ASHTON COAL PROJECT

EXTRACTION LAND MANAGEMENT PLAN UPPER LIDDELL SEAM LW 1-8

Version Date: 01/08/2012

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Version History

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External Approval Register

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1. INTRODUCTION

This Extraction Land Management Plan (ELMP) describes the measures that will be implemented by Ashton Coal Operations Ltd (ACOL) to manage and mitigate impacts on land condition and agricultural value as a result of underground mining (second workings) within Longwall Panels 1 to 8 (LW 1-8) in the Upper Liddell (ULD) Seam at the Ashton Coal Project (ACP).

The development consent (as modified) requires the preparation of Extraction Plans (Condition 3.12) that include a consultation and assessment process to further determine the impacts and management of key features (including land condition) based on the final mine design. An Extraction Plan for ULD LW 1-8 has been prepared in accordance with this condition. Specifically Condition 3.12(h) requires that a Land Management Plan be included as part of the Extraction Plan to "...*manage the potential impacts and/or environmental consequences of the proposed second workings on land in general*".

In accordance with DA 309-11-2001 (as modified) this ELMP has been prepared as a component of the Extraction Plan for ULD LW 1-8 to manage the potential impacts and/or environmental consequences of the secondary extraction upon land in general as identified through the revised subsidence predictions (SCT 2011) and relevant approval documents, including the Environmental Impact Statement (EIS) for the overall project (HLA, 2001) and Environmental Assessment (EA) for the Bowmans Creek Diversion (Evans and Peck 2009).

This ELMP has been prepared pursuant only to 3.12(h) of DA 309-11-2001 with respect to specific management outcomes for the underground mine. This plan supplements the site-wide Land Management Plan (LMP) approved pursuant to Condition 3.58 of DA 309-11-2001 with respect to specific management regimes for the underground operations. The site-wide LMP still provides for overall land management across the ACP.

Subsidence effects from longwall extraction of the Pikes Gully (PG) Seam at the ACP has been managed in accordance with two approved Subsidence Management Plans – one governing subsidence monitoring and management for LW 1-4 the other for LW 5-8. At such time as secondary extraction commences in the ULD Seam this management plan will replace the previous two Subsidence Management Plan which applied to the underground mining area.

1.1 BACKGROUND

The modification of DA 309-11-2001 in December 2010 replaced the requirement (under the development consent) for the preparation, approval and implementation of a Subsidence Management Plan(s) with that of an Extraction Plan. Under this new subsidence management regime the development consent becomes the principle approval authorising first workings, while an approved extraction plan governs the monitoring and management of subsidence effects from second workings.

ACOL has prepared this ELMP to coincide with the scheduled progression of longwall mining from the PG Seam to the ULD Seam. The ULD is the next deepest seam to be mined using the longwall extraction method at the ACP.

ACOL has adopted a strategic approach in preparing the ULD Extraction Plan to include wherever practicable the monitoring and management of subsidence effects associated with mining all eight ULD longwall panels (LW 1-8). The key benefits to this approach include:

- The assessment of impacts and development of management strategies consider the site as a whole;
- Management and monitoring of subsidence effects across all eight longwall panels is developed and applied consistently, where appropriate; and
- A simplified set of management plans and document structure, providing greater clarity for site personnel and regulators; enabling more effective implementation of management strategies.

While the scope of this plan addresses all longwall panels in the ULD Seam, ACOL is currently only seeking second workings approval for LW 1 to 4. This being due to delays in gaining subordinate approvals for diverting Bowmans Creek and the subsequent restrictions this imposes on ACOL to fully extract LW 6B, 7A and 7B in accordance with the approved mine plan and development consent conditions 1.18, 4.5 and 4.6 (to Schedule 2). This Plan will be reviewed following completion of the creek diversions and prior to seeking approval for second workings in ULD LW 5 to 8.

This review process is documented in **Section 6.3**.

1.2 SCOPE

This ELMP applies only to the management of surface impacts resulting from secondary extraction of LW 1-8 in the ULD Seam and details:

- Measures for the monitoring and repair of subsidence-induced cracking; and
- Management of surface ponding and changes in drainage of the landform.

1.3 RELATED DOCUMENTS

This ELMP has been prepared for ULD LW 1-8 Extraction Plan and will fit within ACOL's Environmental Management System (EMS), as a sub-plan. In particular, the following management plans, or their future iterations thereof, as required by the ACOL current development consent are of relevance to land management within the LW 1-8 Extraction Area:

- Flora and Fauna Management Plan;
- Rehabilitation Management Plan;
- Archaeology and Cultural Heritage Management Plan;
- Landscape and Revegetation Management Plan; and
- Bushfire Management Plan.

Review of the above documents is currently in progress following approval of the Bowmans Creek Diversion and other pending development consent modifications. A management plan for the Bowmans Creek Diversions is also in required to be prepared. These revisions will capture the measures outlined in the EA, particularly the following:

- Bowmans Creek Diversion - Rehabilitation Strategy (Evans & Peck, 2010);
- Bowmans Creek Diversion - Landscape Restoration Report (AECOM, 2009); and
- Upcoming changes in guidelines regarding the preparation of Rehabilitation Environmental Management Plans (REMPs).

