), NSW Office of Environment and Heritage (OEH), Muswellbrook Shire Council (MSC), Singleton Council (SC) and the Rural Fire Service (RFS). Each authority was provided with a letter requesting comments in regards to the development of the original LMP. A copy of the correspondence with the agencies is provided in **Appendix 2**. This version of the plan is a minor revision to the original approved document and full consultation with the listed stakeholders has not been undertaken. A new Landscape Management Plan with stakeholder consultation will be prepared following the determination of the current development approval modification (MOD 5).

FIGURE 1.1

Locality Map

File Name (A4): R03_V1/2511_001.dgn
20121113 15.07



Legend
- DA Boundary
- Approved Tailings Areas
- CHPP

FIGURE 1.2
Existing Mining Operations

File Name (A4): R01/3116_003.dgn
20121011 15.17

1.4 Scope

In accordance with the XCN's mine closure standards, this document contains the Conceptual Mine Closure Plan for Liddell Colliery (**Section 3.**), which will be continually revised throughout the operational phase of the mine. The Rehabilitation Management Plan (**Section 5.**) has been designed to progressively achieve the mine closure objectives. At five years prior to mine closure, LCO will commence a detailed mine closure planning process, which will include investigations to provide that the full scope of closure issues are identified, appropriate solutions (e.g. engineering) are developed so that past mining land use objectives are met. Opportunities for alternative post mining sustainable land use options may also be investigated and a Final Void Management Plan is provided (**Section 4.**). Following the completion of these investigations, a Mining Operations Plan for Mine Closure will be prepared and submitted to the relevant government agencies for approval at least two years from the planned cessation of mining operations. The LMP also contains the Bushfire Management Plan (**Section 6.)**.

1.5 History of Operations

Liddell Colliery encompasses the former Liddell, Durham, Hazeldene and Foybrook mines, which commenced underground mining in 1923 and open cut mining in 1946. Liddell Colliery has been in continuous operation, using open cut and underground mining methods since the 1950's.

When the *Environmental and Planning Assessment Act* (EP&A Act) was gazetted in 1979, the former Liddell and Foybrook mines were actively engaged in underground and open cut mining operations which were subject to existing use rights.

In 1980, SC granted development consent to Clutha Development Pty Ltd to extend open cut mining operations at the Foybrook Open Cut Mine, with a further development consent granted two months later by MSC for mining in Foybrook North. Ownership of Foybrook Open Cut mine was transferred to BP Coal Australia in the early 1980s. In 1987 the Foybrook Open Cut mine was further extended to the north.

Underground mining operations at Hazeldene Colliery ceased in 1987 around the same time that the Foybrook Open Cut mine was transferred to Novacoal Australia. In 1989 the Liddell Joint Venture purchased the Liddell Colliery, which was granted development consent twelve months later to extend operations to the north and south using both open cut and underground mining methods. In 1993, the Liddell Joint Venture acquired the Foybrook leases, excluding the Antiene Void which was retained by Novacoal Australia for use as a tailings emplacement area for the Newdell Coal Preparation Plant.

In 1993, the Liddell Joint Venture consolidated the Foybrook and Liddell operations to form the Liddell Colliery Holding. Further development consent were granted in 1994, 1995 and 1996 for the continuation of open cut operations in the Foybrook lease and extension of operations following changes to mining permissibility under the *Mining Act 1992* which allowed for mining within 15 metres of the surface covered by surface ownership rights in the Liddell lease.

In 2002, LCO was granted development consent DA305-11-01 to continue operations and to consolidate the large number of development consent approvals. On 18 July 2007, LCO was granted a modification to this development consent under Section 75W of the EP&A Act. The modification included, but was not limited to, an increase in production, construction of a new coal handling and preparation plant (CHPP), construction of a new office and workshop complex, expansion to open cut mining areas and the creation of a new mine water dam. The following modifications have been approved since that time:

Mod 3 (February 2008) – This modification included alteration of the approved Old New England Highway office and workshop complex access road intersection and the realignment of the development consent boundary in this area. This modification also encompassed re-use of treated effluent from the office and workshop complex in Dam 13/13B to enable recycling of the treated effluent onsite; and

Mod 4 (October 2009) - This modification included minor changes to the Mining Infrastructure Area (MIA) including the construction of additional machinery workshop bays, storage sheds and compounds and an extension to the existing fuel farm including additional fuel and oil tanks.

1.6 Existing Environmental Setting

1.61 Regional Environmental Setting

The upper and central Hunter Valley has been largely cleared of native vegetation, primarily for agriculture and other land uses including mining, power generation and urban development. The predominant land uses in the vicinity of the Liddell Colliery are mining and power generation with the Mt Owen Coal Complex to the east, Lake Liddell and the Liddell and Bayswater Power Stations to the west and Ravensworth Underground Mine and associated CHPP, Ravensworth Coal terminal and the former Cumnock No.1 Colliery to the south. Other land uses in the surrounding area include rural-residential holdings, the Main Northern Railway and rail loops and the Ravensworth State Forest. The private residences surrounding Liddell Colliery are located to the north and north-east of the site. Prior to mining, the predominant land use was grazing. An area of remnant native woodland is located to the north of the Mountain Block.

The nominated end land use for Liddell Colliery is primarily grazing. However, because of the long history of clearing and the degradation of floristic diversity and fauna habitat in the central Hunter Valley, there is a strong commitment to rehabilitating the land with viable woodland as well as pasture land suitable for grazing. Reinstatement of forest, woodland and wildlife corridors is in keeping with the Department of Resources and Energy (DRE) (1999) *Synoptic Plan: Integrated Landscapes for Coal Mine Rehabilitation in the Hunter Valley of NSW.*

1.62 Local Environmental Setting

1.621 Flora and Fauna

The vegetation within the Liddell Colliery development consent area has been heavily modified and fragmented by agricultural and mining activities. The site is dominated by the Derived Grassland vegetation community which comprises a mixture of native and introduced grasses and small herbs. Seven other vegetation communities occur within the Liddell Colliery development consent area, Central Hunter Bulloak Forest Regeneration, Central Hunter Grey Box-Ironbark Woodland endangered ecological community (EEC), Swamp Oak Forest, River Oak Riparian Woodland, riparian vegetation, aquatic vegetation and rehabilitation. One flora species listed as an endangered population, tiger orchid (*Cymbidium canaliculatum*), has been recorded at a flora monitoring site located near the Mountain Block area.

The nature of the remnant woodland areas directly surrounding Liddell Colliery is not well known. The proposed habitat corridors which form a key part of the Liddell Colliery rehabilitation strategy, will provide links between these areas of unknown remnant vegetation communities. To provide that the habitat corridors provide a functional link between these remnant vegetation areas, additional investigations will be conducted to determine the nature of the remnant vegetation areas. As discussed in **Section 5.272**, one control or analogue sites have been established within remnant vegetation in order to collect the relevant baseline information required to monitor the functionality of the habitat corridors and assist with the development of closure criteria for rehabilitation areas on-site.

Six threatened bird species, the speckled warbler (*Pyrrholaemus sagittatus*), the grey-crowned babbler (*Pomatostomus temporalis temporalis*), blue-billed duck (*Oxyura australis*), brown treecreeper (*Climacteris picumnus victoriae*), hooded robin (*Melanodryas cucullata cucullata*) and the little eagle (*Hieraaetus morphnoides*) and seven threatened mammal species the eastern bentwing-bat (*Miniopterus schreibersii oceanensis*), the eastern freetail-bat (*Mormopterus norfolkensis*), the eastern cave bat (*Vespadelus troughtoni*), eastern false pipistrelle (*Falsistrellus tasmaniensis*), greater broad-nosed bat (*Scoteanax rueppellii*), large-footed myotis (*Myotis adversus*) and spotted-tailed quoll (*Dasyurus maculatus*) have been recorded within the development consent area. With the exception of the blue-billed duck, all other threatened species records are relatively commonly recorded threatened species in the Hunter region where suitable habitat exists. The blue-billed duck sightings are significant records of the species in the Hunter region, with the nearest known record occurring in the Newcastle area. No records of the blue-billed duck are known from nearby Lake Liddell.

1.622 Surface and Groundwater

Liddell Colliery is located within three catchments, Lake Liddell to the west, Bowman's Creek to the east and Bayswater Creek to the south. Bowman's Creek and Bayswater Creek drain to the Hunter River. Bowman's Creek catchment has been substantially disturbed by agricultural and mining activities. Bowman's Creek is a natural system, with significant riparian and aquatic communities, which is subject to variable water quality and flow based on fluctuations within the catchment. The catchment of Bayswater Creek has also been substantially disturbed by agricultural and mining activities and significantly reduced by the construction of Lake Liddell. The Bayswater Creek catchment downstream of Lake Liddell is estimated to be one quarter of the former catchment area. This catchment area is insufficient to maintain continuous flow in Bayswater Creek. The creek is a highly modified system engineered in its upper section to accept discharges from Lake Liddell under the Hunter River Salinity Trading Scheme (HRSTS), providing the primary source of stream flow.

The development consent area contains two forms of groundwater aquifer, the alluvial aquifers of Bowman's and Bayswater Creeks and the hard rock aquifer associated with the Wittingham Coal Measures. The underground workings located within the development consent area also contain substantial water. As mining progresses through these workings, the water is pumped from the workings to enable mining to progress.

1.623 Water Quality

This section uses the data from the 2008 LMP as it reflects a baseline level for the site.

The Liddell Colliery Surface Water Monitoring Program (Umwelt 2008) outlines the surface water monitoring required to be undertaken at Liddell Colliery to ensure compliance with statutory requirements at Liddell Colliery. Water quality has been monitored at Liddell Colliery since July 2004 at locations on Bayswater Creek and Bowman's Creek. The water quality of surface water dams and water discharged from Dam 13 has been monitored in accordance with the HRSTS. Monitoring indicates that pH levels across Bayswater and Bowman's creeks generally range from 7.3 to 8.4, with pH levels in the dams located on-site at Liddell Colliery ranging from 7.5 to 10.3. Conductivity in the creeks generally ranged from 244 µS/cm to 6080 µS/cm, with samples collected in Bayswater Creek recording levels up to 7110 µS/cm (AEMR, AECOM 2011). The results of the surface water monitoring program have indicated that despite fluctuations in some water quality parameters, water quality at Liddell Colliery has remained fairly consistent at each sampling location throughout the period of monitoring.

Monitoring of groundwater levels undertaken in piezometers in Bowman's Creek alluvium between 2002 and 2007 indicates that groundwater levels have exhibited an overall downward trend. Groundwater levels generally fluctuated over a two to five metre range. The exceptions were piezometers PGW5 Large, LC1, Haz 4, Haz 6 and Mt Owen Bore which have the same general pattern of fluctuation as the other piezometers but with greater variability associated with periods of pumping from groundwater storages.

Groundwater levels generally decreased over the monitoring period, with the exception of two alluvium piezometers located adjacent to Bowman's Creek (ALV2 and ALV8) which experienced an increase in groundwater levels from May to June 2007 associated with heavy rainfall. The overall decrease in water levels in the majority of the piezometers is likely to be related to continued low levels of rainfall throughout the monitoring period. The results of this monitoring indicate that dewatering of underground workings is not having a discernible impact on water levels in the alluvial aquifers.

The groundwater quality at Liddell Colliery has been monitored at a series of piezometers every two months since October 2002. The groundwater quality of the alluvial aquifer has been monitored at seven locations using dual piezometers and the groundwater quality of the hardrock aquifer has been monitored at five locations. This monitoring has found that the pH of the alluvial aquifer ranged from 6.7 to 9.1 excluding outliers and conductivity generally ranged from 648 µS/cm to 4890 µS/cm. pH levels in the hardrock aquifer ranged from 7.3 to 8.8 excluding outliers and conductivity in the hardrock aquifer generally ranged from 23.2 µS/cm to 5840 µS/cm (LMP, Umwelt 2008).

1.624 Land Capability

Six land capability classes (Classes IV to VIII and M) occur within the Liddell Colliery development consent area. Classes IV, V and VI dominate the majority of the Liddell Colliery development consent area, with some minor areas of Class VII land. The current mining operations have been identified as Class M.

The highest land capability class within the Liddell Colliery development consent area is Class IV which is predominately located along areas of alluvial deposits including Bowman's Creek, Chain of Ponds Creek and Bayswater Creek. The remainder of the site is dominated by Class VI land.

1.7 Preliminary Final Land Use Options and Rehabilitation Strategy

The nominated end land use for Liddell Colliery is grazing, with habitat corridors consisting of trees, shrubs and groundcover. The rehabilitation strategy aims to emulate the pre-mining grazing areas, enhance local and regional ecological linkages and provide for a sustainable land use option (Umwelt 2006). The pre-mining land capability of the site was assessed as Classes IV, V, VI and VII. The rehabilitation strategy aims to rehabilitate the site to an equivalent land capability.

The end land use and landscape design for Liddell Colliery is intended to be compatible with adjoining lands, the DRE's Synoptic Plan and more recently the Strategic Regional Land Use Plan for the Upper Hunter (Department of Planning and Infrastructure 2012).

Alternative sustainable land use options may also be investigated as part of the detailed mine closure planning phase. Where alternative options are considered both environmentally and economically feasible, consultation will be undertaken with relevant stakeholders and approvals sought (if required) prior to implementation.

2. MINE CLOSURE AND REHABILITATION STAKEHOLDER CONSULTATION STRATEGY

2.1 Stakeholder Identification Analysis

A range of stakeholders have been identified as part of the EA (Umwelt 2006). A list of these stakeholders and their potential needs pertaining to rehabilitation and mine closure is outlined in **Table 2.1**.

Table 2.1 – Stakeholder Needs Analysis

Stakeholder	**Information Requirements and Method of Consultation**
Local community	To be informed and provided with the opportunity to provide feedback in relation to rehabilitation objectives/criteria and progress throughout the life of the mine and at closure. Communication will be undertaken via periodic newsletters and face to face meetings.
Community Consultative Committee (CCC)	To be informed and provided with the opportunity to provide feedback in relation to rehabilitation objectives/criteria and progress throughout the life of the mine and at closure. Communication will be undertaken via CCC scheduled meetings.
Division of Resources and Energy (DRE)	Refer to **Sections 1.3, 2.2 and 3.33**
Environment Protection Authority (EPA)	Refer to **Sections 1.3, 2.2 and 3.37**

Stakeholder	Information Requirements and Method of Consultation
Rural Lands Protection Board	To be notified of potential impacts and remediation progress of rural lands or in relation to weed or feral animal control measures to be implemented on site. Communication will be undertaken as required.
NSW Rural Fire Service	Refer to **Sections 1.3 and 2.2**
Department of Planning & Infrastructure	Refer to **Sections 1.3, 2.2 and 3.3**
NSW Office of Water (NOW)	Refer to **Sections 1.3, 2.2 and 3.3**
Singleton Council	Refer to **Sections 1.3 and 2.2**
Muswellbrook Council	Refer to **Sections 1.3 and 2.2**
Minewatch	To be informed and provided with the opportunity to provide feedback in relation to rehabilitation objectives/criteria and progress throughout the life of the mine and at closure. Communication will be undertaken via periodic newsletters.
Surrounding land users – mines, power stations	To be informed and provided with the opportunity to provide feedback in relation to rehabilitation objectives/criteria. In particular, the potential for synergies between the mine area and these land uses (i.e. linkage of conservation corridors etc.). Communication will be undertaken as part of ongoing rehabilitation planning process.
Xstrata Coal	As per Xstrata and XCN internal communication standards.
Potential Final land user	If identified, land user should be consulted through the detailed mine closure development process in order to maximise potential opportunities to value add to the land.
Aboriginal groups	Consultation as required pertaining to the management of Aboriginal heritage sites.
Local business community	To be consulted regarding any Social Impact Assessments that may be required prior to mine closure (refer to **Section 2.4**).
Employees	Likely timing of mine closure and implications for future employment. To be communicated via Liddell Coal's internal communication procedures.

2.2 Regulatory Authorities

The closure, decommissioning and rehabilitation process for Liddell Colliery will be regulated by the DRE. The consultation strategy with the DRE will include the following:

- annual environmental inspections following the submission of the Annual Environmental Management Report (AEMR);
- submission of a Mining Operations Plan for Mine Closure;
- periodic inspections with Departmental representatives throughout the closure process; and
- the supply of 'as-constructed' drawings of the final landform for submission to the DRE on completion of closure.

Throughout the operational phase of Liddell Colliery, copies of the AEMR will be distributed to other relevant regulatory authorities to enable feedback on Liddell Coal's rehabilitation strategy and progress. If requested, the MOP for Mine Closure will also be forwarded to the other relevant regulatory authorities (SC and MSC, EPA, DP&I and NOW) for review.

During the mine closure phase, it is envisaged that each of these authorities will be invited to attend an annual status meeting to discuss the progress of closure, decommissioning and rehabilitation works until there is regulatory consensus on the successful closure of the site.

2.3 Other Relevant Stakeholders

Liddell Colliery actively seeks to engage and consult with the community to provide information relating to the rehabilitation and mine closure strategies for Liddell Colliery and to enable the community to provide feedback.

Liddell Colliery employs a variety of strategies to facilitate effective stakeholder communications including the distribution of community newsletters and one on one meetings where required. Public access to information relating to Liddell Colliery operations is available through the website: www.liddellcoal.com.au.

The Liddell Colliery Community Consultative Committee (CCC) enhances the mine's relationship with the community by providing a formal forum for interaction between the community and mine management. The CCC includes members of the local community and local government. These representatives share information from the meetings with the rest of the community and bring back items for discussion at the CCC meetings. The CCC reviews and provides advice on the environmental performance of the development, including any construction or environmental management plans, monitoring results, audit reports or complaints. The CCC will be continued during the mine closure process.

2.4 Social Impact Assessment

As per the Xstrata and XCN Mine Closure Planning Standards, a social impact assessment will be required leading up to the development of a Mining Operations Plan for Mine Closure (e.g. within five years of life of mine). The following issues may be included as part of the scope of the social impact assessment includes:

- an assessment of Liddell Colliery's expenditure patterns in the local area, community contributions, location of the residence of employees as well as potentially affected local businesses and suppliers. The aim being to identify the dependence of the local community on the mine;
- level of dependence between employees/contractors, and local/regional community such as their use of local infrastructure, e.g. where do employees send their children to school, what health facilities do they use? etc.;

- the proportion of local business provided by Liddell Colliery to local businesses/suppliers;
- potential impacts on service providers as a result of eventual closure and potential relocation of staff, e.g. schools;
- community/stakeholder views on closure options to be investigated; and
- identification of growth industries within the LGAs and other possible industries of future employment for employees following closure.

The outcomes of the social impact assessment will be utilised by LCO to determine whether there may be feasible opportunities to minimise negative social impacts of mine closure (e.g. re-training for employees; redundancy packages; building skill base in community).

The social impact assessment may also identify opportunities where LCO can provide a positive social legacy following closure. Examples may include the implementation of a sustainable final land use that will provide ongoing employment opportunities. However, any alternative final land use options would be the subject of the approval from the relevant government agencies.

3. MINE CLOSURE PLAN

The Liddell Colliery Mine Closure Plan has been developed in consideration of economic, social and environmental factors to provide that LCO meets the relevant statutory obligations, establishes a sustainable post-mining land use and achieves successful relinquishment of leases and licences.

3.1 Issues/Risks to Achieve Successful Mine Closure

A list of issues and risks that may impact upon Liddell Coal's ability to achieve successful mine closure and where they are addressed within this document is outlined in **Table 3.1**.

Table 3.1 – Issues/Risks that may affect successful Mine Closure and where they are addressed in this Plan

Issue/Risk	**Section of Report Addressed**
Failure to comply with Xstrata Standards	**Section 3.43** – Xstrata Standards and Guidelines
Failure to meet government and community guidelines and expectations	**Section 3.2** – Mine Closure Socio Economic Risks and Opportunities **Section 3.5** – Mine Closure Objectives and Criteria **Section 2.** – Stakeholder Consultation Strategy
Inadequate provision to meet the cost of both planned and unexpected mine closure	**Section 3.11** – Mine Closure Cost Estimates
Delayed relinquishment of lease due to poor rehabilitation	**Section 3.43** – Xstrata Standards and Guidelines **Section 3.82** – Care and Maintenance Period **Section 7.** – Lease and Licence Relinquishment Process
Lost opportunity on most feasible/sustainable land use option	**Section 3.43 –** Xstrata Standards
Delays in closure project	**Section 3.11** – Mine Closure Cost Estimates

Issue/Risk	Section of Report Addressed
Availability of contractors, equipment etc	**Section 3.10 -** Management of Risks Associated with Mine Closure
Inefficient use of machinery during closure	**Section 3.10 -** Management of Risks Associated with Mine Closure
Legal implications due to termination of site contracts	**Section 3.3 –** Legal and Other Requirements
Not having proper permits/approvals in place for closure activities	**Section 3.3 –** Legal and Other Requirements
Asset theft	**Section 3.10 -** Management of Risks Associated with Mine Closure
Loss of Corporate History during or after transition	Whole of Plan
Inability to maintain Operations due to extremely high turnover in workforce	**Section 3.10 -** Management of Risks Associated with Mine Closure
Delay in final closure due to extended time in asset disposal	**Section 3.10 -** Management of Risks Associated with Mine Closure

3.2 Mine Closure Socio Economic Risks/Opportunities

There are approximately 377 employees at Liddell Colliery, comprised of 342 LCO employees and 35 contractors. Employment provided by Liddell Colliery and the benefits of indirect employment have significant economic flow on effects in the local and regional communities. Substantial industry expenditure occurs locally, in the townships of Singleton and Muswellbrook, but is also directed to the broader Hunter and NSW regions.