Therefore, this ELMP should be read and implemented in conjunction with the latest approved versions of the above documents.

1.4 CONSULTATION REQUIREMENTS

Should significant amendments to this document be required as a result of operational changes, statutory requirements or following an internal audit/review, the amendments will be made in consultation with relevant stakeholders and to the satisfaction of the Division of Resources and Energy (DRE). Contact details of the relevant stakeholders are listed in **Table 1**.

Table 1 Relevant Stakeholders and Representatives

Organisation	Representative	Phone	Address
Landowner – Property 130	Mr A Bowman	*Refer to internal contact register*	
Macquarie Generation (Landowner – Property 153)	Production Manager	(02) 6542 0711	Private Mail Bag 2 Muswellbrook NSW 2333
Division of Resources and Energy	Director, Mine Safety Operations	(02) 4931 6644	PO Box 344 Hunter Regional Mail Centre, NSW 2310

1.5 STRUCTURE OF THIS REPORT

The remainder of this ELMP is structured as follows:

Section 2: Outlines the **objectives** of this management plan and sets out the **performance measures** and **performance indicators** relevant to the management of land in general.

Section 3: **Describes** the existing environment within the LW 1-8 Extraction Area.

Section 4: **Identifies** potential subsidence impacts and environmental consequences of mining within the ULD Seam on land in general.

Section 5: **Details** the proposed management and monitoring actions relevant to the management land in general.

Section 6: **Summarises** the responsibilities, reporting and auditing processes under this LMP.

Appendix A Lists relevant development consent requirements.

Appendix B Sets out methodology for the monitoring subsidence impacts.

Appendix C Sets out methodology for the management of subsidence impacts.

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2 OBJECTIVES & PERFORMANCE

2.1 OBJECTIVES

The objectives of the site-wide LMP and other relevant documents (see **Section 1.3**) that are also relevant to this ELMP for the management of subsidence impacts include:

- To prevent land degradation and to rehabilitate disturbed land as soon as practicable to a level equal to or better than the original landscape;
- To manage existing pastures and remnant vegetation to ensure minimal degradation to these areas; and
- Restore land affected by subsidence to a free draining landform suitable for agriculture and native vegetation establishment consistent with the long term rehabilitation objectives for the site.

The intent of this ELMP is to document the proposed monitoring and management measures associated with subsidence impacts to the land surface, consistent with ACOL's statutory obligations and conditions of the development consent.

These requirements include commitments made in the EA and rehabilitation objectives for the Bowmans Creek Diversion project which include, *inter alia*:

- Creating a natural looking, stable creek that mimics the geomorphic form of the existing channel of Bowmans Creek and provides increased areas of aquatic habitat as well as improved diversity and quality of aquatic habitat (pools and large woody debris) whilst maintaining the fish passage characteristics of the original creek;
- Reinstating surface drainage to create a free draining landform by filling areas of subsidence on the alluvial floodplain and, where practicable, provision of minor drainage works;
- Preventing soil erosion and sedimentation as a result of construction works, placement of temporary stockpiles or as a result of changes in land slope resulting from subsidence;
- Fencing designated riparian and revegetation corridors so as to prevent impact from domestic stock;
- Progressing towards meeting closure and post-mining land use objectives in a timely and cost effective manner; and
- Maintaining a setback of at least 40 m (horizontally) between longwall voids and any point vertically beneath the high bank of Bowmans Creek to ensure that mine subsidence effects do not impact flow through the creek channel once diverted.

2.2 STATUTORY REQUIREMENTS

Development consent (309-11-2001-i) requirements relevant to this LMP are reproduced in **Appendix A**.

2.3 PERFORMANCE MEASURES

Detailed performance indicators for the management of land in general have been developed for the ACP in accordance with Condition 3.12 and are presented in **Table 2**.

Monitoring will be used to assess the impact of the ACP against these performance measures and indicators as detailed in **Section** 4. If monitoring and assessment indicates that a performance indicator has been exceeded, or likely to be exceeded, ACOL will implement the contingency measures outlined in **Section 6.1**.

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Table 2 Performance Measures

Criteria	Performance Measure A	Indicator of Success B	Key Assessment Considerations C
Land Management			
Land in general	Restore land affected by subsidence to a free draining landform.	Surface cracking remediated as soon as practically possible. All remediation works provide a stable landform with comparable functionality and agricultural capability. Adequate groundcover has been maintained. Erosion and slope stability issues as they relate to subsidence are remediated.	1. Does the monitoring and assessment indicate that a performance measure or development consent condition has been exceeded, or likely to be exceeded? 2. Does this exceedence increase the risk for any of the environmental consequences? 3. What is the nature of the risk? ▪ Altered surface flow. ▪ Increased risk of erosion. ▪ Soil loss and/or exposure of subsoil. ▪ Large surface cracks. ▪ Loss of agricultural productivity. ▪ Increased sedimentation. ▪ Altered soil moisture or nutrient distribution patterns. 4. What are the potential factors that may have contributed to the risk i.e. subsidence, inadequate management measure or climatic conditions? 5. What actions, if any are required to mitigate and/or minimise the potential for future impacts and monitor the long term impacts of the exceedence?
	Restore ecosystem function, including maintaining or establishing self-sustaining ecosystems comprised of native plant species and a landform consistent with the surrounding environment.		
	Maintain and/or re-establish agricultural land of comparable land capability to that of the pre-disturbance environment.		
Feral Animal Control	Feral animal control for any declared pest species known on the ACP.	Feral animals managed so that they do not have deleterious impacts on threatened species, threatened populations, endangered ecological communities or their habitats.	
Weed Control	Weeds controlled in accordance with the requirements of the relevant legislation and weed/land management authorities.	Weed densities and sprawl across the site broadly comparable to (or less than) previous surveys. Surveys confirm that all areas targeted during previous years weed control program had been controlled with limited regrowth.	

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3 EXISTING ENVIRONMENT

The pre-mining land capability and value was described in the EIS (HLA, 2001) and Bowmans Creek Diversion Environmental Assessment (Evans & Peck, 2009). A brief description is provided below, with further details regarding land use, condition and land values, vegetation and weeds, and agricultural value provided in the site-wide LMP. **Figure 1** provides a site overview whilst **Figure 2** identifies land ownership for the site and immediate surrounds.

The Extraction Area has been cleared previously for agricultural purposes, including grazing and some improved pasture. Natural vegetation within the western portion (i.e. LW 5-8) is limited to a narrow riparian corridor along the banks of Bowmans Creek. This vegetation corridor is not continuous and in some parts consists only of a single row of trees/shrubs on the creek bank with grasses/sedges within the creek channel. Within the eastern portion (i.e. LW 1-4), natural vegetation is protected within the Southern Woodland voluntary conservation area.

3.1 SOILS AND TOPOGRAPHY

In general the land overlying LW 1-8 is predominantly gently sloping with ground slope generally ranging between two and three degrees. The soil landscapes across the underground area are characterised by the Hunter and Bayswater soil landscape units (Kovac and Laurie, 1991). The Hunter soil landscape unit lies along the floodplains of the Hunter River and its tributaries, with the main soils formed in the alluvium. The Bayswater unit generally occurs on areas with high relief and steeper slopes.

Minor stream bank erosion occurs on the watercourses with minor sheet and gully erosion on adjacent terraces. Bowmans Creek has been the subject of significant bank stabilisation works since the 1960s, with some steep sided banks of Bowmans Creek noted to be unstable, as they are typically in areas with limited riparian vegetation. Whilst active bank erosion has been reported for some areas, annual erosion rates appear to be relatively low to moderate.

3.2 LANDUSE

Agricultural activities historically and currently taking place on land in and adjacent the project area include cattle grazing on less productive slopes and ridges, dairying on the alluvial flats and some irrigation and cultivation on the Bowmans Creek and Hunter River floodplain. The area is predominantly owned by ACOL (see **Figure 2**) and much of it has previously been subsided by longwall mining in the PG Seam. The northwest corner of the area includes a triangle of land owned by Macquarie Generation (MacGen) that fringes the now completed and backfilled Ravensworth East Open Cut Mine. The southeast corner is currently privately-owned (Property 130) and is subject to a continued agricultural enterprise.

3.3 LAND CAPABILITY

Land Capability is a system of categorising rural land on the basis of the physical ability of the land to remain stable under particular rural land uses. The particular capability class into which land is placed depends of the physical characteristics of the site, the soils and specific limitations to their use, land management constraints and the local climate. The capability of land can be affected if not protected from various forms of soil degradation such as erosion and loss of topsoil, water logging, and so on.

Land Capability across the Extraction Area ranges from Class II to Class V. Class II land generally follows the alluvial soils along the floodplain of Bowmans Creek with Class IV and V land located on the surrounding slopes. The land classes are defined as follows:

- Class II – Land capable of being regularly cultivated. Usually gently sloping land suitable for a wide range of uses.
- Class IV – Land not capable of being regularly cultivated but suitable for grazing with occasional cultivation. Limitations usually include slope gradient, soil erosion, shallowness or rockiness, climate or a combination of these factors.
- Class V - Land not capable of being regularly cultivated but suitable for grazing with occasional cultivation. Considerable limitations include slope gradient, soil erosion, shallowness or rockiness, climate or a combination of these factors.

3.4 SURFACE WATER

The major natural features in the area include Bowmans Creek which lies directly over the LW 5-8 Extraction Area, the Hunter River to the south outside the proposed mining area, and Glennies Creek to the east of LW 1, also outside the mining area. ACOL has consent to divert Bowmans Creek to allow more efficient recovery of the coal resource. Flows in Glennies Creek are regulated by releases from Glennies Creek Dam, whereas flows in Bowmans Creek are unregulated and surface flows periodically cease during droughts. A detailed description of the geomorphology of both Bowmans and Glennies Creek has been included within the Extraction Plan.

Subsidence has the potential to alter some topography, impacting on surface water catchment flow patterns. Most of the affected tributaries drain into Bowmans Creek. A detailed description of surface water flow across the Extraction Area is provided in the Water Management Plan.