In consideration of Liddell Colliery's contribution to the socio economic status of the community, the closure of the site may require the development of social impact mitigation strategies as part of the Mining Operations Plan for Mine Closure. Details regarding the scope of a social impact assessment that may be undertaken leading up to planned mine closure in order to identify any necessary social impact mitigation strategies is outlined in **Section 2.4**.

3.3 Implications of Legal and Other Requirements for Mine Closure

This plan has been developed to address a range of legal and other requirements, specifically in relation to rehabilitation and mine closure. A description of these legal and other requirements are detailed in the sections below.

3.31 Development Consent

Liddell Colliery is operated in accordance with development consent DA305-11-01. The development consent is valid until 31 December 2023. From that date, the consent will continue to apply in all other respects other than the right to conduct further mining operations until the site has been rehabilitated to a satisfactory standard.

Development consent conditions with relevance to mine closure are those that impose restrictions or requirements on final rehabilitation and require post-mining monitoring. Specific consent conditions relating to the preparation of this LMP are outlined in A**ppendix 1**.

3.32 Mining Leases

Liddell Colliery operates primarily under one consolidated mining lease, ML 1597. ML 1597 expires on 5 November 2028. Small parts of other leases detailed in **Table 3.2** also apply.

Table 3.2 – Leases and Licences

Instrument	Authority	Approval/Expiry
Mining Lease 1597	Division of Resources and Energy	Expires 5 November 2028
Consolidated Coal Lease No. 708	Division of Resources and Energy	Expires 30/12/2023
Mining Lease No. 1313	Division of Resources and Energy	Expires 13/10/2023
Mining lease No. 1552	Division of Resources and Energy	Expires 10/03/2025

3.33 DRE Guidelines

DRE have several guidelines and policies relevant to mine closure available on their website: www.resources.nsw.gov.au/environment. These documents have been considered in the development of this Closure Strategy.

3.34 Mining Operations Plan

The Liddell Colliery MOP (Umwelt 2007) details the continuance of mining activities during the period of 2008 to 2015. Prior to the cessation of mining operations, a new MOP detailing mine closure activities will be required to be submitted to the DRE for approval.

3.35 DRE Synoptic Plan

The DRE Synoptic Plan aims to provide a basis for the development of a long term integrated strategy for rehabilitation of mines. The rehabilitation strategy for Liddell Colliery has been developed to fulfill the Synoptic Plan and considers the potential regional outcomes for visual amenity, biodiversity and sustainable post closure use. The final landform aims to provide habitat corridors which are consistent with the intent of the broader regional corridor system outlined within the Synoptic Plan.

3.36 Strategic Regional Land Use Plan for the Upper Hunter (DP&I 2012)

The Strategic Regional Land Use Plan for the Upper Hunter 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. Amongst the various land use types, the Strategy outlines the importance of the protection of biodiversity through strategic land use planning. It recognises that post mining rehabilitation has the potential to contribute to biodiversity conservation in the longer term, but will require effective design and planning to maximise its landscape in the future.

The Strategic Regional Land Use Plan has provided a regional conservation assessment and has identified and mapped areas of high (Tier 1) and moderate (Tier 2) terrestrial and aquatic values. Several pockets of Tier 2 Terrestrial Biodiversity areas have been identified within the Ravensworth area. It is considered that the proposed final land use within Liddell Colliery will be consistent with these values, with vegetation corridors designed to facilitate linkages with the biodiversity values of the broader area.

3.37 Environment Protection Licence

Liddell Colliery operates under Environmental Protection Licence (EPL) 2094. The licence is held by Liddell Coal.

Fees for the EPL are based on production levels of saleable material. The current production level category for the EPL is 3.5 to 5 Million tonnes per annum (Mtpa) of saleable material. During operation, this will be increased to 5 Mtpa of saleable material at peak production, and then reduced as the productions level decline.

The EPL specifies monitoring 'points' and these are detailed in **Table 3.3** and **Figure 3.1**.

Table 3.3 – Monitoring Points Specified in Liddell Colliery EPL 2094 (14 Dec 2011 version)

Monitoring Point	Pollutant/ parameter measured	Units of Measure	Frequency	Location
1 – Total Suspended particulate network, PM10 and Total Suspended Particles	PM_{10}	$\mu g/m^3$	Every 6 days	At locations where the level of particulate matter being sampled is representative of emissions from the operation of the mine taking into account prevailing wind direction and the location of residential properties or other sensitive receivers
	TSP	$\mu g/m^3$	Every 6 days	
2 - Hunter River Salinity Trading Scheme discharge and monitoring point	Conductivity	µS/cm	Continuous during discharge	Discharge point located at Dam 13, south of siphons, upstream of discharge flume and labelled 'Licence Discharge Point' on plan no. LOC/A4/253 titled 'LCO Operations Licence Discharge Points and Downstream Sampling Location' dated 24/2/00.
	Total Suspended Solids	mg/L	Daily when wastes discharged	
	pH	pH	Daily when wastes discharged	
3 - Dust Deposition Network	Deposited Matter	$g/m^2/month$	Once a month (min of 4 weeks)	Dust deposition monitoring sites as shown on drawing titled 'Figure 1 LCO Noise, Dust and Blast Monitoring Locations' on file 270051A14 with NEF14618 dated 17 June 2004.

Monitoring Point	Pollutant/ parameter measured	Units of Measure	Frequency	Location
4 – Weather Monitoring	Rainfall Wind speed @10m Wind direction @10m Temperature @ 2m Temperature @10m Sigma Theta @10m	mm m/s degrees Deg C Deg C Degrees	Continuous	At a location where the parameters being sampled are representative of the prevailing weather conditions of the licence area.
5 – Discharge to waters. Discharge quality monitoring	Faecal coliforms	Once a month (min of 4 weeks)	Grab sample	Discharge from the wastewater treatment plant to Dam 13/13B shown on figure 2.1 of the "SEE for Liddell Colliery Modification to Development Consent" dated February 2008.

Legend

- DA Boundary
- CHPP Infrastructure
- Depositional Dust Monitoring site
- High Volume Air Sampler - PM10
- High Volume Air Sampler - TSP
- Private Residence
- Mine Owned Tenanted Residence

File Name (A4): R01/3116_004.dgn
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FIGURE 3.1

Liddell Colliery EPL Monitoring Points

In most cases following mine closure, the EPA will generally not relinquish the EPL until such time that DRE has signed-off on the successful rehabilitation of the site. Measures to provide for compliance with the EPL have been considered as part of this document and an annual return for the EPL will be required until the licence is relinquished.

It is likely that EPA will require that monitoring of air quality and any discharge water be continued during active decommissioning works and potentially as part of post mine closure until the site is fully decommissioned and rehabilitated. The exact scope of ongoing monitoring will be confirmed with EPA as part of the development of the Mining Operations Plan for Mine Closure.

Upon the cessation of mining operations, LCO will seek a variation to the existing licence to reflect mine closure activities as opposed to an operating mine (e.g. monitoring conditions, licence fee activity scale).

At the completion of closure or at such time that EPA has confirmed that an EPL is no longer required for the site, following the approval of XCN and application to relinquish the EPL will be submitted to EPA. The application will need to be accompanied with support documentation to demonstrate that there will be no ongoing pollution issues associated with the site.

Further to the EPL, Liddell Colliery also holds a licence in regards to the management of density gauges on site that contain radioactive materials (refer to **Table 3.4**).

Table 3.4 - Radiation Density Gauge Licences

Radionuclide	EPA Registration Number	Nominal Activity
Am-241	1259 exp 23/6/14	1100MBq
Cs-137	1260 exp 23/6/14	370 MBq
Cs-137	20152 exp 1/12/14	7.4GBq
Cs-137	20153 exp 1/12/14	7.4GBq
Cs-137	20148 exp 1/12/14	370 MBq

Prior to the decommissioning of the CHPP infrastructure at closure, LCO will be required to either dispose of the gauges in an EPA approved manner or through consultation with EPA, transfer the licence if sold for use by another operation.

3.38 Water Licences

A list of the water licences that are held for Liddell Colliery is provided in **Tables 3.5** and **3.6**.

Table 3.5 – Liddell Colliery Surface Water Licences

Site	Instrument	Authority	Issue Date	Expiry Date
Bowman's Creek	Licence No. WAL 18320 Irrigation – 50ML annually	NOW	5/04/2002	Ongoing
Bayswater Creek	Licence No. WAL 18306 Industrial – 100 ML annually	NOW	5/11/2001	Ongoing
Hunter River	Licence No. WAL 13387 Industrial – 20 ML annually	NOW	N/A	N/A
Hunter River via Macquarie Generation	Licence No. WAL 7815 Industrial – 20ML annually	NOW	13/08/2008	Ongoing
Bowmans Creek	WAL 18304 Irrigation – 32 ML annually	NOW	N/A	N/A
Bowmans Creek	WAL 18318 Irrigation – 55 ML annually	NOW	N/A	N/A
Bowmans Creek	WAL 18302 5ML annually	NOW	1/8/2009	31/7/2019

Note: N/A – Information not available

Table 3.6 – Liddell Colliery Groundwater Licences

Site	Instrument	Authority	Issue Date	Expiry Date
Haz 6	Licence No. 20BL168066 Monitoring Bore	NOW	28/05/2002	In perpetuity
Dur 3	Licence No. 20BL168065 Monitoring Bore	NOW	28/05/2002	In perpetuity
LC1	Licence No. 20BL168064 Monitoring Bore	NOW	27/05/2002	In perpetuity
Durham 1	Licence No. 20BL168063 Mine Dewatering – 6000ML annually	NOW	22/09/2004	21/09/2014
8 South 1 & 2	Licence No. 20BL168062 Mine Dewatering – 6000 ML annually	NOW	22/09/2004	21/09/2014
Durham 2 & 4	Licence No. 20BL168061 Mine Dewatering – 1000 ML annually. Dur 4 redundant	NOW	22/09/2004	21/09/2014
Haz 1 & 2	Licence No. 20BL168060 Mine Dewatering – 5500ML annually	NOW	22/09/2004	21/09/2014
ALV1, ALV2, ALV3, ALV4, ALV7, ALV8	Licence No. 20BL168053 Monitoring Bores	NOW	23/03/2001	In perpetuity
463 Hebden Road, Ravensworth	Licence No. 20BL020923 Irrigation	NOW	N/A	N/A
M49	Licence No. 20BL172293 Mine Dewatering	NOW	5/02/07	12/2/2014
Middle Liddell	Licence No. 20BL172588	NOW	16/9/2010	15/9/2015

Note: N/A – Information not available

There are no specific conditions within these licences that relate to mine closure however, at mine closure, the mine dewatering boreholes will be sealed in accordance with the DRE's guidelines. Where no longer required, groundwater monitoring boreholes will also be sealed.

3.4 Planning Requirements

3.41 State Planning Policies

The *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (the Mining SEPP) applies to mining and associated activities at Liddell Colliery. Section 10 of the Mining SEPP outlines a range of exempt development, which does not require approval under the EP&A Act. Exempt development listed under the Mining SEPP that specifically relates to the decommissioning process includes the demolition of a building or structure that is carried out in accordance with *AS 2601 – 2001 Demolition of Structures*. However, this is only if the building or structure is not or is not part of a heritage item, or in a heritage conservation area identified by an environmental planning instrument.

3.42 Local Environmental Plans

Liddell Colliery is divided between the Singleton and Muswellbrook Local Government Areas (LGAs). As a result both the Singleton Local Environmental Plan (LEP) 1996 and the Muswellbrook LEP 2012 apply. The rehabilitation and closure strategy has been developed in consideration of the objectives of each of these LEPs. Amendments that may occur to these LEPs will be evaluated as part of ongoing revisions to this LMP and in the development of the Mining Operations Plan for Mine Closure.

3.421 Singleton Local Environmental Plan 1996

The Liddell Colliery area within the Singleton LGA is classified as 1(a) Rural Zone. The objectives of 1(a) Rural zone are:

- to protect and conserve agricultural land and to encourage continuing viable and sustainable agricultural land use;
- to promote the protection and preservation of natural ecological systems and processes;
- to allow mining where environmental impacts do not exceed acceptable limits and the land is satisfactorily rehabilitated after mining;
- to maintain the scenic amenity and landscape quality of the area;
- to provide for the proper and co-ordinated use of rivers and water catchment areas; and
- to promote provision of roads which are compatible with the nature and intensity of development and the character of the area.

3.422 Muswellbrook Local Environmental Plan 1985

The Liddell Colliery area within the Muswellbrook LGA is classified as RU1 Primary Production, with the CHPP area classified as SP2 Infrastructure.

The objectives of zone RU1 Primary Production are:

- To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.
- To encourage diversity in primary industry enterprises and systems appropriate for the area.
- To minimise the fragmentation and alienation of resource lands.
- To minimise conflict between land uses within this zone and land uses within adjoining zones.
- To protect the agricultural potential of rural land not identified for alternative land use, and to minimise the cost to the community of providing, extending and maintaining public amenities and services.

- To maintain the rural landscape character of the land in the long term.
- To ensure that development for the purpose of extractive industries, underground mines (other than surface works associated with underground mines) or open cut mines (other than open cut mines from the surface of the flood plain), will not:
  a) destroy or impair the agricultural production potential of the land or, in the case of underground mining, unreasonably restrict or otherwise affect any other development on the surface;
  b) detrimentally affect in any way the quantity, flow and quality of water in either subterranean or surface water systems; or
  c) visually intrude into its surroundings, except by way of suitable screening.
- To protect or conserve (or both):
  a) soil stability by controlling development in accordance with land capability;
  b) trees and other vegetation;
  c) water resources, water quality and wetland areas, and their catchments and buffer areas, and
  d) valuable deposits of minerals and extractive materials by restricting development that would compromise the efficient extraction of those deposits.

The key objectives of SP2 Infrastructure zone that are relevant to Liddell Colliery are to:

- To provide for infrastructure and related uses.
- To prevent development that is not compatible with or that may detract from the provision of infrastructure.
- To recognise existing railway land and to enable future development for railway and associated purposes.
- To recognise major roads and to enable future development and expansion of major road networks and associated purposes.
- To recognise existing land and to enable future development for utility undertakings and associated purposes.

3.43 Xstrata Standards and Guidelines

Further to the legal requirements as outlined above, Xstrata has undertaken a pro-active approach to rehabilitation and mine closure by developing a range of standards that are to be implemented across its business units. This plan has been prepared to address the requirements of these standards that are outlined in the sections below.

3.431 Xstrata Plc Standard – Planning, Resources and Targets

It is an Xstrata Plc Standard requirement that an Annual HSEC Plan (for internal purposes only) is to include a closure plan that:

- provides an assessment of all operational closure impacts;
- includes a fully costed closure plan, which is reviewed on an annual basis; and
- includes operational provisioning for closure.

3.432 Xstrata Plc Standard – Biodiversity and Land Management

It is an Xstrata Plc Standard requirement that:

- biodiversity considerations shall be addressed when determining post-closure land use and the rehabilitation or restoration of ecosystems as appropriate; and
- all disturbed and contaminated land shall be progressively rehabilitated and wastes generated by operations shall be effectively managed to a planned post-closure land use.

3.433 Xstrata Coal and XCN Mine Closure Standards

The XCN Mine Closure Standard has been developed to be consistent with the Xstrata Coal Mine Closure Planning Standard; the Xstrata Coal Project Management Manual, which outlines the process for project planning and approvals; and the Xstrata Coal Life of Mine Planning Process. The XCN mine closure planning process includes the trigger points and associated timeframes for the phases of mine closure planning, which includes:

- The development and review of a Conceptual Mine Closure Plan.

  A Conceptual Closure Plan is required where a reserve has a Life of Mine (LOM) greater than five years and includes all new operations. Conceptual closure planning commences during the feasibility, project planning and operational phases of a mine until a Detailed Project Closure Plan is required.
- The process of Detailed Closure Planning, which involves both Pre-feasibility and Feasibility phases to define and develop the scope of a Project Closure Plan.

  The Detailed Closure Planning process is required to be initiated where a reserve has a LOM of less than 5 years. The process requires detailed investigations to provide that the full scope of closure issues are identified, appropriate solutions (e.g. engineering) are developed and adequate provisions are accrued so that post mining land use objectives are met following the execution of a Project Closure Plan (i.e. MOP for Mine Closure).

The XCN Mine Closure Planning Standard also defines the requirements for the development of closure costing and outlines the pathway for obtaining sign-off for lease and licence relinquishment (refer to **Sections 3.11** and **7.0** respectively).

As the life of mine for Liddell Colliery is greater than five years, this document has been prepared in accordance with the requirements of the XCN Mine Closure Standard in relation to the preparation of conceptual mine closure plans.

3.434 XCN Standard for Closure Criteria Development and Rehabilitation Monitoring

This XCN Standard provides guidance to XCN business on developing site specific rehabilitation monitoring programs that will:

- provide the scientific basis for defining rehabilitation objectives and for developing closure criteria and a rehabilitation program that will facilitate lease relinquishment following mine closure;
- assess the long-term stability and functioning of re-established ecosystems on mine affected land; and
- facilitate continuous improvement in rehabilitation practices.

Details regarding the implications of the standard on the development of closure criteria and rehabilitation monitoring for Liddell Colliery are outlined in **Sections 5.1** and **5.27** respectively.

3.44 Other Approvals, Standards and Guidelines

3.441 Strategic Framework for Mine Closure

The Strategic Framework for Mine Closure (ANZMEC and 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 3.7**, along with the relevant section of this document where they are addressed.

Table 3.7 – Key Objectives from the Strategic Framework to be addressed in MOP for Mine Closure Document

Key Objectives	Relevant Section of Document
To enable all stakeholders to have their interests considered during the mine closure process	2.1
To ensure the process of closure occurs in an orderly, cost-effective and timely manner	3.
To ensure that the cost of closure is adequately represented in company accounts and that the community is not left with a liability	3.11
To ensure there is clear accountability and adequate resources for the implementation of the closure plan	1.2
To establish a set of indicators which will demonstrate the successful completion of the closure process	3.5
To reach a point where the company has met agreed completion criteria to the satisfaction of the responsible authority	3.5

3.442 Australian Minerals Industry Code for Environmental Management

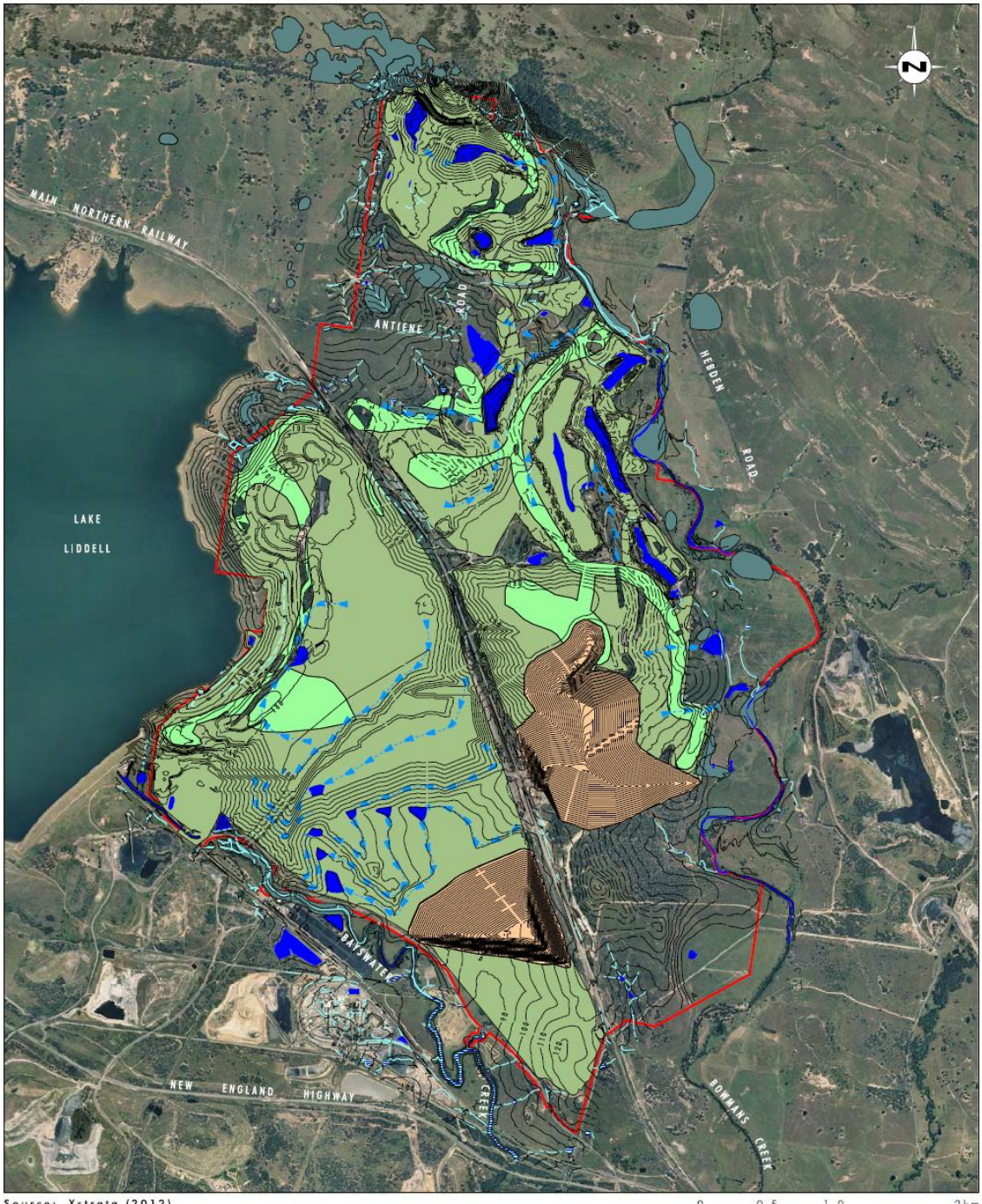
Enduring Value is the Australian Minerals Industry Framework for Sustainable Development. Enduring Value outlines 10 principles that outline the industries commitment to sustainable development. As a business unit of XCN, a signatory to Enduring Value, LCO is committed to adhering to these principles. The objectives relating to mine closure within Enduring Value (contained within Principle 6) are included in **Table 3.8**, along with the relevant section of this document where they are addressed.