3.5 STEEP SLOPES

The land overlying LW 1-8 is predominantly gently sloping with ground slope generally ranging between two and three degrees. However, there are steep slopes at the edges or just outside of the subsidence area. A detailed pre-mining baseline assessment was undertaken by Parsons Brinkerhoff in 2006 and an updated assessment of potential subsidence impacts is provided within the Extraction Plan.

On the eastern edge of LW 1, the ground slopes steeply to Glennies Creek with a maximum slope of 32 degrees, and relief of 40 m. The steep portion of the slope runs for about 600 m in length parallel to LW 1. The slope is uniform and grass covered and was noted to have no outcropping bedrock and there is no evidence of past or existing instability on the slope.

To the south of the Extraction Area, the ground slopes to the Hunter River at a maximum gradient of 15 degrees with a maximum relief of 30 to 40 m. Parsons Brinkerhoff (2006) observed outcropping conglomerate bedrock near the crest and approximately midway down the slope. Partial undermining of the slope has occurred adjacent to the Hunter River due to scouring in high flows. The slopes are expected to be underlain by a thin veneer of silty sand then bedrock.

4 POTENTIAL ENVIRONMENTAL CONSEQUENCES

A detailed Subsidence Impact Assessment was prepared for the proposed ULD LW 1-8 (SCT 2011) and has been provided in full as an Appendix to the Extraction Plan.

A primary impact of longwall mining is surface subsidence. There are several resulting consequences of subsidence, including: surface cracking, subsurface cracking, slope instability and erosion, valley closure and uplift, and ponding. These consequences may then trigger a number of environmental responses related to land in general. These responses are summarised in **Table 3**. In addition to these consequences there is potential to increase weed species and alter vegetation coverage through changes to site management and water movement.

Other potential environmental consequences of surface cracking, including 'trapping' of ground dwelling fauna, risks to public safety and damage to infrastructure, are the subject of other management plans which form part of the Extraction Plan.

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Table 3 Consequences Associated with Land Subsidence

Subsidence Impact	Summary of Revised Subsidence Prediction (SCT 2011)	Potential Environmental Consequence		
Surface Subsidence Trough	Maximum incremental subsidence associated with mining the ULD Seam is expected to be typically 2.4-2.5 m but range up to 3.4 m. The cumulative maximum subsidence from mining in both ULD and PG Seams is expected to be typically less than 4.0 m but up to 4.5 m in the vicinity of LW 7B and LW 8. The maximum total subsidence below the alignment of the proposed diversion of Bowmans Creek is likely to be less than 0.1 m and in most areas less than 20 mm.	Altered surface flow.	Redirection of soil moisture and nutrient distribution patterns.	Increased risk of erosion.
Surface Cracking	Surface cracks are expected to get generally less as the overburden depth increases to the west but in the shallow parts of LW 1, large cracks of up to several hundred millimetres wide are expected about solid goaf edges and at the top of steep slopes. Cracks and surface impacts are expected to have magnitudes of two to three times greater than the cracks observed during mining in the PG Seam. Some remediation is expected to be necessary to reduce ingress of surface water, injury to livestock and entrapment of small animals. This remediation activity may cause disturbance to woodland areas similar to that which has occurred previously during mining in the PG Seam.	Large cracks in soil surface.	Increased surface drainage and altered (decreased or increased) productivity.	Increased risk of erosion.
Slope Instability	Subsidence might present a small risk of mass movement on the valley wall of Glennies Creek although the risk of slope instability adjacent to the Hunter River and Glennies Creek is very low. The assessed likelihood of shallow slumping of soils is rare and the likelihood of slope failure is barely credible.	Landslip of surface terrain.	Increased erosion and sedimentation of drainage lines.	Soil loss and exposure of sub-soil.
Ponding	Subsidence troughs are expected to increase the storage volume available on the surface in topographic low points and water falling as rain, water flowing as runoff from adjacent areas and water that overtops the Bowmans Creek diversion during a flood event is expected to flow to these low points in the landform and pool there. Predicted subsidence below the original alignment of Bowmans Creek and the adjacent floodplain of up to 4.5 m at the completion of mining within both the PG and ULD Seams is expected to leave the creek diversion elevated above the surrounding landform. This will result in areas of ponding within the excised channel and within subsidence troughs on the floodplain.	Decreased productivity on agricultural lands.	Altered surface flow, increased erosion and localised changes in water availability.	Altered soil moisture or nutrient distribution patterns.

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5 MANAGEMENT, MITIGATION AND RESPONSIBILITIES

The actions that ACOL undertake to fulfil the relevant consent conditions (refer to **Appendix A**) are shown in **Table 4**. These actions have been categorised into Monitoring and Management, Incident Response and Notification/Consultation.

Table 4 Management, Monitoring and Responsibilities

Item	Action	Timing	Responsibility	Reporting
	Monitoring			
1.1	Visual inspection of the area immediately behind the longwall face passage to identify/map subsidence cracking. Documented inspection of steep slopes along the Hunter River and Glennies Creek to identify cracking requiring remediation.	Weekly	Underground Mining Engineer	Fortnightly Status Report
1.2	Light Detection and Ranging (LiDAR) data will be captured across the entire Extraction Area to document baseline landscape morphology and to quantify topographic change, including creek slope, width and depth as outlined within **Appendix B**.	Prior to and following completion of secondary extraction in ULD Seam	Environment and Community Relations Manager	Nil
1.3	Agricultural monitoring will assess attributes that relate to pasture productivity and soil nutrient status and will include the sampling of six established monitoring sites as outlined within **Appendix B**.	Prior to mining within the ULD and repeat annually in early spring.	Environment and Community Relations Manager	Nil
1.4	Visual inspections of drainage lines to identify potential erosion, or the development of nick points where erosion could advance.	Following rainfall (>50mm in 24 hours) and weekly during active subsidence.	Underground Mining Engineer	Fortnightly Status Report
1.5	Inspect temporary stockpiles of alluvial material to ensure adequate vegetative cover and integrity of bunds and erosion controls.	Following heavy rainfall and weekly during active subsidence.	Environment and Community Relations Manager/ Underground Mining Engineer	Nil
1.6	Visual inspection of low lying areas to identify if any surface ponding is occurring.	Following rainfall (>50mm in 24 hours) and weekly during active subsidence.	Underground Mining Engineer	Fortnightly Status Report
1.7	Reassessment of the site slope stability by a suitably qualified geotechnical engineer.	Following longwall extraction in closest panel.	Underground Technical Services Manager	End-of Panel Report

Item	Action	Timing	Responsibility	Reporting
	Management			
2.1	All land management works will be conducted in accordance with the relevant management plan.	Ongoing	All staff	Nil
2.2	Repair any permanent subsidence cracking (i.e. they have not closed within one month of the longwall passing) by filling or ripping, and revegetated to prevent erosion and reduce safety risks as outlined within **Appendix C**.	Post-subsidence	Underground Mining Engineer	End-of Panel Report
2.3	Revegetate temporary stockpiles of alluvial spoil (from Bowmans Creek Diversion construction works) to stabilise against erosion and periodically inspect to ensure vegetation coverage is maintained.	Post-construction of diversions	Environment and Community Relations Manager	Nil
2.4	Redistribute material from temporary stockpiles as subsidence of the floodplain occurs in order to maintain a free draining landform as far as practicable. Revegetate in a manner consistent with the final landuse.	Post-subsidence	Underground Mining Engineer	Fortnightly Status Report, Annual Environmental Management Report (AEMR)
2.5	Undertake drainage works and rehabilitation of subsidence troughs on areas elevated above the floodplain as necessary to maintain a free draining landscape.	Post-subsidence	Underground Mining Engineer	Fortnightly Status Report, AEMR
2.6	Fence the full length of the diverted sections of Bowmans creek (at least 5 m from the alignment of any riparian trees) to exclude stock to protect revegetation works, whilst still allowing access for weed control, monitoring and ongoing revegetation works.	Post-construction and initial stabilisation of diversions.	Environment and Community Relations Manager	AEMR
2.7	Where required (e.g. by restricted access to Bowmans Creek), stock watering troughs will be installed at strategic locations on pasture areas adjacent to the creek in the post-mine landscape.	Post mining	Environment and Community Relations Manager	Nil
	Incident Response			

Item	Action	Timing	Responsibility	Reporting
3.1	Whilst the risk has been assessed as very low, if slope instability occurs or recognised as potentially having an increased risk during extraction (as a result of visible signs of mass movement or excessive cracking at the crest of the slope) a geotechnical engineer will be engaged to assist and measures developed and implemented to mitigate the risk, Such measures may include, additional remediation of cracking using deep ripping, and/or temporary diversion of surface runoff until the slope can be stabilised. Any areas of mass movement that have already occurred with be assessed, stabilised and revegetated as soon as practicable.	Signs of mass movement or excessive cracking near steep slopes.	Underground Mining Engineer	Fortnightly Status Report, End of Panel Report
3.2	If a free-draining landform is considered as not practically or cost-effectively achievable based on post-subsidence landform and/or environmental constraints (i.e. impacts to vegetation or heritage), an assessment will be undertaken into the suitability of creating a permanent wetland with due consideration given to the: ▪ Overall rehabilitation and final land use objectives of the ACP; ▪ Feasibility of providing sustainable wetland habitat based on its likely long-term hydrology and its potential to support threatened species (i.e. Green and Golden Bell Frog); ▪ Impacts to terrestrial threatened species and /or loss of agricultural land; and ▪ Risk of inrush into the underground workings. Any proposed works will be developed in consultation with DRE and DP&I.	If areas of ponding that are unable to be practically drained or filled to create a free-draining landform.	Underground Mining Engineer , Environment and Community Relations Manager	Notify DRE and DP&I, report in AEMR
	Notification & Communications			
4.1	Notify affected landowner/s of potential for surface cracking and impacts of subsidence generally in accordance with the relevant components of the Extraction Built Features Management Plan and Extraction Public Safety Management Plan.	As longwall progresses.	Underground Mining Engineer	Fortnightly status report
4.2	Consult with affected landowners and convey the need to access property for the purposes of monitoring and to undertake remediation works. Access to private property should be in accordance with any relevant access agreements (if in place) with the property owner and suitable notice provided (if required).	If repair or remediation works are required on land owned by third parties.	Environment and Community Relations Manager	Fortnightly status report