Table 3.8 – Key Objectives from Enduring Value Relating to Mine Closure

Enduring Value Objective	**Relevant Section of Document**
Rehabilitate land disturbed or occupied by operations in accordance with appropriate post-mining land uses.	
Consult relevant stakeholders and develop a closure plan that clearly defines the post closure land use.	2.1 and 3.
Where appropriate, rehabilitate progressively over the life of the operation.	5.
Undertake and support research into land and water rehabilitation practices.	5.
Use appropriate technologies to reduce negative environmental impacts and improve site rehabilitation techniques.	5.
Manage and, where appropriate, rehabilitate historical disturbances to an appropriate standard.	5.
Design and plan all operations so that adequate resources are available to meet the closure requirements of all operations.	
Plan operations to minimise costs and risks; comply with relevant laws, standards and guidelines; maximise sustainable development opportunities; and deliver post closure landforms that are safe and stable from physical, geotechnical and ecological perspectives.	3.3, 3.10, 4.
Provide adequate resources to achieve social objectives of closure including any costs associated with community dislocation.	2.4
Set aside funds externally held and not accessible for other purposes to implement the closure plan and to undertake post closure monitoring and maintenance, taking risk into account.	3.11
Periodically review closure plans in the light of changing regulatory requirements and community expectations.	7.

3.5 Mine Closure Objectives

The EA (Umwelt 2006) identified the nominated end land use for Liddell Colliery following rehabilitation as pasture designed to emulate the pre-mining grazing areas. The end land use also includes habitat corridors to enable the protection and preservation of natural ecological systems and processes by linking existing areas of vegetation in surrounding areas. The conceptual final landform and rehabilitation strategy for Liddell Colliery is shown in **Figure 3.2**.



Source: Xstrata (2012)
Note: Contour Interval 5m

0 0.5 1.0 2km
1:40 000

Legend

- DA Boundary
- Remnant Vegetation
- Rehabilitation Habitat Corridors
- Rehabilitation Pasture
- Final Void
- Clean Water Dam
- Stabilised Drainage Line

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FIGURE 3.2

Conceptual Final Landform and Rehabilitation Strategy

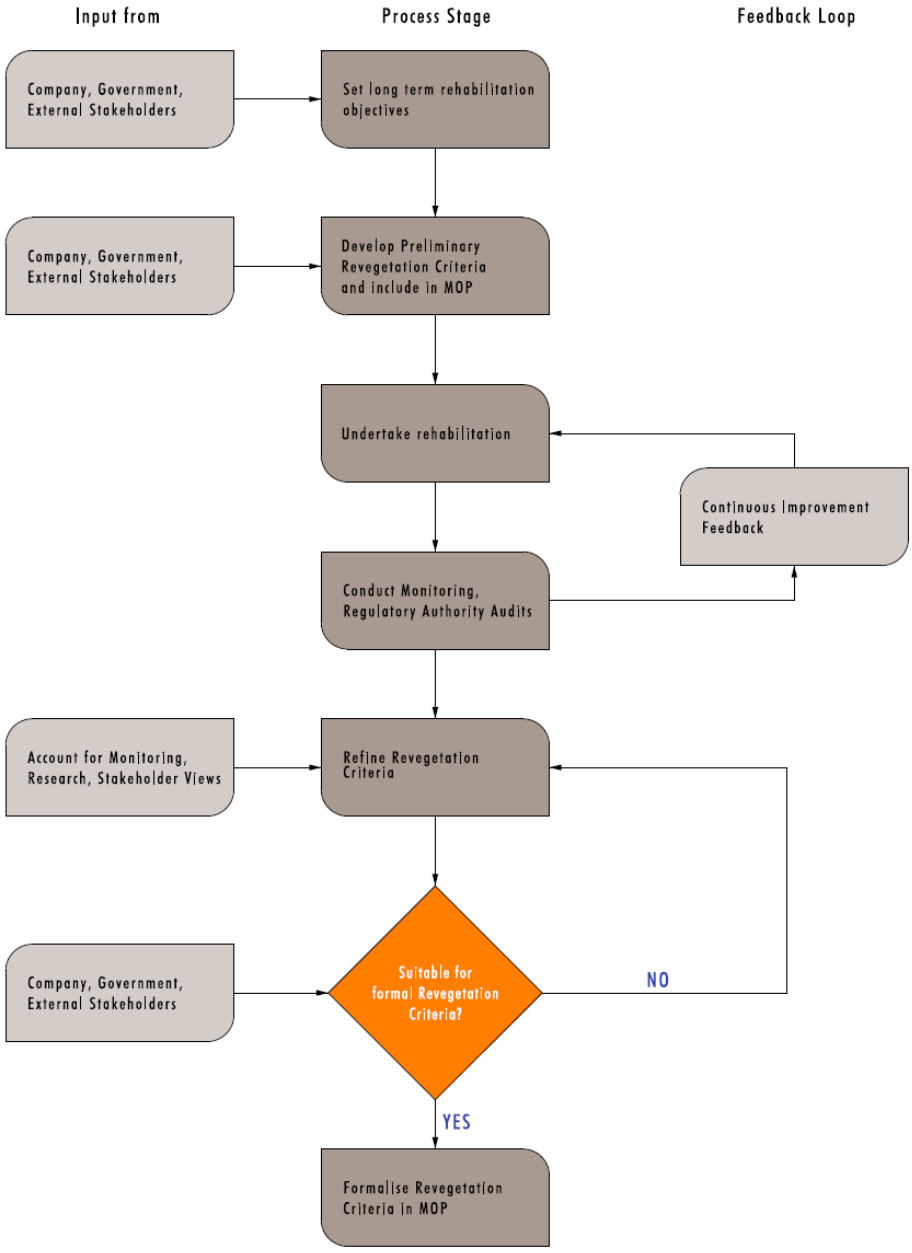

FIGURE 3.3

XCN Process for Developing and Refining Rehabilitation Closure Criteria

Source: Adapted from Nichols 2006

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3.6 Closure and Rehabilitation Completion Criteria

Completion criteria are objective target levels or values assigned to a variety of indicators (i.e. slope, species diversity, groundcover etc.), which can be measured against to demonstrate progress and ultimate success of rehabilitation. As such, they provide a defined end point, at which point in time rehabilitation can be deemed successful and the lease relinquishment process can proceed.

Completion criteria, determined in 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 AEMR.

The preliminary closure and rehabilitation completion criteria for the Project are outlined in **Appendix 3**. The criteria have been developed considering site specific issues and objectives, and the relevant XCN Standard.

As illustrated in **Figure 3.3**, the preliminary closure completion criteria will be reviewed and revised throughout the mine life and used as the basis for further refinement following the commencement of rehabilitation activities; consideration of the results of rehabilitation monitoring programs and research trials; and consideration of stakeholder feedback. The completion criteria will be refined and finalised following the completion of the detailed mine closure planning process and presented in the Mining Operations Plan for Mine Closure for approval by the relevant government agencies.

The gradual achievement (or otherwise) of these completion criteria will be assessed and discussed in the annual documentation of monitoring results, which will include the identification of any failures of the criteria, and measures taken to address any such issue. Rehabilitation monitoring is discussed in **Section 5**.

The annual rehabilitation monitoring program will be modified whenever the completion criteria are revised. In 2012, the annual rehabilitation monitoring program was reviewed and updated to ensure the current completion criteria are being assessed appropriately.

3.7 Life of Mine Closure Schedule

During the operational phase, rehabilitation will be undertaken progressively to minimise the total disturbed area at closure.

The current Life of Mine schedule for Liddell Colliery involves the cessation of coal mining in 2023. At this point in time, the decommissioning phase will include activities such as building and infrastructure demolition, capping of tailings dams, overburden reshaping and revegetation activities. The likely duration of the decommissioning phase will be confirmed following the completion of the Mining Operations Plan for Mine Closure. However, given the size of the operation, a two to three year period may be required.

Following the completion of decommissioning works, a rehabilitation care and maintenance program (refer to **Section 3.82**) will be implemented. The aim of this program is to provide that rehabilitated areas are maintained and monitored with the goal of achieving completion criteria and DRE sign off.

3.8 Phases of Mine Closure

3.81 Decommissioning and Rehabilitation Phase

The decommissioning and rehabilitation phase of mine closure will commence upon completion of mining activities in 2021. The details of the decommissioning and rehabilitation phase will be documented as part of a Mining Operations Plan for Mine Closure. The decommissioning and rehabilitation phase will involve:

- the progressive decommissioning of all on-site infrastructure, including the CHPP, administration buildings and train loading facilities;
- removal and rehabilitation of haul roads and rail crossings;
- the completion of contamination studies for relevant areas and subsequent decontamination where required;
- shaping of remaining overburden areas and lowwalls;
- stabilisation of highwall treatments and establishment of safety features (e.g. safety berm and fence);
- capping of tailings dams;
- revegetation activities; and
- maintenance of existing rehabilitation.

Appropriate pollution control measures will be incorporated in decommissioning works to minimise potential impacts on noise, air quality, visual amenity and erosion.

3.82 Rehabilitation Care and Maintenance Phase

Dependent upon the outcomes of the rehabilitation and environmental monitoring programs, the scope of the rehabilitation care and maintenance phase may include the following:

- weed and feral animal control of rehabilitation and offset areas;
- erosion control works and or modification to surface water drains;
- re-seeding/planting of rehabilitation areas that may have failed;
- maintenance fertilising; and
- repair of fence lines, access tracks and other general related land management activities.

It is envisaged that an employee will be required to project manage the care and maintenance phase post-closure to provide for the achievement of lease relinquishment in a timely and cost effective manner.

3.9 Environmental Monitoring

Liddell Colliery has an extensive environmental monitoring network. The requirements of all environmental monitoring are recorded in the Liddell Colliery Environmental Monitoring Program. It is anticipated that various aspects of the environmental monitoring program will continue to be implemented throughout decommissioning works as well as post closure. The exact scope of environmental monitoring will be developed in consultation with the appropriate regulatory authority and included in the Mining Operations Plan for Mine Closure prior to the commencement of decommissioning activities.

During the decommissioning period, a range of pollution control measures will need to be adopted to minimise the potential of escalating noise levels and dust impacts, particularly as machinery will be working at the surface and will not be shielded within the confines of the mining pit, which provides a buffer against noise and dust generation. The continuation of an environmental monitoring program during this period will allow LCO to measure the effectiveness of pollution control measures adopted on site. Based on the outcomes of environmental monitoring, changes to surface activities and or pollution control measures may be required to reduce pollution levels. Following the completion of decommissioning works, further consultation will be undertaken with the appropriate regulatory authorities to tailor an environmental monitoring program for the rehabilitation care and maintenance phase. Proposed variations to the monitoring program may include a reduction and or removal of environmental monitoring points (such as dust and noise monitoring).

An overview of the environmental monitoring requirements that may apply through active decommissioning works and potentially into the rehabilitation care and maintenance phase are outlined below. The results of environmental monitoring will be included in the AEMR.

3.91 Surface Water Monitoring

The requirements of the Liddell Colliery Surface Water Monitoring Program (refer to the Liddell Colliery Water Management Plan) developed in accordance with the development consent and the EPL include the requirement to monitor the following:

- volume and quality of water discharged from the site under the Hunter River Salinity Trading Scheme;
- surface water flows and quality upstream and downstream of the development in Bowman's Creek and Bayswater Creek; and
- surface water quality in on site dams.

Surface water monitoring locations are shown on **Figure 3.4**.

FIGURE 3.4

Liddell Colliery Surface and Groundwater Monitoring Locations

3.92 Groundwater Monitoring

The requirements of the Liddell Colliery Groundwater Monitoring Program (refer to the Liddell Colliery Water Management Plan) developed in accordance with the development consent, requires LCO to monitor:

- the volume of groundwater seeping into the open cut mine workings;
- regional groundwater levels and quality in the surrounding aquifers; and
- the groundwater pressure response in the surrounding coal measures.

Groundwater monitoring locations are shown on **Figure 3.4**.

3.93 Noise Monitoring

The requirements of the Noise Monitoring Program, developed in accordance with the development consent, requires LCO to undertake attended and unattended noise monitoring at the locations shown on **Figure 3.5**.

3.94 Air Quality Monitoring

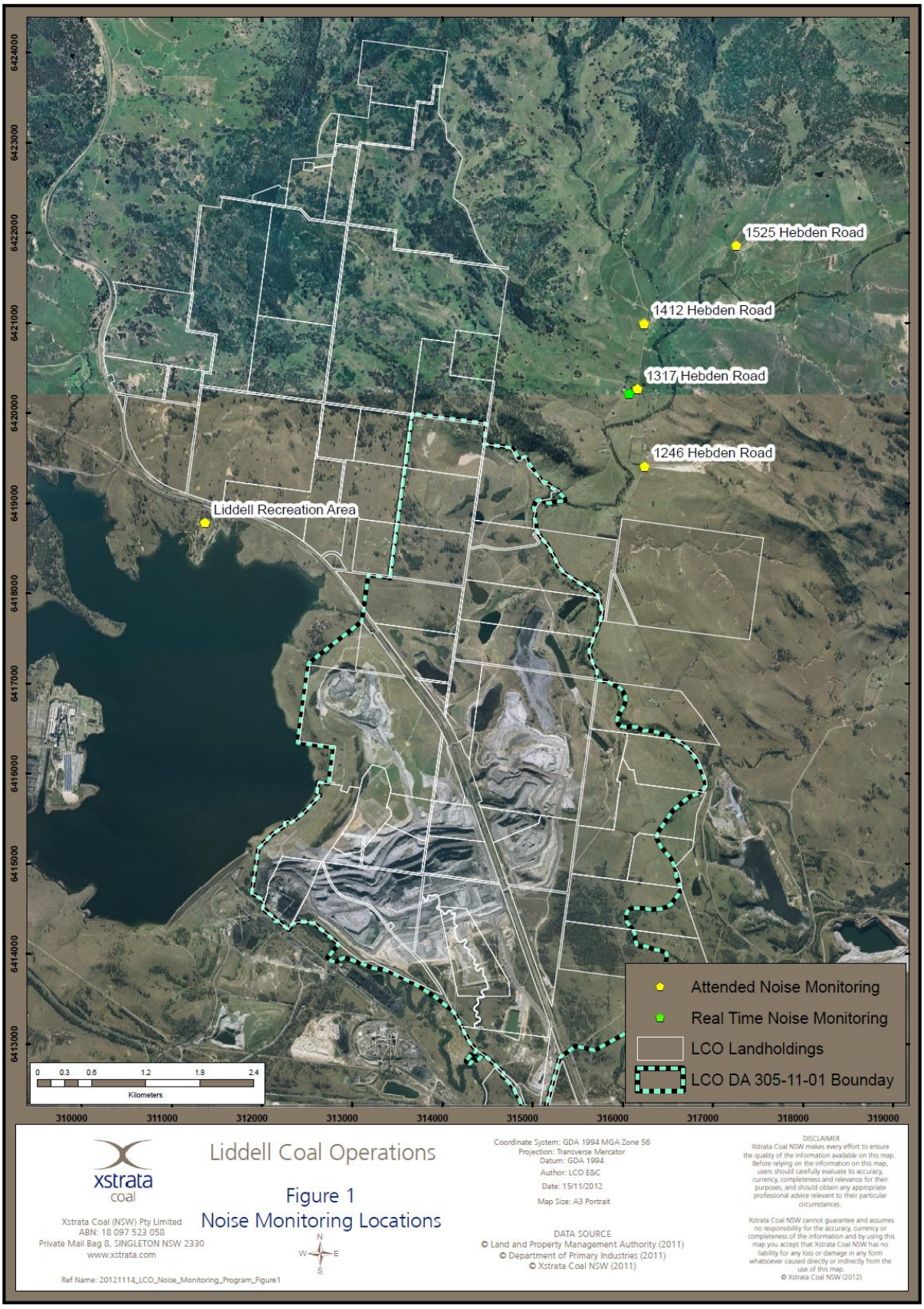
The Liddell Colliery EPL and Air Quality Monitoring Program developed in accordance with the development consent require LCO to undertake air quality monitoring of depositional dust, PM_{10} and TSP. Ambient air monitoring is required to determine representative emissions from the operation of the mine and is required to continue until rehabilitation works at Liddell Colliery have ceased. The current air quality monitoring locations are provided on **Figure 3.1**.

3.95 Meteorological Monitoring

The Liddell Colliery weather station is utilised for measuring rainfall, temperature, wind direction and wind speed. It is envisaged that the weather station would be maintained until lease relinquishment with the aim of providing meteorological support data to other environmental and rehabilitation monitoring programs on site.

3.96 Rehabilitation Monitoring

Rehabilitation monitoring will continue throughout the care and maintenance period. Monitoring to be undertaken in the post rehabilitation phase of the mine operation is outlined in **Section 5.27**.


1525 Hebden Road
1412 Hebden Road
1317 Hebden Road
1246 Hebden Road
Liddell Recreation Area
Attended Noise Monitoring
Real Time Noise Monitoring
LCO Landholdings
LCO DA 305-11-01 Bounday
0 0.3 0.6 1.2 1.8 2.4
Kilometers
6424000
6423000
6422000
6421000
6420000
6419000
6418000
6417000
6416000
6415000
6414000
6413000
310000
311000
312000
313000
314000
315000
316000
317000
318000
319000
Liddell Coal Operations
Figure 1
Noise Monitoring Locations
Xstrata Coal (NSW) Pty Limited
ABN: 18 097 523 058
Private Mail Bag B, SINGLETON NSW 2330
www.xstrata.com
Ref Name: 20121114_LCO_Noise_Monitoring_Program_Figure1
Coordinate System: GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994
Author: LCO E&C
Date: 15/11/2012
Map Size: A3 Portrait
DATA SOURCE
© Land and Property Management Authority (2011)
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3.10 Management of Risks Associated with Mine Closure

The Mining Operations Plan for Mine Closure and associated cost estimates (refer to **Section 3.11**) will be developed to address the key issues/risks that may affect successful mine closure. Amongst the issues to be addressed include:

- delays in closure project;
- availability of contractors, equipment;
- inefficient use of machinery during closure;
- legal implications due to termination of site contracts;
- site security/asset theft;
- inability to maintain operations due to extremely high turnover in workforce; and
- delay in final closure due to extended time in asset disposal.

3.11 Mine Closure Cost Estimates

As per the XCN Mine Closure Standard, LCO has developed cost estimates for the following two mine closure scenarios:

- Planned mine closure at 2023.

  LCO has prepared a cost estimate for planned mine closure, which has been used as the basis for the implementation of a mine closure accrual system. The objective of this accrual system is to provide that sufficient funds are available to undertake and satisfactorily complete mine closure activities.

  Costs for planned mine closure are calculated on the costs incurred following the cessation of coal mining. All costs incurred up until this time, including progressive rehabilitation, are considered as operational costs.

  As per XCN requirements, these costs are to be reviewed internally only by XCN and LCO on an annual basis and closure accruals adjusted accordingly. As the scope of mine closure activities become more defined closer to the closure date, cost estimates will be further refined based on the outcomes of detailed closure planning.
- Imminent mine closure, which is the basis for the self-calculated security deposit required by DRE.

  This estimate, which is calculated in accordance with the DRE's Security Calculation Tool, is reviewed annually and if substantial change has occurred (+/- 10%) a revised estimate is submitted to DRE.

4. FINAL VOID MANAGEMENT PLAN

The proposed final landform at Liddell Colliery will contain two final voids. The final voids will be located within the South Pit and Entrance Pit areas. The depth and area of the final voids will be dependent on the timing of mine closure and decommissioning, and the extent of mining conducted on the site at the time of closure. The conceptual final voids are shown on the final landform plan, refer to **Figure 3.2**.

The main objectives of final void management will be to:

- minimise the area of disturbance and maximise the area of land restored to its former land capability;
- provide a landform which is stable and able to be maintained in the long term; and
- provide for a minimal risk to public safety.

Specific rehabilitation criteria/requirements for the highwall and lowwalls of the final voids will include the following:

- where practical, bulk earthworks on internal benches and lowwalls will be undertaken to achieve a final landform of 18º or less;
- material recovered from highwalls will be used to cover exposed coal seams and other carbonaceous material; and
- a geotechnical assessment will be undertaken on the remaining highwall to determine the extent of stabilisation works required. At a minimum, a safety berm, trench and security fence will be established along the remaining highwall to provide for public safety.

The current proposed use for the final voids at Liddell Colliery is for water storage. However, during the life of the mine and during the detailed mine closure planning process (e.g. at least five years from closure) LCO will undertake a review of opportunities for final void use in consultation with the appropriate government agencies. Other potential opportunities for utilisation of the final voids at Liddell Colliery, which will require further investigation will include:

- storage of fly ash from nearby power stations or as a coal reject disposal area for other nearby mining operations; and
- access to potential future underground coal reserves.

Further detailed assessment will be required prior to determining the most suitable post mining land use for the final voids. Amongst the issues to be assessed would include:

- groundwater and surface water management;
- long term geotechnical stability of the void walls;
- sealing of coal seams in the final highwall and end wall to prevent any spontaneous combustion;
- rehabilitation and revegetation for visual amenity and long term stability;
- public safety, including construction of engineered barriers or bunds;
- access requirements; and
- monitoring requirements.

Monitoring of the final voids would be undertaken as part of ongoing monitoring during the care and maintenance period. In addition to the monitoring requirements outlined in **Section 3.9**, specific monitoring of erosion, runoff volumes and geotechnical stability would be undertaken until such time that it could be determined that the final voids pose minimal risk to public safety.

Details regarding final void management will be finalised as part of the Mining Operations Plan for Mine Closure, which will be submitted to the appropriate government agencies at least two years prior to the cessation of mining operations.

5. REHABILITATION MANAGEMENT PLAN

5.1 Rehabilitation Strategy

Rehabilitation activities are undertaken as soon as possible following the completion of mining activities. Details of the proposed schedule and type of rehabilitation works during the mine life will be included in the Liddell Colliery Mining Operations Plan. Details of rehabilitation undertaken annually are reported in the AEMR.

The proposed final landform and rehabilitation strategy for Liddell Colliery is shown in **Figure 3.2**.

The rehabilitation strategy aims to emulate the pre-mining grazing areas, enhance local and regional ecological linkages and provide for a sustainable final land use option. The pre-mining land use (refer to **Section 1.6**) was primarily agricultural with areas of remnant vegetation. The rehabilitation strategy includes the establishment of primarily pasture with habitat corridors which have been designed to provide a functional link between remnant vegetation areas. Habitat corridors consisting of trees, shrubs and groundcover will be established in visually prominent areas in order to reduce the visual impact of the mining operations.

5.11 Rehabilitation Strategy for Next Three Years

The rehabilitation strategy for the next three years will include:

- continued rehabilitation maintenance of the Mountain Block;
- further habitat corridor establishment within the Railway Block area;
- pasture and habitat corridor establishment within the Southern Tailings Dam area;
- establishment of a habitat corridor within the Reservoir Pit area;
- monitoring and maintenance of the blue-billed duck habitat enhancement measures; and
- maintenance of existing rehabilitation.

This strategy aims to minimise the extent of disturbed areas and improve the visual amenity of the site. A plan providing the location and sequencing of rehabilitation during the next three years at Liddell Colliery is provided in the Liddell Colliery MOP (2008-2015) (Umwelt 2008) (refer to Plans 5A and 5B). Rehabilitation undertaken is reported in the AEMR.

5.2 Rehabilitation Methodology

5.21 Landform Design

The post-mining landform design of Liddell Colliery has been undertaken in accordance with the Synoptic Plan.

Overburden dumps will be generally reshaped to less than 10 degrees slope with a maximum of 18 degrees. Where steep slopes are constructed, suitable erosion control structures such as contour banks, drop structures may be utilised to provide for stability.

Elements such as drainage paths, contour drains, ridgelines, and emplacements are shaped into undulating informal profiles in keeping with natural landforms of the surrounding environment and allowing for a greater diversity of plant species over time.

5.22 Topsoil Management

Where topsoil is available, the following measures will be adopted to protect its quality and enhance rehabilitation outcomes:

- where possible, topsoil will be stripped when moist to help maintain soil structure and to reduce dust generation;
- topsoil stockpiles are to be located away from mining, traffic areas and watercourses;
- level or gently sloping areas will be selected as stockpiles sites to minimise erosion and potential soil loss;
- appropriate sediment controls will be installed at the base of stockpiles to prevent soil loss;

- stockpiles will be generally less than three metres high and will be set out in windrows to maximise surface exposure and biological activity. They will be shaped to gently rounded mounds including existing stockpiles east of the Durham Pit;
- stockpiles to be kept longer than three months will be sown with a suitable pasture or cover crop to minimise soil erosion and invasion of weed species;
- weed growth will be monitored and subsequently controlled if necessary;
- prior to re-spreading, weed growth will be scalped from the top of the stockpiles to minimise the transport of weeds into rehabilitated areas; and
- stockpiles will be appropriately sign-posted to identify the area and minimise the potential for unauthorised use or disturbance.

5.23 Surface Preparation

Surface preparation activities for rehabilitated areas are commenced as soon as possible following the completion of mining activities. A general overview of surface preparation activities undertaken at Liddell Colliery include:

- prior to revegetation activities, spoils and topsoils will be characterised to determine the type and application rate that may be required for the addition of soil ameliorants (e.g. gypsum, Cal-S, fertiliser, biosolids, organic composts, OGM etc.). Analysis may include pH, Electrical Conductivity and ESP;
- appropriate soil ameliorants will be applied for incorporation into the final shaped surface;
- where direct tree seeding is planned in overburden, final shaped surfaces will be deep ripped parallel with the contour prior to the application of seed to provide for an adequate seed bed;
- where pasture seeding is planned the surface will be harrow/tilled across the contour to provide for an adequate seed bed;
- suitable erosion control measures (e.g. silt fences, mulches etc.) will be implemented to minimise soil loss from areas undergoing rehabilitation; and
- where appropriate and practical, structures such as tree hollows and logs may be incorporated into the final landform to augment the habitat value of proposed habitat corridors or waterside habitat.
- Large rocks will be removed or placed into habitat piles on rehabilitated areas.

5.24 Aboriginal Cultural Heritage

Where it is identified that specific rehabilitation activities have the potential to interact with Aboriginal Cultural Heritage sites or Archaeologically Sensitive Areas (as defined in the Liddell Colliery Aboriginal Heritage Management Plan), LCO will undertake the rehabilitation activities in accordance with the Liddell Colliery Aboriginal Cultural Heritage Management Plan.

5.25 Revegetation

Revegetation activities will generally be undertaken in spring and autumn, however, opportunistic revegetation may be practised if areas become available for sowing in summer and winter. After surface soil amelioration and tillage is completed for any given area, revegetation will commence as soon as practicable.

Primarily, revegetation will involve sowing of pasture species and direct seeding of native tree species. A range of other techniques may also be utilised where appropriate over isolated areas associated with steep slopes.

Revegetation techniques will be continually developed and refined over the life of the mine through a continual process of research, trialling, monitoring and improvement.

5.251 Establishment of Native Vegetation Habitat

The establishment of the native vegetation will be undertaken using a native species seed mix. The seed mix will generally be selected from the following tree and shrub species while additional native grass and groundcover species may be added.

Local native tree and shrub species

- Acacia falcate
- Acacia longissima
- Acacia brownii
- Allocasuarina luehmannii
- Allocasaurina torulosa
- Angophora floribunda
- Brachychiton populneum
- Bursaria spinosa
- Casaurina glauca
- Corymbia maculata
- Eremphila debilis
- Eucalyptus albens
- Eucalyptus crebra
- Eucalyptus dawsonii
- Eucalyptus molucanna
- Eucalyptus punctata
- Eucalyptus tereticornis
- Exocarpus cupressiformis
- Indigofera australia

Local native groundcovers and grasses

- Aristida personata
- Aristida ramosa
- Bothriochloa macra
- Chloris truncate
- Danthonia richardsonii
- Danthonia tenuiur
- Desmodium brachypodum
- Desmodium varians
- Dichelachne micrantha
- Glycine tabacina
- Hardenberfia violacea
- Lomandra filiformis
- Stipa aristiglumis
- Themeda australia

The native revegetation will be constructed to produce habitat corridors with the aim of providing a functional and sustainable ecosystem which will be consistent with the rehabilitation closure criteria.

The species to be utilised within native revegetation habitat corridors will be continually assessed following the completion of monitoring of reference and trial sites with the aim that the species are endemic to the area. Where possible, native seed collection will be undertaken in the local area, and will assist in maintaining local genetic diversity and the genetic integrity of the region. However, dependent upon seed availability, the seed mix may need to be supplemented with stocks sourced from outside of the local area.

Tree and shrub seed will be applied at a rate determined appropriate to site conditions this will generally be a total of approximately 6 kg/ha. Where required, seed will be appropriately pre-treated to provide for germination and will be evenly mixed and spread.

5.252 Pasture Establishment

Areas to be rehabilitated to pasture will generally include, but not necessarily limited to, the following species (refer LCO SD PRO 0008 - Land Rehabilitation):

Species	**Variety**	**Sowing Rate kg/ha**
Cocksfoot	Greenly	5
Annual Ryegrass	Wimmera	6
Perennial Ryegrass	Kangaroo Valley	6
Setaria	Narok	1
Rhodes Grass	Callide	3
Couch	(Un-hulled)	2
Lucerne	Aurora	5
White clover	Haifa	3
Medic	Sephi	1
Subclover	Seaton Park	3
Woolly Pod Vetch	Namoi	4
Chicory	Puna II	1
Tonic	Tonic Plantain	1
Brassica	Winfred	1
Rye-corn	N/A	6
TOTAL		**48**

The seed mix may vary dependent upon the season and other species may be utilised where appropriate. Similar to direct seeding of native tree species, the sowing application rate for pasture species will be determined upon a review of site conditions.

5.26 Rehabilitation Trials

In order to determine the most appropriate method of reinstating Endangered Ecological Communities (EEC's) LCO has commenced trials aimed at establishing two EEC's, being Central Hunter Grey Box – Ironbark Woodland and Central Hunter Ironbark – Spotted Gum Grey Box Forest. The species selected were representative of the communities found in the Hunter valley and consisted of the following species:

Grey Box- Ironbark Woodland Forest Community

- Acacia pendula
- Allocasuarina leuhmanii
- Angophora floribunda
- Austrostipa scabra
- Bothriochloa decipiens
- Brachychiton populneus subs. populeus
- Bursaria spinosa subs spinosa
- Calotis lappulacea
- Callitris endlicheri
- Cassinia quinquefaria
- Chrysocephalum apiculatum
- Cyperus gracillis
- Dodonaea viscosa
- Eragrostis leptostachya
- Einadia nutans
- Eremophila debilis
- Eucalyptus crebra
- Eucalyptus moluccana
- Glycine tabacina
- Microlaena stipodes var. stipoides

Ironbark – Spotted Gum Forest Community

- Acacia falcate
- Acacia parvipinnula
- Allocasuarina luehmanii
- Bursaria spinosa subsp spinosa
- Corymbia maculate
- Daviesia ulicifolia subsp. ulicifolia
- Dianella revoluta var. revoluta
- Eremophila debilis
- Eucalyptus crebra
- Eucalyptus fibrosa
- Eucalyptus tereticornis

- Eucalyptus fibrosa
- Eucalyptus moluccana
- Hakea sericea
- Microlaena stipoides var stipoides
- Paspalidium distans
- Pultenaea spinosa
- Themeda australis

Rehabilitation monitoring will be conducted in accordance with the Closure Criteria Development and Rehabilitation Monitoring Standard to gauge the performance of the trials and the germination of the many species involved in order to refine the seed mix for future ecological community rehabilitation. The two trial sites will form the native vegetation rehabilitation monitoring areas as discussed in **Section 5.27**.

5.27 Rehabilitation Monitoring

In accordance with the XCN Standard for Closure Criteria Development and Rehabilitation Monitoring, LCO have developed an annual flora and fauna rehabilitation monitoring program. The results of annual monitoring are considered when determining the extent of maintenance works (e.g. weed management) required within each rehabilitation area.

5.271 Pre-Mining Baseline Surveys

As per the XCN Standard for Closure Criteria Development and Rehabilitation Monitoring, baseline monitoring is to be conducted prior to any site disturbance. Details regarding baseline monitoring that has been undertaken to date across Liddell Colliery are outlined in **Section 1.6** and is typically assessed in the site environmental assessment flora and fauna surveys. This information has been used to develop Liddell Colliery's Mine Closure Criteria (refer to **Appendix 3**) and to assess the performance of rehabilitation on site.

5.272 Control or Analogue Sites

Monitoring within rehabilitation areas is also compared with carefully selected control or analogue sites within the surrounding locality. The methodology used for the flora plots will be in accordance with previous flora monitoring at Liddell Colliery and will involve the following parameters being recorded within a permanent plot at each site:

- full floristics (including cover abundance);
- general health of vegetation;
- evidence of natural regeneration;
- occurrence and abundance of weed species;
- signs of disturbance either by stock or humans;
- evidence of feral animals;
- any impacts from mining activities; and
- Percentage of bare ground, logs and rocks present

In 2012 a review of the Liddell Coal Rehabilitation Monitoring was conducted by Eco Logical Australia Pty Ltd (ELA) and the program developed by ELA addresses flora and fauna monitoring on two control or "analogue" native vegetation sites.

5.273 Active Mining

During active mining operations, LCO will maintain records of processes that may have the potential to affect the success of rehabilitation on site. This information will provide a valuable baseline for comparison with later rehabilitation monitoring outcomes. At a minimum, records include:

- detailed rehabilitation procedures;
- a register of contaminated sites;
- records of production wastes and other waste streams and where they are located on site;
- environmental monitoring records, including surface and groundwater quality;
- a register of topsoil and or soil substitute stockpiles (e.g. biosolids); and
- environmental incident records.

5.274 Rehabilitation Methodology Records

LCO 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 on site. 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).

5.275 Post-Rehabilitation

As per the XCN Standard Closure Criteria Development and Rehabilitation Monitoring, LCO's approach to post-mining rehabilitation monitoring includes undertaking the following:

- Annual Rehabilitation Inspection; and
- Long Term Rehabilitation Monitoring

5.276 Annual Rehabilitation Inspection

LCO undertakes an internal annual rehabilitation inspection to evaluate how successful the rehabilitation on site has been. These inspections incorporate existing and recently completed rehabilitation areas at the Liddell Colliery.

Outcomes of the annual rehabilitation inspection are recorded and any corrective actions that are identified as part of the inspection are to be entered into the sites action database for implementation. Where necessary, rehabilitation procedures will be amended to improve rehabilitation standards.

In the event that the annual inspection indicates a failure of a rehabilitated area, further investigations to establish the cause and appropriate remediation strategy(s) are undertaken. Issues to consider during the investigation may include the following:

- nutrient availability;
- pH, salinity and metal toxicity;
- shallow root depth;
- other soil limitations;
- insect attack;
- lack of N-fixing legumes;
- lack of organisms involved in litter breakdown (e.g. fungal fruiting bodies) and nutrient cycling (e.g. puff balls);
- excessive grazing;
- predation;
- evidence of drought effects or storm damage;
- poor soil preparation;
- weed competition; and
- Based on the results of soil analysis, maintenance fertilisation may be undertaken through spreading of fertilisers or ameliorants. This may include aerial fertiliser application.

5.277 Long Term Rehabilitation Monitoring

Long term rehabilitation monitoring is undertaken at Liddell Colliery to evaluate the success of rehabilitation and the sites progress towards fulfilling long term land use objectives. The monitoring program will be continued within rehabilitation areas until they have satisfied the rehabilitation closure criteria. Plot-based sampling of vegetation is undertaken in accordance with the XCN Standard for Closure Criteria Development and Rehabilitation Monitoring.

Outcomes of this monitoring program are detailed in a report and any mitigation actions entered into LCO's action based reporting tool Xstrasafe for implementation. The outcomes of this monitoring are reported in the AEMR.

In 2012 a review of the Liddell Coal Rehabilitation Monitoring was conducted by Eco Logical Australia Pty Ltd (ECA) and the program developed by ECA addresses flora and fauna monitoring on two rehabilitated and two control or "analogue" sites.

5.278 Monitoring for Native Habitat Establishment

Plot-based sampling of vegetation is undertaken to assess:

- plant community structural attributes;
- cover, species density, height and structural diversity;
- species richness (the number of plant species present in each structural layer of each vegetation community);
- the presence and abundance of any weed species; and
- assessment of natural regeneration/recruitment of new species.

The monitoring survey will continue to be conducted within both rehabilitation areas and analogue sites over the life of the mine. The number of sites surveyed will depend on size of the study area and the number of vegetation communities. The results of this monitoring will also be utilised to provide feedback as to the success of revegetation methodologies as well as to support justification for sign off with completion criteria.

5.279 Monitoring for Pasture Establishment

The pasture rehabilitation monitoring site locations will be confirmed during the 2012 monitoring program. The monitoring methodology for these sites will follow methodology outlined within LCO's Annual Flora and Fauna Monitoring 2012 (ELA, 2012) and will include a flora plot and LFA transect at each site. In subsequent years, additional sites will be added to this program to account for future rehabilitation activities. The data collected from monitoring sites will be compared to benchmark values to ensure that the rehabilitation is progressing towards a satisfactory condition.

5.3 Rehabilitation Reporting

A summary of rehabilitation activities and progress against the Liddell Colliery rehabilitation schedule and completion criteria will be reported annually in the Liddell Colliery AEMR. The results of ongoing rehabilitation will also be provided to the Liddell Colliery CCC.

5.4 Land Management

5.41 Grazing Management

LCO has historically allowed limited grazing activities to occur on site. Prior to undertaking broad scale grazing activities on site LCO will complete a grazing trial to assess whether there is sufficient ground cover within rehabilitation areas to sustain grazing activities. Depending upon the outcome of these trials, the following measures may be undertaken to manage grazing activities at Liddell Colliery:

- manage stocking rates to prevent grasses from being overgrazed;
- limit stock access to lakes, dams and creeks to prevent bank erosion and excess water turbidity;
- prevent stock access into habitat corridors by fencing;
- allow adequate time between grazing of land for grasses to regenerate (development of a stock rotation plan); and
- provide for adequate amounts of endemic trees are established to provide shade and shelter for livestock.

5.42 Erosion and Sediment Controls

LCO will establish adequate erosion and sediment controls across the operation to minimise erosion of land surfaces and the impacts from sedimentation. Typical controls to be implemented at Liddell Colliery include but are not limited to:

- appropriately designed final landform drainage structures;
- diverting clean water from disturbed areas, and redirecting sediment-loaded water into sedimentation basins;
- utilisation of cover crops to provide quick re-establishment of ground cover over reshaped emplacement areas for protection against wind and water erosion;
- construction of sediment control structures where required (e.g. silt fences, hay bales etc); and
- rehabilitating overburden emplacement areas as close as practical behind active mining areas.
- Repairs to older rehabilitation areas where erosion is evident eg Reservoir block and the Mountain Block

5.43 Weeds

Weed control will be conducted in accordance with the existing LCO management practices, which require:

- regular site inspections to identify areas of weed infestation and type of weed species;
- development and implementation of an eradication plan applicable to the circumstances, which may include manual removal, spot spraying, boom spraying, aerial spraying or biological control;
- regular contact with neighbouring property owners to attempt to eradicate weed species from the surrounding area;
- early establishment and maintenance of vigorous grasses and native trees particularly during rehabilitation of overburden dumps; and
- regular maintenance of topsoil stockpiles to eradicate weed infestation.

Galenia (*Galenia pubescens*) occurs in areas throughout the Liddell Colliery development consent area. This weed has a vigorous growth habitat which results in it smothering native groundcovers and inhibiting regeneration. LCO will continue to target this species for eradication in areas that it has been recorded as well as implement measures (e.g. application of herbicide) to prevent it from establishing in new rehabilitation areas.

In 2012, the weeds African Olive and Acacia saligna were added to the weed species identified on site and are subject to weed control activities.

If a substantial increase in the density of any known weed species, or the occurrence of a previously unrecorded weed species, is discovered, LCO will seek advice on the management and control options for that species and endeavour to minimise its impact on native flora and fauna. Where weeds have been controlled, suitable pasture species will be sown to prevent weed regrowth.

Weed management activities are reported in the AEMR.

5.44 Vertebrate Pest Control

Programs to control vertebrate pests include the determination of appropriate control practices, consultation with appropriate authority, obtaining appropriate approvals, implementing control practice and undertaking follow-up monitoring and control as required. If monitoring shows a substantial increase in the density of any known feral fauna species, or the occurrence of a previously unrecorded feral fauna species, is discovered, LCO will seek expert advice on the management and control options for that species and endeavour to minimise its impact on native flora and fauna.

5.45 Bushfire Management

Section 6 contains the Bushfire Management Plan (BMP) for Liddell Colliery including detail on fire prevention and control measures, monitoring and reporting.

5.5 Flora and Fauna Management

This section details the management strategies that will be adopted at Liddell Colliery to promote the conservation of biodiversity throughout its operations. Flora and Fauna management strategies to be implemented at Liddell Colliery will include:

- management of remnant vegetation;
- management of vegetation clearance;
- enhancement of habitat for the blue billed duck; and
- rehabilitation and development of habitat corridors.

As committed in the EA, no works or machinery are to impact upon the Bayswater Creek bed environment.

5.51 Management of Remnant Vegetation

The remnant woodland occurring within the Liddell Colliery development consent area will be managed during the life of the project to maintain its ecological values and promote biodiversity. Strategies include management of grazing impacts, weeds, feral animal control, erosion and sediment control and encouragement of natural regeneration.