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6 IMPLEMENTATION

6.1 CONTINGENCY RESPONSE

In the event the performance measures provided in **Section 2.3** are considered to have been exceeded, or are likely to be exceeded, ACOL will undertake the following:

- Report the likely exceedance of the performance indicator to the relevant agencies as required under the development consent or legislation after becoming aware of the exceedance;
- Assess public safety and where appropriate implement safety measures in accordance with the Public Safety Management Plan;
- Identify an appropriate course of action with respect to the identified impact in consultation with appropriate specialists and relevant agencies;
- Submit the proposed course of action to the any relevant government agencies for consultation/approval (if required);
- Implement the approved course of action, consistent with other relevant management plans to the satisfaction of the appropriate agencies (if required); and
- Review the effectiveness of this ELMP to adequately manage potential impacts within the limits of the project approval.

6.2 REPORTING

The Annual Environmental Management Report (AEMR) (or a successor to this report), is the primary reporting tool for the ACP. The AEMR is required to be prepared under the ACP development consent and Mining Lease and its purpose is to review the performance of the mine against the Environmental Management Strategy and the relevant Mining Operations Plans, the conditions of consent, and other licences and approvals relating to the mine. The AEMR is required to include:

- An annual compliance audit of the performance of the project against conditions of the consent and statutory approvals; and
- Assess the development against the predictions made in the EIS and the terms and commitments.

In context of land management the AEMR will report against and review the findings of monitoring conducted in relation to the items in **Tables 1** and **3**. Following submission of the report to the relevant agencies, the AEMR will be made publicly available via ACOL's website.

6.3 AUDITS AND REVIEWS

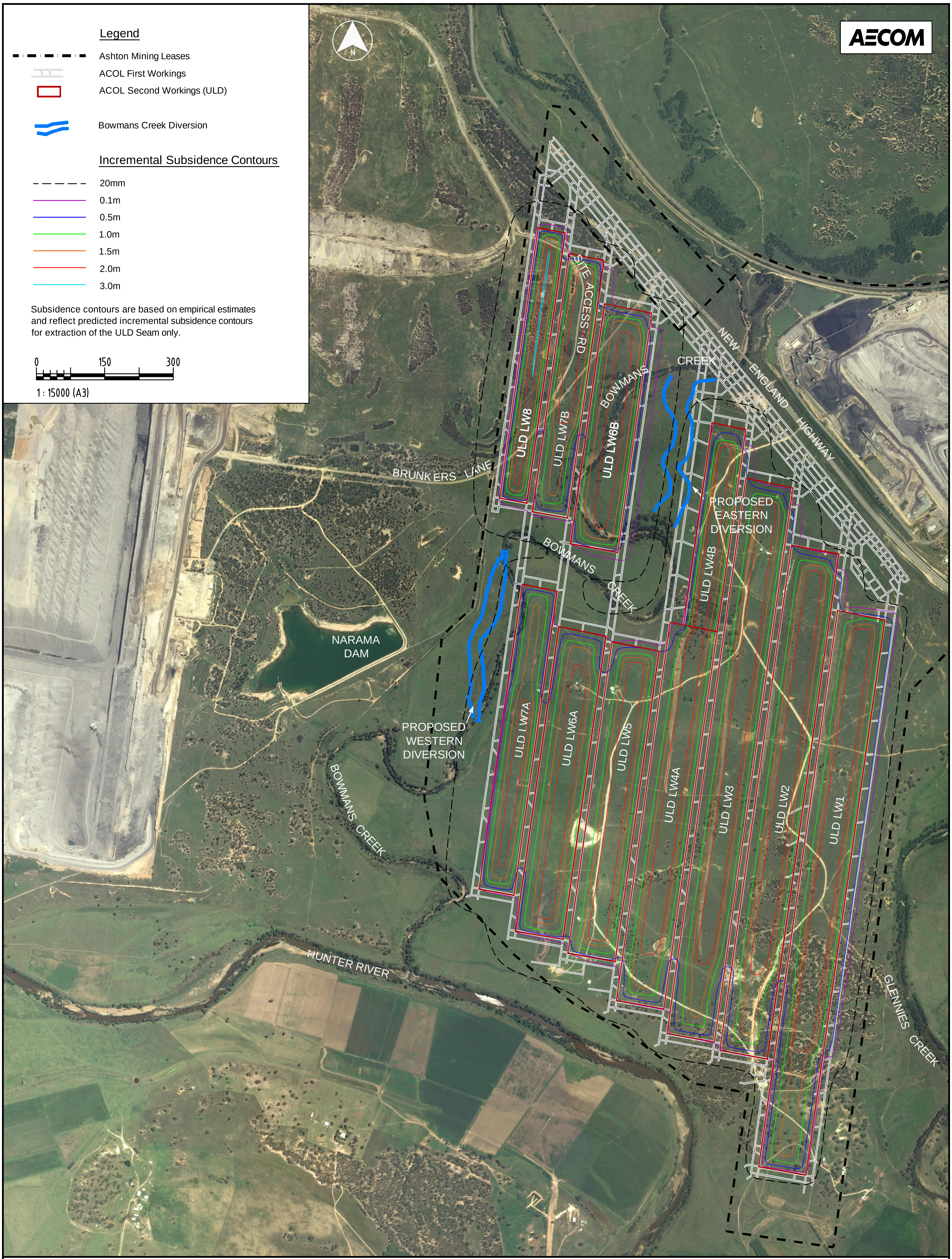
This ELMP may be audited (if required) under the scope of any external environmental compliance audits. An internal review of this ELMP will be conducted in response to:

- An incident recorded as a result of the operations that potentially affects the long term management or productivity of land in general;
- A significant change in operation that may affect the implementation of this management plan;
- Statutory requirements or directions/conditions of approvals requiring such action; or
- Recommendations as a result of internal or external audits.

A review of this plan will also be conducted prior to submitting an application to the Department of Planning & Infrastructure for approval to undertake second workings within ULD LW 5-8.

A review and any associated amendments to this plan will be based on:

- Comparison of results of subsidence monitoring to predicted subsidence (SCT, 2010);
- Review of monitoring results under this ELMP and confirmation that observed impacts are within predicted limits; and
- Review of monitoring and management practices under this plan and their adequacy to capture and address the environmental consequences of secondary extraction.



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AshtonCoal

Extraction Land Management Plan

Figure 1
Site Overview

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Ref.	Land Owner
56	Ashton Coal Mines Ltd
130	Alistair Stuart Bowman
153	Renison Ltd - Ravensworth Operations PTY Ltd
155	Macquarie Generation
159	Glendell Tenements PTY Ltd
181	Coal & Allied Operations PTY Ltd

Legend

- Ashton Mining Leases
- EL Boundaries
- Ashton Coal Mines Limited (ACML)
- Glendell Land Leased to ACML
- Savage Mineral Ltd & Enex Foydell Ltd
- Glendell Tenements PTY Ltd
- Macquarie Generation
- Renison Ltd - Ravensworth Operations PTY Ltd
- Crown Land
- Coal & Allied Operations PTY Ltd
- Freehold Land
- Singleton Council
- ACOL First Workings (ULD)
- Bowmans Creek Diversion

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AshtonCoal

Extraction Land Management Plan

Figure 2
Land Ownership

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APPENDIX A – APPROVAL CONDITIONS

Table 5 Development Consent (309-11-2001-i) Conditions

Condition number	Condition requirement	Addressed in ELMP
3.12(h)	The Applicant shall prepare and implement an Extraction Plan for the second workings within each seam to be mined to the satisfaction of the Director-General. Each Extraction Plan must: h) include a: ▪ Land Management Plan, which has been prepared in consultation with any affected public authorities, to manage the potential impacts and/or environmental consequences of the proposed second workings on land in general.	This ELMP
Sched. C	**Statement of Commitments**	
2.	**General**	
2.1	Subsidence troughs will be reshaped and fill will be used where practicable to create a free-draining landform. This approach is expected to reduce the potential for surface pooling and inflow into the mine.	Table 4, Item 2.6
9.	**Rehabilitation and Land Management**	
9.1	Subsidence troughs will be rehabilitated to provide a free draining surface.	Table 4, Item 2.6
9.4	Stock proof fencing (at least 5 m from the alignment of any riparian trees) will be installed along both sides of the functioning diverted creek for its full length between the New England Highway and the Hunter River.	Table 4, Item 2.7
9.5	Stock watering troughs will be installed at strategic locations on pasture areas adjacent to the creek in the post-mine landscape, where required.	Table 4, Item 2.6

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APPENDIX B – MONITORING

Given the size of the target area and key environments a multi-scale monitoring approach has been developed to monitor the consequences of longwall mining on land in general above LW 1-8.

SURFACE CRACKING

Surface cracking is likely to occur rapidly causing risk of erosion, creation of nick points and headcut initiation, consequences to flora and fauna as well as potentially hazardous public safety risks.

Monitoring of surface cracking will be undertaken during and post-mining. Visual inspections for surface cracking of areas immediately behind the longwall face passage should take place on a weekly basis to monitor for active subsidence. Opportunistic observations of any subsidence impacts (including surface cracking, ponding, landslips and erosion) should also be undertaken by ACOL during other routine monitoring and operations. Observations are recorded using a visual subsidence inspection sheet recording the characteristics, impacts and extent of surface cracking and any remedial action required.

REMOTE SENSING

It is proposed to use remote sensing data to provide for quantitative comparison of key land surface condition parameters. Light Detection and Ranging (LiDAR) data will be captured across the entire Extraction Area. The baseline data and all subsequent LiDAR captures will be processed into a land surface digital elevation model (DEM). Each new dataset will be subtracted from those produced from earlier captures creating a series of DEM change images.