One of the aims of remnant vegetation management is to improve connectivity of remnant vegetation patches within the Liddell Colliery development consent area to provide improved habitat corridor function. The locations of the habitat corridors are shown on **Figure 3.2**. The habitat corridors provide for the connection of remnant vegetation located on Bowman's Creek, the shore of Lake Liddell and to the north of the Mountain Block.

Grazing within remnant vegetation areas will be prohibited to enable tree, shrub and ground cover species to regenerate and enhance fauna habitats.

Annual inspections of remnant woodland areas will be undertaken by suitably qualified persons to identify any weed or feral animal issues, identify any areas affected by erosion and to assess the extent of natural regeneration occurring. Actions will be taken to address any issues identified.

The need for bushfire management controls will also be assessed by the Liddell Colliery Environment and Community Coordinator to restrict the occurrence of high intensity burns. Where required and practical, infrequent burns of moderate intensity will be undertaken within remnant vegetation areas to manage fuel loads and allow native species to set seed in consultation with the local Rural Fire Service.

5.511 Vegetation Clearance

Prior to any site clearing activities, the following mitigation measures will be undertaken:

- a Ground Disturbance Permit will be obtained from the Liddell Colliery Environment and Community Department in accordance with Liddell Colliery Environmental Procedure – LCO SD PRO 0007- Land Clearing & Topsoil Stripping;
- areas to be cleared should be clearly marked in the field to avoid any unnecessary clearing of native vegetation;
- any machinery used for the clearing activities should be kept in the disturbance areas and not placed in adjacent remnant vegetation;
- a pre-clearance survey will be conducted by the Liddell Colliery Environment and Community Superintendent or his/her delegate, prior to any clearing being carried out to identify potential habitat trees. During the pre-clearance survey all hollow-bearing or other identified habitat trees will be marked;

- the vegetation surrounding any habitat trees will be removed at least one day prior to those trees being cleared to encourage any fauna to relocate;
- trees are to be felled as gently as is practicable. Felled trees should be positioned on the ground to ensure that hollows are not blocked. Felled habitat trees are to be left undisturbed for a period of 24 hours to allow any native fauna present to relocate;
- native fauna detected during vegetation clearance should be relocated to areas of appropriate habitat;
- during any clearance works, where practical, any habitat structures (such as rocks, logs and stumps) removed from the disturbance areas should be relocated to rehabilitation areas;
- where practical, nest boxes will be installed ahead of clearing;
- Nest boxes will be established in nearby rehabilitation areas to compensate for the loss of hollows in habitat trees. The number and designs of nest boxes required should be determined by a supervising ecologist prior to clearing activities following assessment of the number and type of tree hollows removed during clearing;and
- no works or machinery will be allowed to impact upon the Bayswater Creek bed environment.

5.52 Management of Threatened Species

5.521 Threatened Flora

Only one threatened flora species has been recorded within the Liddell Colliery development consent area, the tiger orchid (*Cymbidium canaliculatum*). This species is listed as an endangered population under the *Threatened Species Conservation Act 1995* (TSC Act) for the Hunter catchment. One individual clump was recorded near the Mountain Block plot. LCO will continue to monitor the tiger orchid during annual flora and fauna monitoring onsite to provide for its ongoing viability.

In the event a previously unrecorded threatened flora species is discovered, or a recorded species is newly listed under the TSC Act 1995 or the EPBC Act, LCO will seek the advice of a suitably qualified and experienced ecologist on the appropriate management options for that species.

5.522 Threatened Fauna

The previous fauna surveys identified six threatened fauna species in the study area, comprising the grey-crowned babbler (*Pomatostomus temporalis temporalis*), the blue-billed duck (*Oxyura australis*), the speckled warbler (*Pyrrholaemus sagittatus*), the eastern bentwing-bat (*Miniopterus schreibersii oceanensis*), the eastern freetail-bat (*Mormopterus norfolcensis*) and the eastern cave bat (*Vespadelus troughtoni*).

The ecological assessment conducted for previously approved modifications identified 16 threatened fauna species that may potentially occur within the study area (Umwelt, 2006). An assessment of the significance of the impacts of the modifications on these 16 threatened fauna species was undertaken. The results of assessment under both the EP&A Act and the EPBC Act (where relevant) revealed that the development would have a significant impact on only one of the 16 fauna species potentially occurring within the study area, namely, the blue-billed duck.

In the event that a previously unrecorded threatened fauna species is discovered, or a recorded species is newly listed under the TSC Act 1995 or the EPBC Act (1995*)*, LCO will seek the advice of a suitably qualified and experienced ecologist on the appropriate management options for that species.

LCO will continue to monitor these threatened fauna species during the annual fauna monitoring undertaken onsite.

Blue-Billed Duck Management

In accordance with schedule 3, condition 28 of the development consent, LCO has undertaken habitat enhancement measures to Dam 3. Habitat enhancement works of the Mountain Block Dam were also to be undertaken, however subsequent investigations revealed that this dam was unlikely to provide suitable habitat for the blue-billed duck. In order to compensate for this, in February 2011 LCO constructed two blue-billed duck habitat dams on site. The dams were designed and constructed to provide suitable habitat for the blue-billed duck with half of the dam's surface area having a depth of less than 5 metres. Suitable revegetation was carried out on the dam's gentle slopes using indigenous species including *Typha orientalis* (broadleaf cumbungi), *Eleocharis sphacelata* (tall spike rush), *Bolboschoenus caldwellii* (club rush), and *Baumea juncea* (common twig rush).

To assist LCO in implementing appropriate habitat enhancement measures, LCO will continue to implement a management strategy for the blue-billed duck as detailed within Liddell Colliery's Blue-Billed Duck Management Strategy (Umwelt, 2008).

Improvements to the waterside habitat in the Reservoir Block will be made by the placement of logs around water storages. This will enhance the habitat value of the Blue billed duck and other dams.

5.53 Habitat Management

During clearance activities, where practical, any habitat structures (such as rocks, logs and stumps) removed from the disturbance areas will be relocated to rehabilitation areas. Clearing activities will be undertaken according to LCO SD PRO 0007 - Land Clearing & Topsoil Stripping to minimise the impacts of felling activities on tree nesting and denning species.

Habitat corridors will be established through the rehabilitation area (**Figure 3.2**) generally in accordance with the Synoptic Plan (DRE, 1999). The habitat corridors will replace areas of woodland vegetation that are to be removed during the life of Liddell Colliery and will link areas of remnant vegetation to the north of the development consent area to habitat areas along Bowman's Creek. The corridors will facilitate fauna movement between the vegetation remnants and rehabilitated areas on adjacent land holdings.

Flora and Fauna Monitoring

LCO currently undertakes a variety of flora and fauna monitoring activities across its operation. These activities will be continued throughout the life of the mine. The details of each monitoring activity are outlined below.

Flora Monitoring

Up until 2012, monitoring of vegetation was conducted annually within four plots located within the Entrance Block and Mountain Block. Each plot is marked with a metal stake in each corner and a metal tag showing the plot number. The location of the flora monitoring plots is shown on **Figure 5.1**. Due to changes to the active mining areas, 4 new sites were selected for monitoring from the 2013 survey. These are:

Site 1: Within remnant woodland patches south-east of Dam 5.

Site 2: Within remnant woodland south of Barrier Pit

Site 3: Within riparian vegetation along Bowmans creek north of Dam 1.

Site 4: Within riparian vegetation along Bowmans Creek (previous site 5).

The exact locations have not yet been determined and will be provided in the 2013 Flora and Fauna Monitoring Report

The following information is recorded for each plot:

- cover-abundance value;
- general health of vegetation;
- evidence of natural regeneration;
- occurrence and abundance of weed species;
- signs of disturbance, either by stock or humans;
- evidence of feral animals;
- any observable impacts of the mining operations, such as the effectiveness of sediment and erosion control structures;
- the percentage of bare ground present, density of log cover and percentage of rock cover; and
- a photograph of each site is taken from a fixed bearing at the photo monitoring point to enable changes in vegetation health and structure to be visually recorded and compared.

Monitoring of these plots will be undertaken on an annual basis to determine the impact of Liddell Colliery on species diversity, composition and health. Other criteria will also be assessed and includes:

- species and habitat losses or gains;
- factors that impact upon biodiversity;
- security of protected areas;
- management of biological resources such as topsoil and the use of cleared vegetation;
- on-going rehabilitation and restoration of ecosystems; and
- resilience of ecosystems.

Where required, additional plots may be monitored to assess vegetation located in other areas within the Liddell Colliery development consent area.

As discussed in **Section 5.27.2**, analogue sites representative of remnant vegetation will be established during 2012 to gather baseline data which will assist in the refinement of rehabilitation closure criteria.

5.531 Fauna Monitoring

Fauna monitoring is undertaken annually at Liddell Colliery and includes terrestrial fauna monitoring, water bird monitoring and nest box monitoring. Fauna monitoring is undertaken in late summer/early autumn each year to coincide with the breeding activity of the blue-billed duck. Where it is considered to be beneficial, the monitoring period may be altered, or additional monitoring may be carried out.

Up until 2012, LCO undertook annual fauna monitoring at five nominated monitoring sites. The fauna monitoring sites were established in 2005 by HLA-Envirosciences (HLA-Envirosciences 2005). The five monitoring sites were located within the Entrance Block, Mountain Block (two sites), Dam 13 and Bowman's Creek (refer to **Figure 5.1**). Due to changes to the active mining areas, 4 new sites were selected for monitoring from the 2013 survey. These are:

Site 1: Within remnant woodland patches south-east of Dam 5.

Site 2: Within remnant woodland south of Barrier Pit

Site 3: Within riparian vegetation along Bowmans creek north of Dam 1.

Site 4: Within riparian vegetation along Bowmans Creek (previous site 5).

The exact locations have not yet been determined and will be provided in the 2013 Flora and Fauna Monitoring Report

At each of the monitoring sites a range of techniques will be used to determine the fauna utilisation of the Liddell Colliery development consent area, including the identification of threatened species. Methods which will continue to be utilised include, spotlighting, diurnal bird census; diurnal herpetological survey, nocturnal herpetological surveys and Anabat surveys.

A habitat assessment of each fauna monitoring site will be undertaken, and will include an assessment the following:

- evidence of fire;
- nature of and extent of erosion;
- extent of weed species;
- presence of feral animals;
- type of ground cover (e.g. litter, rock, soil);
- degree of dieback;
- presence of mistletoe;
- structure and floristics of vegetation cover; and
- number of habitat trees.

Annual monitoring targeting water birds will be undertaken at dams 1, 3 and 13 and the two blue-billed duck habitat dams, "New Dam" and "Mountain Block Dam" that were established in February 2011. In particular the monitoring is aimed at identifying habitats utilised by the blue-billed duck.

Water bird monitoring will consist of:

- two one hour diurnal bird census points over two days; and
- habitat assessment at each of the dams.

5.532 Nest Box Monitoring

Prior to 2008 ten nest boxes were erected in the Entrance Block area and were monitored annually however, due to advancing mining activities, these boxes were removed in 2011. In 2011 14 new nest boxes were installed, five nest boxes were erected north-west of Dam 1 and nine nest boxes were erected west of Dam 3. Annual monitoring of these nest boxes will continue to be undertaken to determine the level of usage by native fauna species and to determine if the boxes have been successful in the provision of alternative habitat for arboreal species. Each nest box will be assessed for:

- the condition of the nest box;
- the presence of fauna or whether they are being used by target fauna species;
- predator use of the nest box; and
- the condition of the nest box and tree attachment and any additional design features that may aid the future use of un-used boxes.

5.533 Monitoring of Blue-billed duck Habitat Enhancement Measures

As discussed in **Section 5.522**, LCO will continue to implement a blue-billed duck management strategy. The management strategy includes a baseline survey and ongoing monitoring of the success of the habitat enhancement measures at Dam 3 and the two blue-billed duck habitat dams that were established in February 2011.

The baseline survey of Dam 3 and the blue-billed duck habitat dams will assess:

- the general health, densities and species diversity of the existing terrestrial and aquatic vegetation associated with the dams;
- the water quality, including current levels of turbidity, nutrients and dissolved oxygen; and
- the species diversity and abundance of aquatic macro-invertebrates.

Following the completion of the habitat enhancement measures, an annual monitoring program of the two dams will be implemented. The monitoring program will focus on the presence of blue-billed ducks, vegetation health, water quality and the diversity and abundance of aquatic macro-invertebrates.

6. BUSHFIRE MANAGEMENT PLAN

6.1 Introduction

This Bushfire Management Plan documents the bushfire management measures to be implemented at Liddell Colliery to limit impacts on the surrounding area, in accordance with the conditions of development consent.

6.2 Purpose and Scope

The purpose of this Bushfire Management Plan is to define the mechanisms to be implemented for the control of fire hazard and potential ignition sources at Liddell Colliery. This Plan applies to all land within the area of mining operations (**Figure 1.2**). It has been developed to comply with the conditions of development consent and to provide guidance on preparedness and response to a bushfire at Liddell Colliery.

The Bushfire Management Plan complies with the *Rural Fires Act* 1997 (RFA) and the Rural Fires Regulation 1997 (RFR). Under section 63 of the RFA, Liddell Coal is required to take all practical steps to prevent bushfires and minimise the danger of the spread of bushfires on or from land under its control.

6.3 Objectives

The objectives of this plan are to:

- prevent the occurrence of unplanned bushfire;
- suppress unplanned bushfires;
- minimise the potential spread of bushfire in, from, or into the area of continued Liddell Colliery operations;
- protect persons, property and assets (including those of heritage value) on, or immediately adjacent to, the Colliery from bushfire;
- work cooperatively with neighbours, lessees and rural fire brigades in managing bushfires;
- maintain ecosystem processes associated with remnant native species and communities in the area;
- identify fuel types in the area which may constitute a hazard;
- serve as a guide in the setting of strategies for the management of fire and fuel accumulation; and
- consider possible environmental effects of such management strategies.

6.4 Existing Environment in Respect to Bushfire Management

6.41 Climate

The climate of the Hunter Valley, as recorded at Muswellbrook and Singleton, is warm temperate and the seasonal climate varies from hot, wet summers to cool, mild winters. The mean daily maximum temperatures ranged from 16.5 °C in July to 32 °C in January (2010). Mean daily minimum temperatures ranged from 4.9 °C in July to 18.2 °C in January (2010). Mean daily maximum and minimum temperatures are listed in **Table 6.1**.

Table 6.1 – Mean Daily Temperature Recorded at Singleton (Station 061397)

Month	Mean Daily Maximum Temperature (°C)	Mean Daily Minimum Temperature (°C)
January	32	18.2
February	30	18.6
March	28.3	15.5
April	25.5	10.9
May	21.1	6.6
June	17.7	5.2
July	16.5	4.9
August	17.7	4.4
September	22.0	8.2
October	24.4	11.4
November	26.3	14.2
December	28.6	16.3
Annual	**24.2**	**11.2**

Source: Bureau of Meteorology, December 2010.

The closest Bureau of Meteorology data collection station to Liddell Colliery is at Muswellbrook, approximately 13 kilometres northwest of the site. Rainfall data were collected at Muswellbrook between 1870 and 2011. Mean rainfall based on this data is shown in **Table 6.2**.

Table 6.2 – Rainfall Data – Muswellbrook (Station 61053)

Month	Mean Rainfall (mm)
January	69.6
February	66.5
March	52.5
April	43.6
May	41.7
June	51.4
July	43.9
August	38.8
September	40.7
October	48.6
November	56.1
December	67.3
Annual	**620.4**

Source: Bureau of Meteorology, December 2011 (20/12/2011).

Seasonal variation in wind speed and direction at the Ravensworth weather station, which is located 0.5 kilometres to the southeast of Liddell Colliery. During the period July 1999 to September 2001 the prevailing winds were from the northwest during the winter and from the southwest during the summer months. The highest wind speed of 22.0 m/s was recorded on 17 September 1999. September is generally the windiest month of the year with a mean monthly wind speed of 4.25 m/s. September typically has the greatest percentage of winds over 10 m/s. April is the calmest month, with a mean monthly wind speed of 2.4 m/s. The annual average wind speed is 3.3 m/s.

6.42 Topography

The general topography of Liddell Colliery is characterised by gently undulating hills with a relief of up to 90 metres. The Colliery is located on very gently inclined alluvial fans (1 to 3%), bordered by gently inclined rises (3 to 10 %) at elevations ranging from 100 mAHD to 185 mAHD. At the northern end of the colliery the elevation increases to 280 mAHD and slopes up to 10% occur.

6.43 Vegetation Communities

Five vegetation communities were recorded in the area of Liddell Coal Operations; pastoral grassland, *Eucalyptus creba/E. moluccana* woodland, *Allocasuarina luehmannii* woodland, riparian vegetation and aquatic vegetation. Each of the community areas shows relatively high levels of disturbance, with evidence of past and ongoing grazing activities. All communities contain a significant number of weed species. In addition, a significant portion of the area of mining operations is disturbed by existing mining operations and devoid of vegetation.

The identified *Eucalyptus creba/E. moluccana* woodland, *Allocasuarina luehmannii* woodland and riparian vegetation communities are consistent with the Woodland vegetation classification provided in Table A2.1 of *Planning for Bushfire Protection*, whilst the pastoral grassland is consistent with the Grassland (pasture) vegetation classification. On this basis, the predominant 'vegetation groups' of the continued operations area and surrounds is Vegetation Group 2 (Woodlands and Heaths) and Vegetation Group 3 (Grasslands).

6.5 Fire History

Information relating to the frequency and intensity of bush fires within the Liddell Colliery Holding is anecdotal only; however, this evidence indicates that most outbreaks have been minor in nature and restricted to small spot fires in heavily grassed areas adjacent to major trafficked areas such as roads. As stated in the 2003 revision of this document it was noted that over the previous two to five years there have been at most two instances when fire has threatened operations. On these occasions however, mine personnel in conjunction with the [then] Rural Bush Fire Brigade have been able to contain and extinguish the outbreaks, without damage to site infrastructure or injury to personnel.

6.6 Fire Hazard and Risk

The bushfire hazard pertaining to a particular area is assessed by rating two main land based factors of fire, these being vegetation (fuel) and terrain (slope), and their relative contributions to a potential fire. The intention of bushfire protection is to prevent flame contact on a structure, reduce the radiant heat to below ignition thresholds for the various elements of a building, to minimise the potential for embers to cause ignition and to reduce the effects of smoke on residents and fire fighters. Bushfire has the potential to cause damage or harm to neighbours, personnel, facilities and installations, mine infrastructure, biodiversity and archaeological heritage.

Two land units occur at the Colliery: woodland on slopes ranging from 4 to 13 per cent and native and improved pasture on slopes ranging from 5 to 18 per cent. Fire burning uphill poses the most significant hazard. Rehabilitated lands are vulnerable to fire, with uphill slope lengths of 170 to 730 metres.

Liddell Colliery and surrounds has been rated as having a low risk of bushfire in the Bush Fire Risk Management Plan (Muswellbrook, Scone and Singleton Bush Fire Management Committee, 2000). The Colliery is located in the Eastern fire zone. In this fire zone, forest and shrub fires predominate and the main fire season is from September or October through to January or February (Luke and McArthur 1978).

Continued mining is not expected to increase the fire hazard in the locality, as areas will be disturbed and rehabilitated progressively, with similar areas of pasture and woodland available to fuel fires at any given time. Due to its nature as a mine site, Liddell Colliery's emergency preparedness is high and fire fighting equipment is readily available during the life of the operation.

6.7 Liddell Colliery Assets Requiring Protection from Fire

6.71 Site Equipment and Infrastructure

Site equipment and infrastructure that will be protected under the Bushfire Management Plan include:

- Liddell Coal Preparation Plant, including ROM coal stockpiles, ROM Coal Receival Facility, product coal stockpiles, Rail Loadout Bin, workshops and fuel depot;
- active mine areas;

- major mine infrastructure and installations including tailings disposal line;
- rehabilitated lands;
- coal haulage contractor facilities;
- mining contractor facilities and open cut administration; and
- water cart filling station.

6.72 Heritage Sites

An assessment of the historic heritage within and in the vicinity of the management area identified three historic sites. Two of these sites: the former Chain of Ponds Hotel and Police Lock-up are of high significance; the other, the former Foybrook open cut mine office, is of low significance.

All reasonable effort will be made to protect the Chain of Ponds Hotel and Police Lock-up from fire using appropriate prevention and control measures.

6.73 Archaeology Sites

Archaeological investigations undertaken in 2001 identified 37 Aboriginal sites that have not been previously recorded, and re-recorded five previously identified sites. No particular protection of these sites is required, as they will not be damaged by exposure to fire. The location of firebreaks and other controls will be selected to avoid these sites where possible.

6.74 Natural Assets

Specific control measures (refer to **Section 6.10**) will be implemented in order to protect patches of remnant vegetation, to promote and maintain biological diversity within Liddell Colliery.

The proposed habitat corridors, where established, and existing trees (refer to **Figure 3.2**) are considerable natural assets which will be protected under the Bushfire Management Plan in order to maintain both flora and fauna habitat.

6.8 Bushfire Management Strategies

6.81 Identification of Ignition Sources

Ignition sources as identified in Umwelt "*Liddell Colliery Landscape Management Plan 2008",* include natural occurrences such as lightening strikes, while other occurrences include sparks from powerlines and human ignition sources. Traffic on Antiene Road, Hebden Road, New England Highway and the Main Northern Railway can be considered a fire hazard. Possible on-site ignition sources also include sparks and fire from machinery and fuel storage areas.

Areas of native pasture have been identified as having a medium fire hazard rating and are likely ignition sources. Ignition sources and areas of potential fire hazard also include the habitat corridor areas. These areas will be the focus of fire hazard reduction measures to minimise fuel levels.

Fire bans, as determined by the Rural Fire Service, will be adhered to by all personnel and enforced by the mine management. Potential ignition sources such as those resulting from hot work practices including welding and cutting will be restricted where possible to workshop areas or within active parts of the mine where vegetation is non-existent. From time to time, however, due to the remoteness of plant and infrastructure, this may not be possible and work within vegetated areas may need to occur. In such cases, all due care and caution will be employed to minimise the potential for fire ignition.

6.82 Control Measures

6.821 On-Site Fire Fighting Equipment

Liddell Colliery maintains a fire tender as well as two water carts equipped with fire fighting equipment and capable of extinguishing fire outbreaks. This fire fighting equipment, together with graders and bulldozers used for mining, provides effective bushfire fighting capability. In addition, emergency preparedness training for mine-site personnel enhances the responsiveness.

The trucks are fully equipped with both rear and side sprays, and front monitor nozzle with a spaying capacity of 25 metres. Each cart is fitted with a 64 millimetre stortz coupling, to which a standard fire hose can be fitted. The trucks have a carrying capacity of 70 kilolitres and 20 kilolitres respectively each with a fill time of between two to four minutes.

6.822 Asset Protection Zones

Planning for Bushfire Protection (NSW Rural Fire Service 2006) states that Asset Protection Zones (APZ) are to be identified, installed and "*managed progressively to minimise fuel loads and reduce potential radiant heat levels, flame, ember and smoke attack".* An Asset Protection Zone (APZ) as defined in the Planning for Bushfire Protection (NSW Rural Fire Service 2006) aims to "*protect human life, property and highly valued public assets and values".*

Planning for Bushfire Protection (NSW Rural Fire Service 2006) defines an APZ as being a buffer zone between bushfire hazard and buildings, which is managed progressively to minimise fuel loads and reduce potential radiant heat levels, flame, ember and smoke attack. Although these guidelines were specifically developed for protecting residential developments, they can also be used and applied as a guide to the level of protection required to protect Liddell Colliery assets from fire such as monitoring stations and all mining infrastructure.

An APZ consists of an Inner Protection Area (IPA), maintained to minimal fuel loads and an Outer Protection Area (OPA), where fuel loads are maintained at less than 8 tonnes per hectare. The IPA provides a fuel free space around the assets that allow them to be defended from bushfires. It also reduces the risk of wind-blown burning embers starting spot fires close to assets.

Table A2.2 of *Planning for Bushfire Protection* was used to determine the appropriate setback requirements for the Colliery. As outlined in **Section 6.52** of this plan, the topography of the site is described as gently sloping terrain with slopes generally less than 8°. Group 2 (Woodland Vegetation) and Group 3 (Grassland Vegetation) were identified throughout and immediately adjacent to the area of continued operations.

Based on the guidelines *Planning for Bushfire Protection 2006* an APZ should be established around all Liddell Colliery Assets located within 30 metres of the identified Group 2 and Group 3 vegetation areas, which have been rated as low risk in the Bushfire Risk Management Plan (Muswellbrook, Scone and Singleton Bush Fire Management Committee 2000).

Liddell Colliery Assets located within 30 metres of identified Group 2 vegetation, require a 40 metre APZ, consisting of a 30 metre IPA and a 10 metre OPA on the hazard side of the asset. Liddell Colliery Assets located within 30 metres of identified Group 3 vegetation require a 20 metre APZ, consisting of a 20 metre IPA on the hazard side of the asset.

The APZ provides for:

- minimal separation for safe fire fighting;
- minimised radiant heat;
- reduced influence of convection column driven winds; and
- reduced ember viability thereby limiting the impact of ember attack.

It is not intended to establish any APZs within the Liddell Colliery Holding, however the guidelines for establishment of such zones will be used as a reference to ensure that fuel loads are minimised and clearances to assets and infrastructure are maintained at appropriate distances.

6.823 Existing Fire Barriers

Firebreaks are to be maintained around the Liddell Colliery area of continued operations to prevent the spread of bushfires onto or from adjacent properties.

6.824 Proposed Fire Management

The proposed fire management for mining operation of Liddell Colliery includes creating and maintaining fire breaks using ploughing, chain sawing and slashing methods. This method ensures that fire does not spread both into and from the Liddell Colliery operations.

Any incident of unplanned bushfire will be reported directly to the Environment and Community Superintendent who will initiate Emergency Response Procedures. If required, the Environment and Community Superintendent will notify the Singleton or Muswellbrook Rural Bushfire Service to be on standby. Should the fire be deemed significant or spread outside the area of Liddell Colliery operations (**Figure 1.2**) the Environment and Community Superintendent will contact the relevant Rural Bushfire Service office for action.

The Team Co-ordinator's office at the LCPP and OCE's office at the Open Cut Administration area, as appropriate to each respective site, will be the emergency fire fighting control unit (EFFU). Topographic maps of the area at a scale of 1:25,000 or other suitable drawings and a radio communications system will be made available at the EFFU. Fire management resources include:

- road and helipad access areas;
- water carts equipped with fire fighting equipment;
- dams and maintained water fill points;
- portable radios;
- emergency phones and fire extinguishers (where appropriate to the threat) provided at vantage points within the surface facilities; and
- earthmoving equipment.
- Emergency response will be undertaken in accordance with the Liddell Colliery Emergency Response Plan.
- Preventative Measures
- Fuel Management

A number of mechanical methods may be used to achieve a reduction in fuel levels. Such methods include mowing, slashing, ploughing and manual removal. Fuel load measurements are to be assessed on a yearly basis by the Environment and Community Superintendent with any fuel reduction works required to maintain fuel levels to a minimum or an equivalent measure (as recommended previously by the Rural Fire Service)

However as a best practise it was advised in Hunter Land Management's "*Liddell Annual Bushfire Monitoring and Inspections 2011-2012"* - fuel loads in grazing areas are to be inspected monthly with fuel levels to be kept to a "low" rating along firebreaks and tracks. Fuel load management will be determined by the Environment and Community Superintendent.

6.825 Suppression Activities

Fire suppression will be co-ordinated at the EFFU on site or as directed by the Environment and Community Supervisor. Keys to all gates within Liddell Colliery, topographic maps or other suitable drawings illustrating all access trails, and emergency fire fighting equipment will be available within the EFFU.

Details of the location and personnel involved in emergency fire suppression will be held by the Environment and Community Supervisor, with an additional copy in the EFFU.

Trained personnel of the EFFU will continue fire suppression, in collaboration with the Singleton and Muswellbrook Rural Bushfire Service units, outside the immediate area, if required, should the fire spread to adjoining properties.

The containment of fire may be achieved using earthmoving equipment, hand implements, water carts, aerial and ground-based chemical retardants (where available), back burning and/or burning out.

The habitat corridors may also be used as windbreaks to slow wind speeds and to intercept flying embers. In order for the habitat corridors to be effective trees will be planted evenly at medium density to avoid high turbulent effects. Fire tolerant species such as smooth barked eucalypts are recommended for such breaks, and these have been included in site revegetation.

6.826 Vehicular Access

Main access to Liddell Colliery will be provided via Pikes Gully Road and along the Old New England Highway. A network of roads surrounding and traversing the area of mining operations (**Figure 1.2**) are to be maintained to allow access for fire fighting trucks, ensuring all areas are accessible.

6.827 Water Supply

Fire fighting within the Liddell Colliery operations rely on water stored on-site in dams or at defined water fill points. Ready access will be available for vehicles to engage in water abstraction at these points. Outlets should be compatible with fire fighting equipment including all hose fittings.

As the electricity supply may fail during a bushfire, it is recommended that a minimum 3 kW (5 hp) portable petrol or diesel powered fire pump with hose be made available for emergency use at water storage locations. Diesel dewatering pumps used for mine dewatering, which could be used to fill water carts can be made available for use in these emergency situations.

6.828 Landscaping

General recommendations for site landscaping include:

- maintenance of mown lawns or bare ground (paths etc) immediately adjacent to infrastructure;
- avoid continuous tree canopies;
- removal of any existing trees that overhang the infrastructure/asset; and

- use of fire resistant trees and shrubs for future landscaping that do not retain dead material in their canopies, deposit large quantities of litter in a short period or have rough fibrous or shedding bark.
- The plants selected for site revegetation have been chosen to suit the conditions of the local environment, with fire as an important consideration. The selection of species to be planted in areas of moderate risk will be undertaken with additional emphasis on fire control.

6.83 Monitoring and Communication

6.831 Monitoring

Annual inspections will be undertaken of identified ignition source areas prior to the bushfire season and appropriate action taken, as necessary, to ensure that fuel levels are maintained to a "low" risk ranking.

The Environment and Community Superintendent will liaise with the Singleton and Muswellbrook Rural Fire Service as required, to ensure that both parties are aware of fires in and adjoining the area of mining operations.

Fire weather conditions will be monitored regularly and all fires identified on or near the area of mining operations will be immediately reported to the Environment and Community Superintendent.

6.832 Reporting

Liddell Colliery employees and contractors will report all fires, regardless of the size, and take appropriate action in accordance with the Emergency Response Plan. Bushfire management performance, including monitoring, incidents, corrective action and preventative measures, is to be reported in the AEMR.

6.833 NSW Rural Fire Service Report and Corrective Actions

For fires in which the NSW Rural Fire Service are involved, the Environment and Community Superintendent may receive a report from the Rural Fire Service regarding the cause of ignition and any difficulties encountered during bushfire suppression. Problems associated with the source of bushfire ignitions and fire suppression activities will be addressed by the Environment and Community Superintendent and appropriate mitigation measures adopted, in consultation with the Operations Manager.

7. LEASE AND LICENCE RELINQUISHMENT PROCESS

Once compliance with the agreed closure completion criteria is achieved, LCO will seek to relinquish existing leases and licences in accordance with the XCN Mine Closure Standard which involves the following process:

1. The completion of a Closure Report including a compilation of supporting documentation that demonstrates that the closure completion criteria have been met. Supporting documentation includes all relevant records, monitoring and research data and long-term rehabilitation monitoring reports. The Closure Report will be supported by a final rehabilitation inspection report completed by a suitably qualified and experienced person. The Closure Report will be prepared and submitted in accordance with the DRE – Mineral Resources' Reporting Requirements for Mine Closure and Lease Relinquishment (this guideline is currently under review).
2. Arrange a meeting with DRE to discuss any outcomes of its review of the Closure Report, in order to identify and address any potentially outstanding issues that may exist.

3. Depending on the Closure Plan's stakeholder communication strategy, the closure report may need to be circulated to other relevant government agencies for review.
4. Arrange a site inspection by DRE and other relevant stakeholders to verify the findings of the Closure Report. Following inspection and consensus among stakeholders that closure completion criteria have been met, DRE will submit a recommendation to the Minister for relinquishment of mining tenements. As part of the lease relinquishment process, where required a suitable caveat may be developed to provide that potential constraints to post-mining land uses are readily identifiable for future land holders.
5. Submit formal application for the relinquishment of leases and licences etc. regulated under various other statutory instruments, such as the submission of an application for Cancellation of Authority under the Mining Act 1992 as well as an Environment Protection Licence Surrender Application Form to EPA.

8. REVIEW

A review of the Landscape Management Plan is to be undertaken every three years.

9. ACCOUNTABILITIES AND TRAINING

9.1 Roles and Responsibilities

Responsibilities for review and approval of various aspects of the LMP are provided below. The responsibilities have been developed to be consistent with the relevant XCN standards as outlined in **Section 3.43.**

Role	Accountabilities for this document
Operations Manager	Provide that sufficient resources are allocated for the implementation of this LMP. Authorise internal and external reporting requirements as well as subsequent revisions of this program.
Manager Mining Engineering	Integrate mine rehabilitation into the short and long term mine planning process to provide that it is effectively implemented.

Role	Accountabilities for this document
Environment & Community Superintendent	Coordinating the implementation of this LMP. Review and analyse rehabilitation monitoring data and assess progress against mine closure objective and criteria. Develop and implement care and maintenance programs to progress rehabilitation areas towards meeting the closure criteria in a timely manner. Review rehabilitation methodologies based on the outcomes of monitoring programs to facilitate continual improvement. Complete reporting requirements relating to rehabilitation in the Annual Environmental Management Report and MOP. Provide that all relevant records are effectively maintained on site. Monitor all fire fighting equipment and ensure hose connections to suit the Rural Fire service are available. Monitor fuel loads to ensure a "low" risk ranking is maintained around infrastructure/assets and access tracks.
Technical Services Manager	Schedule rehabilitation activities as per the Mining Operations Plan (MOP). Coordinate updates to the MOP as required including information on mine rehabilitation.
Commercial Manager	Provide that adequate provisions are available for mine closure by implementing and updating an accrual system over the life of the mine.
Environment & Community Officer	Have a sound understanding of the Landscape Management Plan. Implement, monitor and review programs, systems and procedures linked to the LMPP. Monitor and review the data that is being collected for the LMP. Monitor, document and communicate progress against LMP objectives and targets as per the Communication and Reporting Schedule.

9.2 Awareness and Training

LCO provides training commensurate with the roles and responsibilities of personnel outlined above.

Training implemented at LCO with respect to landscape management includes the following:

- Site Familiarisation Inductions provided to all new employees and contractors;
- General Environmental Awareness provided to all existing employees and permanent contractors; and

- Issue specific training sessions provided to employees and contractors as required.
- Other methods used to communicate the responsibilities of LCO employees and contractors relating to landscape management include:
- Communication sessions;
- Tool-Box Talks;
- Electronic site notice boards; and
- Site newsletters.
- auditing and review provisions

The LMP and related procedures and systems will be reviewed at least every three years or earlier as required following changes to the sites internal or external context. The objective of the scheduled review process being primarily to:

- Monitor and report on compliance with Objectives and Targets which cover statutory requirements and other commitments;
- Account for changes in environmental requirements, technology or operational procedures; and
- Identify opportunities to drive continuous improvement and to reduce the overall risk profile of the operation.

10. DEFINITIONS

Term	Definition
Annual Environmental Management Report	A report prepared by each mining operation in NSW as a condition of its mining lease and accepted by DRE. The report is prepared on an annual basis and reports on the performance of the leaseholder and 'fine tunes' the Mining Operations Plan.
Closing Mine Site	A mining operation where cessation of operations is anticipated within less than five years.
Conceptual Closure Plan	The plan includes the progressive conceptual plan for site rehabilitation along with indicative closure costs. The Conceptual Closure Plan forms part of the LOM plan.
Life of Mine (LOM)	The period for which a mine operates until economic reserves are exhausted. This may change with changing economic environment or increased understanding of the resource.
Life of Mine Plan	Production and financial plan for the operation over the LOM period.
Mine Closure	Generally, a whole of mine life process that typically culminates in tenement relinquishment (usually occurs after a legally binding sign-off of liability). Closure (generally) is deemed to be complete at the end of decommissioning and rehabilitation and where all current appropriate regulatory obligations have been satisfied. Within this document, the definition will be extended as indicated above.

Term	Definition
Mine Decommissioning	The process that begins near, or at, the cessation of mineral production. This term is often used interchangeably with Mine Closure but here refers to a transition period and activities between cessation of operations and final closure.
Mining Operations Plan (MOP)	A plan prepared by each mining operation in NSW as a condition of its mining lease and accepted by DRE. The plan outlines the proposed sequence of mining activities, infrastructure associated with the mining operations as well as progressive and final rehabilitation programs. Prior to the cessation of mining operations, a MOP for Mine Closure will need to be submitted to the DRE for approval.
Rehabilitation (Reclamation)	The return of the disturbed land to a stable, productive and/or self sustaining condition, taking into account beneficial used of the site and surrounding land.

11. REFERENCES

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- Umwelt Australia Pty Limited, 2001, *Liddell Colliery Continued Operations Environmental Impact Statement*, prepared for Liddell Coal Operations Pty Limited.
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- LCO SD PRO 0008 - Land Rehabilitation

12. APPENDIX 1 – DEVEOPMENT CONSENT CONDITIONS

LCO Development Consent Conditions Relevant to the Landscape Management Plan

Table A.1 – Development Consent Conditions

Development Consent Condition	**Plan Section**
30. The Applicant shall prepare and implement a Landscape Management Plan for the site to the satisfaction of the Director-General and DRE. This Plan must:	
be submitted by 31 January 2008 to the Director-General and DRE for approval;	**Appendix 2**
be prepared by suitably qualified expert/s whose appointment/s have been endorsed by the Director-General;	**Section 1.1** **Appendix 2**
be prepared in consultation with NOW, OEH, MSC, SSC and the Rural Fire Service; and	**Section 1.3** **Appendix 2**
include a: Rehabilitation Management Plan; Final Void Management Plan; and Mine Closure Plan.	**Sections 3.,4.,5.,6.**
31. The Rehabilitation Management Plan must include:	
the rehabilitation objectives for the site;	**Sections 3.5 and 3.6, 5.1**
a strategic description of how the rehabilitation of the site would be integrated with land surrounding the site, with a view to improving or enhancing the regional landscape and flora and fauna habitat values;	**Sections 5.21 and 5.25**

Table A.1 – Development Consent Conditions (Cont.)

Development Consent Condition	Plan Section
a general description of the short, medium and long term measures that would be implemented to rehabilitate the site;	**Sections 5.1 and 5.2**
a detailed description of the measures that would be implemented over the next three years to rehabilitate the site, including the measures to be implemented for:	**Section 5.11**
progressively rehabilitating areas disturbed by mining operations on the site;	**Section 5.1**
managing the remnant vegetation and habitat on site;	**Section 5.51**
minimising impacts on threatened fauna;	**Section 5.5**
minimising visual impacts;	**Sections 5.11**
conserving and reusing topsoil;	**Section 5.22**
collecting and propagating seeds for rehabilitation works;	**Section 5.251**
salvaging and reusing material from the site for habitat enhancement;	**Section 5.53**
controlling weeds, feral pests, and access;	**Sections 5.43 and 5.44**
managing bushfires; and	**Section 5.45 and 6.**
managing any potential conflicts between the rehabilitation works and Aboriginal cultural heritage.	**Section 5.24**
detailed performance and completion criteria for the rehabilitation of the site;	**Section 3.6 5.27, Appendix 3**
a detailed description of how the performance of the rehabilitation works would be monitored over time to achieve the stated objectives and against the relevant performance and completion criteria; and	**Section 5.27**
details of who is responsible for monitoring, reviewing and implementing the plan.	**Section 9.**

Table A.1 – Development Consent Conditions (Cont.)

Development Consent Condition	Plan Section
32. The Final Void Management Plan must describe what actions and measures would be implemented to:	
minimise any potential adverse impacts associated with final voids on the site; and	**Section 4.**
manage and monitor the potential impacts of final voids over time.	**Section 4.**
33. The Mine Closure Plan must:	
define the objectives and criteria for mine closure;	**Sections 3.5 and 3.6**
investigate options for the future use of the site, including the final voids;	**Sections 1.4,1.7 and 4.**
investigate ways to minimise the adverse socio-economic effects associated with mine closure, including reduction in local and regional employment levels;	**Section 3.2**
describe the measures that would be implemented to minimise or manage the on-going environmental effects of the development; and	**Sections 3.8.1 and 3.8.2**
describe how the performance of these measures would be monitored over time.	**Sections 3.9 and 5.27**

Table A.2 – Statement of Commitments Relevant to the Development of a Landscape Management Plan for Liddell Colliery

Commitment No.	Statement	Plan Section
1.16	Liddell will develop a Final Void Management Plan as part of the Landscape Management Plan and review and update the Final Void Management Plat at least five years prior to the cessation of mining.	**Section 4.**
1.19	Liddell will incorporate the management outcomes provided in Section 6.5 of the EA into the Biodiversity and Land Management Plan.	Refer to **Table A.3** (below)

Table A.3 – Mitigation Measures to Limit the Degree of Impact from Mining on Native Vegetation and Threatened Flora and Fauna Species

(Section 6.5.4 of the EA)

Mitigation Measure	**Plan Section**
The proposed development areas should be clearly marked in the field to avoid any unnecessary clearing of native vegetation.	**Section 5.511**
Any machinery used for the proposed development should be kept in the disturbance areas and not placed in adjacent remnant vegetation	**Section 5.511**
No works or machinery should impact upon Bayswater Creek bed environment	**Section 5.511**
Weed and pest species should be managed as described in the Liddell Coal Flora and Fauna Management Plan (Umwelt 2003);	**Section 5.43**
During any clearance works, where practical, any habitat structures (such as rocks, logs and stumps) removed from the disturbance areas should be relocated to rehabilitation areas	**Section 5.53**
Nest boxes should be established in nearby rehabilitation areas to compensate for the loss of hollows in habitat trees. The number and designs of nest boxes required should be determined by a supervising ecologist prior to clearing activities following assessment of the number and type of tree hollows removed during clearing	**Section 5.511**
Clearing activities should be undertaken according to the EMS Procedure LC-EP01-Site Clearing as detailed in the Liddell Coal Flora and Fauna Management Plan to minimise the impacts of felling activities on tree nesting and denning species	**Section 5.511**
Habitat enhancement actions will be carried out at Dam 3 and the Mountain Block Dam as described in Section 6.5.3.3 to provide potential alternative habitat for the blue-billed duck, for when Dams 7 and 13 are removed	**Section 5.522**

13. APPENDIX 2: REGULATORY CONSULTATION

RECEIVED
18 JAN 2008

All communications to be addressed to:

Headquarters
NSW Rural Fire Service
Locked Mail Bag 17
GRANVILLE NSW 2142

Telephone: (02) 8741 5555
e-mail: developmentcontrol@rfs.nsw.gov.au

Headquarters
NSW Rural Fire Service
15 Carter Street
HOMEBUSH BAY NSW 2127

Facsimile: (02) 8741 5550

Umwelt (Australia) PTY Ltd
PO Box 838
TORONTO NSW 2283

Your Ref: 2493/BC?AS?12122007
Our Ref: D07/0001
G07/3965 GB

Attention: Allison Sharp

9 January 2008

Dear Madam,

RE: Liddell Colliery Landscape Management Plan

I refer to your letter dated 12 December 2007 seeking comments on the requirements for the preparation of a landscape management plan for the rehabilitation Liddell Colliery site.

It is noted that in general the site has not been mapped as bush fire prone land and no residential areas exist within the site. However suitable asset protection zones in accordance with *Planning for Bush Fire Protection 2006* should be provided for the existing infrastructure in any revegetation plan for the site.

For any enquiries regarding this correspondence please contact Garth Bladwell.

Yours faithfully,

Nika Fomin
Development Control Co-ordinator

The RFS has made getting additional information easier. For general information on *Planning for Bush Fire Protection 2006*, visit the RFS web page at www.rfs.nsw.gov.au and search under *Planning for Bush Fire Protection 2006*.

1 of 1

Muswellbrook Shire Council

ENQUIRIES
PLEASE ASK FOR Samantha Spicer
DIRECT 02 6549 3775
OUR REFERENCE File 140.001
YOUR REFERENCE

MUSWELLBROOK SHIRE COUNCIL
ADMINISTRATION CENTRE
MUSWELLBROOK NSW 2333
ABN 86 864 180 944

10 December 2007

Ms Barbara Crossley
Umwelt Australia Pty Ltd
PO Box 838
TORONTO NSW 2283

RECEIVED
12 DEC 2007

Dear Ms Crossley,

Re: Liddell Colliery Landscape Management Plan

Council has received your letter dated 29th November 2007 regarding the matters to be included in the completion of the Liddell Colliery Landscape Management Plan.

Please find below some additional matters suggested by Council which should be considered during the completion of the document:

- Maintenance program of rehabilitated areas and planted vegetation, including proposed irrigation of the vegetation;
- Management of water in regards to the rehabilitated areas;
- Sediment and erosion control;
- The integration of the proposed rehabilitated areas with the details of Synoptic Plan produced by Department of Primary Industries.

Additional to these items, Council also requests that during the assessment of the visual impacts, that the view points from the highway and railway corridor be equally considered along with other relevant view points.

If you have any enquiries regarding this matter please contact me on (02) 6549 3775.

Yours faithfully

Samantha Spicer
Section Leader
Environment & Natural Resources

ALL COMMUNICATIONS TO BE ADDRESSED TO THE GENERAL MANAGER PO BOX 122 MUSWELLBROOK NSW 2333
TELEPHONE: (02) 6549 3700 FAX: (02) 6549 3701 EMAIL: council@muswellbrook.nsw.gov.au WEB: www.muswellbrook.nsw.gov.au

Umwelt (Australia) Pty Limited
2/20 The Boulevarde
PO Box 838
Toronto NSW 2283

Umwelt
Environmental Consultants

ph. 02 4950 5322
fax. 02 4950 5737
ABN 18 059 519 041

Our Ref: 2493/BC/AS/291107

29 November 2007

POSTED

Mitch Bennett
Department of Environment and Climate Change
PO Box 488
NEWCASTLE NSW 2300

Dear Mitch

Re: Liddell Colliery Landscape Management Plan

Liddell Coal Operations Pty Limited (Liddell Coal) was granted approval for a modification to development consent (DA305-11-01) by the Minister for Planning on 18 July 2007. Condition 30, schedule 3 of the development consent requires that a Landscape Management Plan be prepared and submitted to the Director-General and the Department of Primary Industries (DPI) by 31 January 2008. Liddell Coal has engaged Umwelt (Australia) Pty Ltd to prepare the Landscape Management Plan.

The Landscape Management Plan will incorporate the requirements of consent conditions 31, 32 and 33, schedule 3 which require the inclusion of a rehabilitation management plan, final void management plan and a mine closure management plan.

In accordance with conditions 31, 32 and 33, the Landscape Management Plan will include:

- the rehabilitation objectives for the site;
- a strategic description of how the rehabilitation of the site would be integrated with land surrounding the site, with a view to improving or enhancing the regional landscape and flora and fauna habitat values;
- a general description of the short, medium and long term measures that would be implemented to rehabilitate the site;
- a detailed description of the measures that would be implemented over the next three years to rehabilitate the site, including the measures to be implemented for:
  - progressively rehabilitating areas disturbed by mining operations on the site;
  - managing the remnant vegetation and habitat on site;
  - minimising impacts on threatened fauna;
  - minimising visual impacts;
  - conserving and reusing topsoil;
  - collecting and propagating seeds for rehabilitation works;
  - salvaging and reusing material from the site for habitat enhancement;
  - controlling weeds, feral pests, and access;
  - managing bushfires; and

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- managing any potential conflicts between the rehabilitation works and Aboriginal cultural heritage;

- detailed performance and completion criteria for the rehabilitation of the site;
- a detailed description of how the performance of the rehabilitation works would be monitored over time to achieve the stated objectives and against the relevant performance and completion criteria;
- details of who is responsible for monitoring, reviewing and implementing the plan;
- minimise any potential adverse impacts associated with final voids on the site;
- manage and monitor the potential impacts of final voids over time;
- define the objectives and criteria for mine closure;
- investigate options for the future use of the site, including the final voids;
- investigate ways to minimise the adverse socio-economic effects associated with mine closure, including reduction in local and regional employment levels;
- describe the measures that would be implemented to minimise or manage the on-going environmental effects of the development; and
- describe how the performance of these measures would be monitored over time.

To provide for effective integration of the Landscape Management plan with Liddell's mining operation, the Landscape Management plan will also be prepared in accordance with Xstrata Standards for Mine Closure Planning, Biodiversity and Land Management and Rehabilitation Monitoring.

In accordance with the condition 30, schedule 3, Liddell Coal must prepare the Landscape Management Plan in consultation with the DECC. We are seeking your comments or matters for consideration in the preparation of the Landscape Management Plan. It would be appreciated if you could provide any comments or matters for consideration regarding the preparation of the Landscape Management Plan by 21 December 2007. If you do not respond by that time, we will assume that you have not comments in relation to this matter.

If you would like to discuss any aspect of this request further, please do not hesitate to contact Allison Sharp or myself on (02) 4950 5322.

Yours faithfully

Barbara Crossley
Director

2493/DECC_Bennett_20071129a-lr

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Umwelt (Australia) Pty Limited
2/20 The Boulevarde
PO Box 838
Toronto NSW 2283

Umwelt
Environmental Consultants

Ph. 02 4950 5322
Fax 02 4950 5737
ABN 18 059 519 041

Our Ref: 2483/BC/AS/29110f

29 November 2007

POSTED

Steve McGrath
General Manager
Singleton Council
PO Box 314
SINGLETON NSW 2330

Dear Steve

Re: Liddell Colliery Landscape Management Plan

Liddell Coal Operations Pty Limited (Liddell Coal) was granted approval for a modification to development consent (DA305-11-01) by the Minister for Planning on 18 July 2007. Condition 30, schedule 3 of the development consent requires that a Landscape Management Plan be prepared and submitted to the Director-General and the Department of Primary Industries (DPI) by 31 January 2008. Liddell Coal has engaged Umwelt (Australia) Pty Ltd to prepare the Landscape Management Plan.

The Landscape Management Plan will incorporate the requirements of consent conditions 31, 32 and 33, schedule 3 which require the inclusion of a rehabilitation management plan, final void management plan and a mine closure management plan.

In accordance with conditions 31, 32 and 33, the Landscape Management Plan will include:

- the rehabilitation objectives for the site;
- a strategic description of how the rehabilitation of the site would be integrated with land surrounding the site, with a view to improving or enhancing the regional landscape and flora and fauna habitat values;
- a general description of the short, medium and long term measures that would be implemented to rehabilitate the site;
- a detailed description of the measures that would be implemented over the next three years to rehabilitate the site, including the measures to be implemented for:
  - progressively rehabilitating areas disturbed by mining operations on the site;
  - managing the remnant vegetation and habitat on site;
  - minimising impacts on threatened fauna;
  - minimising visual impacts;
  - conserving and reusing topsoil;
  - collecting and propagating seeds for rehabilitation works;
  - salvaging and reusing material from the site for habitat enhancement;
  - controlling weeds, feral pests, and access;

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- managing bushfires; and
- managing any potential conflicts between the rehabilitation works and Aboriginal cultural heritage;

- detailed performance and completion criteria for the rehabilitation of the site;
- a detailed description of how the performance of the rehabilitation works would be monitored over time to achieve the stated objectives and against the relevant performance and completion criteria;
- details of who is responsible for monitoring, reviewing and implementing the plan;
- minimise any potential adverse impacts associated with final voids on the site;
- manage and monitor the potential impacts of final voids over time;
- define the objectives and criteria for mine closure;
- investigate options for the future use of the site, including the final voids;
- investigate ways to minimise the adverse socio-economic effects associated with mine closure, including reduction in local and regional employment levels;
- describe the measures that would be implemented to minimise or manage the on-going environmental effects of the development; and
- describe how the performance of these measures would be monitored over time.

To provide for effective integration of the Landscape Management plan with Liddell's mining operation, the Landscape Management plan will also be prepared in accordance with Xstrata Standards for Mine Closure Planning, Biodiversity and Land Management and Rehabilitation Monitoring.

In accordance with the condition 30, schedule 3, Liddell Coal must prepare the Landscape Management Plan in consultation with Singleton Council. We are seeking your comments or matters for consideration in the preparation of the Landscape Management Plan. It would be appreciated if you could provide any comments or matters for consideration regarding the preperation of the Landscape Management Plan by 21 December 2007. If you do not respond by that time, we will assume that you have not comments in relation to this matter.

If you would like to discuss any aspect of this request further, please do not hesitate to contact Allison Sharp or myself on (02) 4950 5322.

Yours faithfully

Barbara Crossley
Director

2499/SC_McGrath_20071128e-ltr

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Umwelt (Australia) Pty Limited
2/20 The Boulevarde
PO Box 838
Toronto NSW 2283

Umwelt
Environmental Consultants

Ph: 02 4950 5322
Fax: 02 4950 5737
ABN 18 059 519 041

Our Ref: 2483/BC/AS/291107

29 November 2007

Mark Mignanelli
Manager, Major Projects and Mining Assessments
Department of Water and Energy
PO Box 2213
DANGAR NSW 2309

POSTED

Dear Mark

Re: Liddell Colliery Landscape Management Plan

Liddell Coal Operations Pty Limited (Liddell Coal) was granted approval for a modification to development consent (DA305-11-01) by the Minister for Planning on 18 July 2007. Condition 30, schedule 3 of the development consent requires that a Landscape Management Plan be prepared and submitted to the Director-General and the Department of Primary Industries (DPI) by 31 January 2008. Liddell Coal has engaged Umwelt (Australia) Pty Ltd to prepare the Landscape Management Plan.

The Landscape Management Plan will incorporate the requirements of consent conditions 31, 32 and 33, schedule 3 which require the inclusion of a rehabilitation management plan, final void management plan and a mine closure management plan.

In accordance with conditions 31, 32 and 33, the Landscape Management Plan will include:

- the rehabilitation objectives for the site;
- a strategic description of how the rehabilitation of the site would be integrated with land surrounding the site, with a view to improving or enhancing the regional landscape and flora and fauna habitat values;
- a general description of the short, medium and long term measures that would be implemented to rehabilitate the site;
- a detailed description of the measures that would be implemented over the next three years to rehabilitate the site, including the measures to be implemented for:
  - progressively rehabilitating areas disturbed by mining operations on the site;
  - managing the remnant vegetation and habitat on site;
  - minimising impacts on threatened fauna;
  - minimising visual impacts;
  - conserving and reusing topsoil;
  - collecting and propagating seeds for rehabilitation works;
  - salvaging and reusing material from the site for habitat enhancement;
  - controlling weeds, feral pests, and access;

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- managing bushfires; and
- managing any potential conflicts between the rehabilitation works and Aboriginal cultural heritage;

- detailed performance and completion criteria for the rehabilitation of the site;
- a detailed description of how the performance of the rehabilitation works would be monitored over time to achieve the stated objectives and against the relevant performance and completion criteria;
- details of who is responsible for monitoring, reviewing and implementing the plan;
- minimise any potential adverse impacts associated with final voids on the site;
- manage and monitor the potential impacts of final voids over time;
- define the objectives and criteria for mine closure;
- investigate options for the future use of the site, including the final voids;
- investigate ways to minimise the adverse socio-economic effects associated with mine closure, including reduction in local and regional employment levels;
- describe the measures that would be implemented to minimise or manage the on-going environmental effects of the development; and
- describe how the performance of these measures would be monitored over time.

To provide for effective integration of the Landscape Management plan with Liddell's mining operation, the Landscape Management plan will also be prepared in accordance with Xstrata Standards for Mine Closure Planning, Biodiversity and Land Management and Rehabilitation Monitoring.

In accordance with the condition 30, schedule 3, Liddell Coal must prepare the Landscape Management Plan in consultation with the DWE. We are seeking your comments or matters for consideration in the preparation of the Landscape Management Plan. It would be appreciated if you could provide any comments or matters for consideration regarding the preparation of the Landscape Management Plan by 21 December 2007. If you do not respond by that time, we will assume that you have not comments in relation to this matter.

If you would like to discuss any aspect of this request further, please do not hesitate to contact Allison Sharp or myself on (02) 4950 5322.

Yours faithfully

Barbara Crossley
Director

2493/DWE_Mignanelli_20071129a-ltr

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NSW GOVERNMENT
Department of Planning

Contact: Paul Freeman
Phone: (02) 9228 6436
Fax: (02) 9228 6466
Email: paul.freeman@planning.nsw.gov.au

Our ref:

Ms Barbara Crossley
Director
Umwelt (Australia) Pty Limited
PO Box 836
TORONTO NSW 2283

RECEIVED
18 DEC 2007

Dear Barbara

Liddell Colliery – Landscape Management Plan

I refer to your letter dated 29 November 2007, seeking the Department's endorsement of nominated personnel from Umwelt (Australia) Pty Limited as suitably qualified experts to undertake the preparation of the landscape management plan required by condition 30 of schedule 3 of the Minister's approval for the Liddell Colliery.

The Department has considered the qualifications and experience of the nominated personnel and believes that they are suitable for appointment. Accordingly, the Director-General has endorsed the following personnel to prepare the Liddell Colliery Landscape Management Plan:

- Mr Matthew Newton;
- Mr Travis Peake; and
- Ms Allison Sharp.

If you have any queries on this matter, please contact Paul Freeman on the details listed above.

Yours sincerely,

Howard Reed 11-12-07
A/Manager
Mining and Extractive Industries
as Delegate for the Director-General

Department of Planning, Major Development Assessments, GPO Box 39, SYDNEY NSW 2001
Phone: (02) 9228 6483 Fax: (02) 9228 6466 DX 10181 Sydney Stock Exchange Website: www.planning.nsw.gov.au

Umwelt (Australia) Pty Limited
2/20 The Boulevarde
PO Box 838
Toronto NSW 2283

Umwelt
Environmental Consultants

Ph: 02 4950 5322
Fax: 02 4950 5737

ABN 18 059 519 041

Our Ref: 2493/BC/MN/AS/291107

29 November 2007

POSTED

Howard Reed
Manager, Mining and Extractive Industries
Department of Planning
GPO Box 39
SYDNEY NSW 2001

Dear Howard

Re: Landscape Management Plan for Liddell Colliery, NSW

Liddell Coal Operations Pty Limited (Liddell Coal) was granted approval for a modification to development consent (DA305-11-01) by the Minister for Planning on 18 July 2007. Condition 30, schedule 3 of the development consent requires that a Landscape Management Plan be prepared and submitted to the Director-General and the Department of Primary Industries (DPI) by 31 January 2008. The Plan is required to include a rehabilitation management plan, final void management plan and a mine closure management plan. Liddell Coal has engaged Umwelt (Australia) Pty Limited (Umwelt) to prepare the Landscape Management Plan.

Condition 30 (b), schedule 3 requires that the Landscape Management Plan be prepared by suitably qualified expert/s whose appointment/s have been endorsed by the Director-General. The Landscape Management Plan will be prepared by Matthew Newton B Env Sc (Hons), Associate and Travis Peake B Nat Res (Hons), Ecology Manager, Associate, with project support provided by Allison Sharp B Env Sc, Senior Environmental Scientist. Strategic direction and review will be provided by Barbara Crossley B Nat Res (Hons), Director of Umwelt. A summary of Matthew, Travis and Allison's relevant experience is outlined below, with their Statements of Experience and Expertise attached for your information. Could you please confirm that the Director-General approves the appointment of these personnel to prepare the Landscape Management Plan as required by condition 30(b), schedule 3 of DA 305-11-01.

Matthew Newton, B Env Sc (Hons)
Associate

Matthew has eleven years experience in environmental management within the coal mining industry, particularly with decommissioning and rehabilitation issues. The most notable projects have involved the development and implementation of mine closure plans right through to completion of closure activities including Xstrata Coal Australia's New Wallsend No.2 Colliery and Great Greta Colliery. Both of these projects have been recognised by industry peers and community groups as being a benchmark for other closure projects with New Wallsend No.2 Colliery being awarded the inaugural NSW Minerals Council Environmental Excellence Award in 2006 and Great Greta Colliery being announced as a finalist in the Hunter Coal Industry Environmental Management Awards in 2001.

Matthew continues to have an ongoing coordination role with the post closure care and maintenance of both of these sites.

Based on his extensive experience in closure and rehabilitation planning, Matthew has prepared both mine closure and rehabilitation monitoring standards for one of Umwelt's key corporate clients to be applied across their world-wide operations.

Throughout the various mine closure projects, Matthew was involved in:

- developing and presenting mine closure papers at a number of industry workshops including the Minerals Council of Australia and ACMER;
- the preparation of conceptual and detailed mine closure plans, which include cost estimates for closure activities;
- the development of mine closure and rehabilitation standards;
- development of mine closure objectives and criteria;
- future land use planning;
- final landform design including water management design;
- development of post-closure groundwater management strategies;
- providing rehabilitation advice and assessment;
- design and implementation of rehabilitation monitoring and assessment programs;
- operational support and environmental management supervision of multi-disciplinary closure and rehabilitation activities including contamination remediation, creek line re-establishment, revegetation, sediment and erosion control, acid mine drainage treatment, hazardous substances management, bulk earthworks and subsidence remediation;
- facilitating community involvement programs as part of mine closure including community meetings and preparing community information brochures;
- understanding relevant policy and regulatory frameworks relating to mine closure, including development of good working relationships with government authorities;
- rehabilitation security calculations and negotiation with government authorities;
- preparing both internal and statutory environmental reporting documentation including the close-out reports for sign-off by government authorities on successful closure; and
- development of post-closure rehabilitation care and maintenance programs.

Other major closure, decommissioning and rehabilitation projects that Matthew has been involved in include:

- preparation of a conceptual mine closure strategy for a BHP Billiton mining project, situated in the Hunter valley, which is in the pre-feasibility stage;
- preparation of Pre-Feasibility Constraints and Opportunities Analysis for Mine Closure for Cumnock No.1 Colliery;
- preparation of conceptual closure plans for the Oceanic Coal group of mines, including two underground mines, an open cut and coal washery. This included providing advice on strategic land use planning as well as indicative land evaluation analysis on potential future site land uses;
- a rehabilitation cost review for a Rubies project within the Gloucester area;
- facilitation of a mine closure workshop for Cumnock No.1 Colliery underground operations;
- the rehabilitation of an abandoned coal stockpile area at Powercoal's Cooranbong Colliery. This project formed the basis of his honours degree which focused on the use of biosolids and seed treatment techniques on re-establishing native trees on a coal mine spoil pile. Based on his

honours thesis, Matthew has written and presented a number of papers at Environmental Conferences including the Newcastle Geological Symposium (1997, 1998);

- the rehabilitation of gaswell and borehole sites as well as access tracks in areas of native bushland contained within Oceanic Coal freehold and leasehold land; and
- utilising biosolids for revegetation to promote visual screening of the coarse refuse emplacement area at Oceanic Coal's Macquarie Coal Preparation Plant.

Travis Peake, B Nat Res (Hons)
Ecology Manager, Associate

Travis provides expertise in ecological assessment and management, drawing on 12 years of experience in consultancy and catchment management authority positions. His experience underpins strengths in the technical aspects of ecological survey design, implementation and significance assessment for complex projects, and also in the preparation of clear management guidelines for community, local government and state government audiences.

He has an excellent understanding of the structure, function, conservation significance and management opportunities associated with diverse vegetation communities and habitats across the Hunter Region, Central Coast and Lower North Coast, as well as an appreciation of the types of management strategies that are practical for implementation in local government planning contexts.

Travis has extensive experience in ecological assessments and management, particularly in the Hunter Region, lower North Coast and the Central Coast of New South Wales. Over the last 12 years, Travis has undertaken numerous specialist vegetation studies, in addition to managing complete ecological assessments for specific developments, including ecological assessments at Newcastle, Lake Macquarie, Muswellbrook, Scone, Tamworth, Gunnedah, Moree, Armidale, Coffs Harbour, Taree, Forster, Port Stephens, the Central Coast, Sydney and Goulburn. Travis' latest published report is the benchmark 2-volume *The Vegetation of the Central Hunter Valley, New South Wales*, reporting on the outcomes of the Hunter Remnant Vegetation Project, a 3200 km^2 study of vegetation in the Hunter Valley. This has enabled him to develop a thorough and expert knowledge of the distribution and conservation status of vegetation throughout the Hunter Region. His previous consultancy and Hunter Catchment Management Trust experience enables Travis to efficiently conduct complex ecological survey, analysis and assessment, and to consider practical management approaches at the property, local and regional scales. Travis was extensively involved in the Hunter Regional Vegetation Committee, and was for two years a member of its Expert Panel on High Conservation Value Vegetation. Travis is also the secretary of the Hunter Rare Plants Committee, a subcommittee of the Hunter Region Botanic Gardens, which is compiling a database of the regionally significant plants of the Hunter, Port Stephens and Central Coast regions. Travis was the author of the Hunter Catchment Management Trust's *Hunter Bushland Resource Kit*, which presents all relevant ecological information for the management of property by private landholders, local and state government throughout the Hunter Region.

Allison Sharp, B Env Sc
Senior Environmental Scientist

Allison is an Environmental Scientist with six years experience in the environmental management field. She has a wide range of experience in environmental impact assessment, site contamination assessment and remediation and environmental monitoring. Prior to joining Umwelt in late 2005, Allison was employed by URS Australia for a period of four years. During that time Allison undertook a wide variety of Phase 1 and 2 site contamination assessments and environmental monitoring programs for noise, groundwater and air quality.

Since joining Umwelt, Allison has been involved in a wide range of projects, including environmental impact assessments, pre-feasibility environmental studies, mining operations plans and environmental auditing for the mining industry. More recently, Allison has been responsible for managing multidisciplinary projects from inception through to completion and is competent in all aspects of project management, from project planning, reporting writing and review, subcontractor management and project completion. Allison has successfully managed the submission of multiple environmental

assessments on behalf of the mining operations and utility suppliers. Allison is regularly involved in the development of management reports and plans for the mining industry including mining operations plans, environmental management plans, auditing of onsite environmental management and environmental monitoring.

If you have any questions or require any additional information relating to the preperaton of the Landscape Management Plan please contact me on (02) 4950 5322.

Yours faithfully

Barbara Crossley
Director

enc

2493/DoP_Reed_20071128a-ltr

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14. APPENDIX 3: LIDDELL COLLIERY SD FORM 0120 – MINE CLOSURE CRITERIA

LCO SD FRM 0120

MINE CLOSURE CRITERIA

INSTRUCTIONS

Mine Closure Criteria were developed for Liddell Coal Operations to monitor rehabilitation progress in line with internal XCN requirements and external relinquishment goals. Further revisions of the Closure Criteria will be required during the life of the operation as criteria and goals become more refined as LCO approached closure.

PRELIMINARY COMPLETEION CRITERIA

Rehabilitation Phase	Aspect or Ecosystem Component	Domain Objective	Indicator	Completion Criteria	Justification / Source
INFRASTRUCTURE AREAS: DOMAIN 1 – Underground Admininstration Office and Coal Preparation Plant DOMAIN 2 – Open Cut Facilities					
Decommissioning	Decommissioning and/or removal of infrastructure	All non-heritage infrastructure removed to ensure the site is safe and free of hazardous materials	Disconnect, terminate and remove all services (power, water, communications, roads, bridges)	Yes / No	Environmental Assessment /Mining Operations Plan (MOP)
			Remove the CHPP and all associated conveyors and structures	Yes / No	Environmental Assessment / MOP Section 5.2
			Demolition and removal of all offices and workshop related facilities, including refuelling facilities, sewage treatment plant and car parks.	Yes / No	Environmental Assessment / MOP Section 5.2
			All demolition works to be carried out in accordance with Australian Standard AS 2601-2001 or latest version.	Yes/No	Development Consent DA 305-11-01
			Removal of associated water management infrastructure – pumps, pipes and power.	Yes / No	Environmental Assessment / MOP Section 5.2
			Removal of all plant and equipment from laydown areas and graveyards	Yes / No	Environmental Assessment
		Adits and shafts sealed to the satisfaction of I&I NSW	Ensure all underground entries sealed as per DPI standards (DPI Document 07C/2008 / MDG 6001 - Guideline for the Permanent Filling and Capping of Surface Entries to Coal Seams – Draft)	Yes / No	Mining Lease
Landform establishment	Landform development consistent with final landuse	Landform suitable for final landuse and compatible with surrounding landscape as predominantly grazing land with sustainable native ecosystem corridors	Maximum slope of final landform (including ROM pad)	10 degrees	MOP / LCO Landscape Management Plan (LMP)
			Maximum longitudinal grade of contour drains designed in accordance with the Blue Book.	Yes/No	Managing Urban Stormwater: Soils and Construction Manual Vol 2E Mines and Quarries (DECC 2008) (the Blue Book Vol 2E)
			Waste rock compaction has been relieved through deep ripping on the contour to a minimum depth of 600mm	Yes / No	MOP
	Erosion	Minimal active accelerated erosion	Gully erosion: No areas of active gully erosion	Yes / No	MOP
			Tunnel erosion: No evidence of tunnel erosion	Yes / No	MOP
			Rill erosion: Limited to isolated areas of minor rilling up to 200mm deep	Yes / No	MOP
		Minimal susceptibility to erosion	Continuous slope length < 100m	Yes / No	AMIC Mine Rehabilitation Handbook

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			All surface water management infrastructure has been designed in accordance with an industry leading practice standard.	Yes / No	The Blue Book Vol 2E
			All soils with >5% ESP mapped	Yes / No	Charman and Murphy (2007): Soils: their properties and management.
			Top surface layer soils with >5% ESP treated with gypsum (>10% gypsum w/w)	Yes / No	Charman and Murphy (2007): Soils: their properties and management.
		Continued viability and stability of constructed surface drainage system	Graded banks designed in accordance with the Blue Book. No significant loss of freeboard or bank channel capacity (e.g. bank slumping, accumulation of sediments or excessive vegetation)	minus 200mm	The Blue Book Vol 2E
			Chutes, flumes and grade control structures: No damage to structures by overflow, outflanking, slumping or loss of rock. No significant loss of capacity due to deposition of accumulated sediments or vegetation; no active scour around inlets or outlet.	Yes / No	The Blue Book Vol 2E
	Water quality	No water pollution from site, and water discharge quality in accordance with requirements of EPL 2094	Total suspended solids	120 mg/L	EPL 2094
			Water pH	pH 6.5-9.0	EPL 2094
			Runoff water electrical conductivity	<1000 µs/cm (after 5 yrs)	LCO Rehabilitation Monitoring Strategy (GSS)
			Runoff water quality in accordance with the ANZECC Guidelines	Yes / No	ANZECC Guidelines for Fresh and Marine Water Quality (2000)
	Contamination	No residual soil contamination onsite	Soil parameters in accordance with relevant guidelines	Yes/No	Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites 1992
			The surface layer to be free of any hazardous material to a depth of at least 1 metre	Yes / No	LCO Rehabilitation Monitoring Strategy (GSS)
	Health and Safety	No latent community / environmental health and/or safety hazards	Dangerous areas removed. Absence of shafts, holes, tunnels, adits or unstable areas, mine entries sealed.	Yes / No	Environmental Assessment / MOP
Growth medium development	Soil profile development	Provide soil chemical and physical properties that are comparable with the reference sites, or alternate growth medium that is suitable for the establishment and maintenance of the selected vegetation species.	Topsoil replacement depth where topsoil resources available.	150mm	MOP - Section 4.5.1
			Surface soil pH	pH 6.0 – 8.0 (after 5 years)	LCO Rehabilitation Monitoring Strategy (GSS)
			Conductivity of surface material	below 900 uS/cm after 5 years	
			The surface layer to be free of any hazardous material to a depth of at least 1m.	Yes / No	
			Exchangeable sodium percentage	No more than 20% higher than for the analogue plot soil after 5 years.	
			Cation exchange capacity	No less than 20% of analogue site after 5 years.	
			Soil loss after 5 years	<40 tonnes/ha/ year	
			Soil N, P, K and S levels	Within 20% of levels in adjacent analogue site after 10 years	
			Total organic carbon percentage	No less than 20% of analogue site value after 10 years	
Ecosystem Development	Native Ecosystem establishment	Native Ecosystem (habitat corridor) established	Specified hectares (Area of land subject to rehabilitation)	Domain 1: 7ha Domain 2: 7.5ha	MOP Rehabilitation Liability calculation
			The presence of at least two overstorey and two understory species in each 10m × 20m plot at all ages.	Yes / No	LCO Rehabilitation Monitoring Strategy

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			Stem densities - minimum total tree/shrub densities for seeded areas.	Year 1 – 1,000 stems/ha Year 5 – 500 stems/ha Year 10 – 400 stems/ha	LCO Rehabilitation Monitoring Strategy
			Natural Regeneration. Evidence of natural regeneration at Year 10 for at least one species.	Yes / No	LCO Rehabilitation Monitoring Strategy
			The return of agreed land capability consistent with commitments in the EA, MOP and relevant consent conditions.	Yes / No	LCO Rehabilitation Monitoring Strategy
			Criteria to be researched and agreed upon within 5 years		
			Minimum canopy cover in native ecosystem areas	To be determined	Recommended in LCO Rehabilitation Monitoring Strategy (GSS)
			Minimum tree height and girth standards for the indicator species Corymbia maiculata for 1,5 and 10 years.	To be determined	Recommended in LCO Rehabilitation Monitoring Strategy (GSS)
			Log density	m2 per hectare to be determined	Analogue reference site community
			Rock pile density	m2 per hectare to be determined	Analogue sites
			Number of artificial hollows	m2 per hectare to be determined	Analogue reference site community
		Habitat areas comparable with reference sites	Water storage, exposed rocks, groundcover, exotic species present to be in line with reference site community. Ecosystem Function Analysis (EFA) performed.	Yes / No	Analogue reference site community
		Ecosystem developed to a point of sustainability	Litter cover (%)	To be determined	Analogue sites
			Percentage of plants affected by negative health indicators (nutrient deficiency, shallow root development, excessive grazing)	To be determined	Analogue sites
			Groundcover %	To be determined	Analogue sites
			Canopy cover %	To be determined	Analogue sites
			Number of native flora species recorded	To be determined	Analogue sites
			Number of native fauna species recorded or evidenced	To be determined	Analogue sites
			Percentage cover of environmental weeds	To be determined	Analogue sites
			Percentage cover of noxious weeds	To be determined	Analogue sites
			Feral fauna species recorded and reported within rehabilitated area	none	
	Pasture/Rural Land Use establishment	Pasture established	Specified hectares (Area of land subject to rehabilitation)	Domain 1: 17ha Domain 2: 17ha	MOP (rehabilitation liability calculation)
			Pasture species to consist of grasses and legumes appropriate to the district and recognised as suitable for beef cattle grazing.	Yes / No	LCO Rehabilitation Monitoring Strategy (GSS)
			Minimum vegetative cover to be established over a minimum of 95% of areas treated after one year.	80% vegetative cover	LCO Rehabilitation Monitoring Strategy (GSS)
			Weeds. Max cover of Galenia secunda.	5 m2 within any 100m2 area. 5% over any one hectare area	LCO Rehabilitation Monitoring Strategy (GSS)
		Pasture/Rural area comparable with reference sites	Water storage and access to water so as to support low intensity grazing activities	Yes/No	Environmental Assessment
			Appropriate fencing and other infrastructure (e.g. stockyards) for managing stock and controlling stock movements.	Yes / No	Analogue sites

		Pasture/Rural area developed to a point of sustainability	Demonstrated carrying capacity of a specified head of stock per ha accounting for a range of climatic conditions e.g.: drought, average rainfall etc.	Yes/No	Analogue sites
			Percentage of plants affected by negative health indicators (nutrient deficiency, shallow root development, excessive grazing)	<X% to be determined	Analogue sites
	Ecosystem health and structure	Floral composition comparable with reference sites	Evidence that projected foliage cover is developing in structure and complexity comparable with reference sites	Yes / No	Analogue sites
		Faunal composition comparable with reference sites	Population number: Not significantly less than 30% below target range from reference sites and demonstrating a sustained positive trend towards target values	Yes / No	Analogue sites
		Flora/Fauna species assemblages	Ecological monitoring identifies no loss of native flora/fauna species diversity within areas of retained vegetation. (Considering natural events or influences such as drought and bushfire).	Yes / No	Analogue sites
			Weeds are addressed as part of the Ecological Management Plan.	Yes / No	Analogue sites
			Nest boxes will be maintained in suitable abundance, position and condition throughout the life of the mine, and beyond. Monitoring of nest boxes identifies usage by target native species.	Yes / No	Analogue sites
	Habitat Corridors	Habitat corridors are shown to be successfully established and consistent with desired vegetation community compositions.	Monitoring of flora/fauna species identifies increasing levels of corridor function in terms of species movement.	Yes / No	
	Ecosystem Function Analysis	EFA comparable with reference sites	Positive results of ecosystem function analysis	Yes / No	
	Residual Risks	Risk Assessment conducted in accordance with Australian & New Zealand Standard for Risk Management AS/NZS 4360:2004	Risk Management: All residual risks identified and provision made for any ongoing management requirements	Yes / No	XCN HSEC STD 5.12 Mine Closure Planning
			Residual Risks: Residual Risks acceptable to Government with an overall rating of no greater than 'moderate.'	Yes / No	XCN HSEC STD 5.12 Mine Closure Planning
OPEN CUT MINING AREAS: DOMAIN 3 – South Pit DOMAIN 6 – Entrance Pit DOMAIN 4 – Railway Pit DOMAIN 9 – Mountain Pit					
Decommissioning	Decommissioning and/or removal of infrastructure	All non-heritage infrastructure removed to ensure the site is safe and free of hazardous materials	Disconnect, terminate and remove all services (power, water, communications, roads, and bridges). Includes ripping of haul roads.	Yes / No	Environmental Assessment /MOP
			Removal of associated water management infrastructure - pumps, pipes and power.	Yes / No	Environmental Assessment /MOP Section 5.2
		Adits and shafts sealed to the satisfaction of I&I NSW	Design specification: Adits sealed as per DPI standards (DPI Document 07C/2008 / MDG 6001 - Guideline for the Permanent Filling and Capping of Surface Entries to Coal Seams – Draft)	Yes / No	Mining Lease
		Plant and equipment Laydown areas	Removal of all plant and equipment from laydown areas and graveyards	Yes / No	Environmental Assessment
Landform establishment	Landform development consistent with final landuse	Landform suitable for final landuse and compatible with surrounding landscape as predominantly grazing land with sustainable native ecosystem corridors	Maximum slope of final landform – overburden dumps	10 degrees	MOP/LMP
			Maximum longitudinal grade of contour drains designed in accordance with the Blue Book.	Yes/No	The Blue Book Vol 2E

			Waste rock compaction has been relieved through deep ripping on the contour to a minimum depth of 600mm	Yes / No	MOP
		No unstable slopes or high walls	Geotechnical assessment report has identified negligible risk of highwall failure	Yes / No	MOP
			All low walls < 18 degrees	Yes / No	Environmental Assessment (Umwelt, 2006) Section 6.1.2.2 / MOP
	Erosion	Minimal active accelerated erosion	As per domain 1		
		Minimal susceptibility to erosion	As per domain 1		
	Drainage	Continued viability and stability of constructed surface drainage system	As per domain 1		
	Water quality	No water pollution from site, and discharge water quality in compliance with requirements of EPL 2094	As per domain 1		
	Contamination	No residual soil contamination onsite	As per domain 1		
	Health and Safety	No latent community / environmental health and/or safety hazards	Dangerous areas removed. Absence of unprotected highwalls, voids, shafts, holes, tunnels, adits or unstable areas, mine entries sealed.	Yes / No	Environmental Assessment
Growth medium development	Soil profile development	Provide soil chemical and physical properties that are comparable with the reference sites, or alternate growth medium that is suitable for the establishment and maintenance of the selected vegetation species	Topsoil replacement depth on shaped overburden areas	150 mm where topsoil available	MOP - Section 4.5.1
			As per domain 1		
Ecosystem Establishment	Native Ecosystem establishment	Native Ecosystem established	Specified hectares (Area of land subject to rehabilitation)	Domain 3 - 66 ha Domain 4 – 97ha Domain 6 – 22ha Domain 9 – 46ha	MOP (Rehabilitation Liability Calculation) Domain 4 and 9 – assumed 30% trees/70% pasture
			As per domain 1		
		Habitat areas comparable with reference sites	As per domain 1		
		Ecosystem developed to a point of sustainability	As per domain 1		
	Pasture/Rural land use establishment	Pasture established	Specified hectares (area of land subject to rehabilitation	Domain 3 - 153 ha Domain 4 – 226ha Domain 6 – 254ha Domain 9 – 108ha	MOP (Rehabilitation Liability Calculation)
	Ecosystem health and structure	Floral composition comparable with reference sites	As per domain 1		
		Faunal composition comparable with reference sites	As per domain 1		
		Flora/Fauna species assemblages	As per domain 1		
	Habitat Corridors	Habitat Corridors are shown to be successfully established and consistent with desired vegetation community compositions.	As per domain 1		
	Ecosystem Function Analysis	EFA comparable with reference sites	As per domain 1		
	Residual Risks	Risk Assessment conducted in accordance with Australian & New Zealand Standard for Risk Management AS/NZS 4360:2004	As per domain 1		
TAILINGS DISPOSAL AREAS:		**DOMAIN 4A – Fines area**	**DOMAIN 7 – Antiene tailings dam**	**DOMAIN 5 – Reservoir area**	**DOMAIN 8 Antiene void area**
Decommissioning	Decommissioning and/or removal of infrastructure	All non-heritage infrastructure removed to ensure the site is safe and free of hazardous materials	As per Open Cut Mining Areas		

		Fines/tailings areas to be decommissioned and capped to the satisfaction of I&I NSW	Decommissioning of the facility in accordance with approval granted under s100 of the *Coal Mines Health and Safety Act 2002* and the requirements of Xstrata Coal under the HSEC STD 8.1 *Tailings Storage Management*. Area to be capped at 2m thick.	Yes / No	Section 101 Decommissioning Approval (I&I NSW) MOP
Landform establishment	Landform development consistent with final landuse	Landform suitable for final landuse and compatible with surrounding landscape as pasture	Maximum slope of final landform	10 degrees	MOP
			Maximum Longitudinal grade of contour drains	2%	MOP
			Waste rock compaction has been relieved through deep ripping on the contour to a minimum depth of 600mm	Yes / No	MOP
		No unstable slopes	Geotechnical assessment report has identified negligible risk for failure	Yes / No	MOP
			All low walls < 18 degrees	Yes / No	Environmental Assessment
	Erosion	Minimal active accelerated erosion	As per Open Cut Mining Areas		
		Minimal susceptibility to erosion	As per Open Cut Mining Areas		
	Drainage	Continued viability and stability of constructed surface drainage system	Ensure capped tailings disposal areas are free draining Other indicators as per Open Cut Mining Areas	Yes/No	
	Water quality	No water pollution from site, and discharge water quality in compliance with requirements of EPL 2094	As per Open Cut Mining Areas		
	Contamination	No residual soil contamination onsite	As per Open Cut Mining Areas		
	Health and Safety	No latent community / environmental health and/or safety hazards	As per Open Cut Mining Areas		
Growth medium development	Soil profile development	Provide soil chemical and physical properties that are comparable with the reference sites, or alternate growth medium that is suitable for the establishment and maintenance of the selected vegetation species	As per Open Cut Mining Areas		
	Pasture/Rural Land use establishment	Pasture established	Specified hectares (Area of land subject to rehabilitation)	Domain 4a – 28 ha Domain 5 – 110 ha Domain 7 – 105 ha Domain 8 – 76ha	MOP rehabilitation liability calculation
			As per domain 1		
	Ecosystem health and structure	Floral composition comparable with reference sites	As per domain 1		
		Faunal composition comparable with reference sites	As per domain 1		
		Flora/Fauna species assemblages	As per domain 1		
	Habitat Corridors	Habitat Corridors are shown to be successfully established and consistent with desired vegetation community compositions.	As per domain 1		
	Ecosystem Function Analysis	EFA comparable with reference sites	As per domain 1		
	Residual Risks	Risk Assessment conducted in accordance with Australian & New Zealand Standard for Risk Management AS/NZS 4360:2004	As per domain 1		

15. CONTROL AND REVISION HISTORY

15.1 Document information

Property	Value
Approved by	Operations Manager
Document Owner	Environment and Community Superintendent
Effective Date	24/05/2013
Keywords	Land, Management, environment, flora, fauna, final, void, rehabilitation, native, leave, licence, bush, fire, mine, closure

For a complete list of document properties, select **View Properties** from the document's context menu on the intranet.

15.2 Revisions

Version	Date reviewed	Review team (consultation)	Nature of the amendment
1	18/3/2013	B de Somer, Colin Davies (Carbon Based)	This document supersedes LCO SD EXT 0077 Landscape Management Plan (Including Mine Closure Plan, Rehabilitation Management Plan & Final Void Management Plan). Prepared as per 2012 Independent Environmental Audit Recommendations
2			
3			