LiDAR datasets are capable of describing channel width and depth, especially where the creek has formed a distinct channel (>1 m depth and 2 m wide). These datasets will enable the long-profile and volume of both Bowmans and Glennies Creek within the Extraction Area to document any changes in creek slope, width and depth. The datasets will also assist in the monitoring of steep slopes associated with Glennies Creek and the Hunter River.

The best results will be derived from repeat data capture and image to image comparison. These comparisons may provide accurate assessment of erosion and deposition. Each dataset produced will be used to create a map for visual interpretation and analysis and for communication of results.

Table 6 Remote Sensing Monitoring Program

Data Source	Parameters	Analysis	Purpose	Sampling Frequency
LiDAR	High resolution topography.	Comparative statistics. Visual assessment.	Document baseline landscape morphology. Quantify topographic change.	Baseline Repeat following completion of each seam
	Creek line slope and volumes.	Description of long-profile and creek volume.	Document baseline creek slope, width and depth. Document changes in creek slope, width and depth.	

AGRICULTURAL AREA SURVEYS

Agricultural monitoring will assess attributes that relate to pasture productivity and soil nutrient status. Existing site-wide surveys undertaken in accordance with the Rehabilitation Management Plan and annual Farmland Monitoring Program have been designed to track any changes in landscape function, soil characteristics and vegetation cover.

In 2007 five pasture monitoring sites were established across the ACOL property with an additional woodland site established in 2008. Each of the six permanent monitoring sites consists of a 20 m x 20 m quadrat (centred along an established transect line) and five 1 m^2 quadrats.

Landscape Function Analyses

Landscape Function Analysis (LFA) is a methodology used to assess key indicators of ecosystem function including landscape organisation and soil surface condition as measure of how well the landscape retains and uses vital resources. The indicators used quantify the utilisation of the vital landscape resources include water, topsoil, organic matter and perennial vegetation in space and time.

Soil analyses

Soil samples are undertaken using standard soil sampling techniques (core sampler). At least 12 cores are taken at each site and bulked together. Soil parameters assessed include pH, electrical conductivity (EC), available calcium, magnesium, potassium, ammonia, sulphur, organic matter, exchangeable sodium, calcium, magnesium, hydrogen, aluminium, cation exchange capacity, available and extractable phosphorus, micronutrients (zinc, manganese, iron, copper, boron), total carbon and nitrogen.

Monitoring structural diversity, floristic and other biodiversity attributes

In addition to LFA, assessments of various biodiversity components are also be made to monitor changes in particular plants and groups of plants through the various successional phases and to document and/or identify critical changes or management actions required. The rapid ecological assessment provides quantitative data that measures changes in:

- Floristic diversity including species area curves and growth forms;
- Ground cover diversity and abundance;
- Vegetation structure and habitat characteristics (including ground cover, cryptogams, logs, rocks, litter, projected foliage cover at various height increments);
- Understorey density and growth (including established shrubs, direct seeding and tubestock plantings and tree regeneration);
- Overstorey characteristics including tree density, health and survival; and
- Other habitat attributes such as the presence of hollows, mistletoe and the production of buds, flowers and fruit.

Permanent transects and photo-points are established to record changes in these attributes over time.

Incidental observations of weeds and erosion will also be recorded during these surveys and any potential problems reported to the ACOL Environment and Community Relations Manager.

Table 7 Agricultural Monitoring Program

Data Source	Parameters	Purpose	Sampling Frequency
Land Function Analysis (20 m x 20 m)	LFA stability, infiltration, nutrient recycling and landscape organisation.	Establish baseline BACI comparisons	Baseline Every year – early spring
Tree density and health (20 m x 20 m)	Number of trees, species, dbh, condition, evidence of fruiting.	Establish baseline BACI comparisons Photographic records Species list	
Shrubs and recruitment (20 m x 20 m)	Number of shrubs and young trees, species and height.		
Structural diversity and habitat complexity (1 m x 1 m)	% cover of litter, annuals, cryptogram, rocks, logs, bare earth and perennials.		
Species cover abundance (1 m x 1 m)	Total species recorded using the Braun-blanquet scale.		
Species diversity (1 m x 1 m and 20 m x 20 m)	Total number of native and exotic species recorded.		
Soil character (top 150 mm from centre of quadrat)	pH, EC, available Ca, Mg, K, Ammonia, sulphur, organic matter, exchangeable Na, Ca, Mg, K, H, Al, cation exchange capacity, available and extractable phosphorus, micronutrients (Zn, Mn, Fe, Cu, B), Total Carbon and Nitrogen.	Establish baseline BACI comparisons	

BACI - before-after control-impact

BOWMANS CREEK MONITORING

Monitoring of the stability and geomorphic function of Bowmans Creek following the construction of the diversions will be addressed in the Bowmans Creek Management Plan. This plan will be prepared, approved and implemented in conjunction with the construction works.

Monitoring of Bowmans Creek is therefore not part of the scope of this ELMP. The Bowmans Creek Management Plan, once finalised, will include those measures outlined in the EA and supporting documentation, in particular the Rehabilitation Strategy. Monitoring of the creek and diversions will include, *inter alia:*

- Creek line surveys designed to identify the main geomorphic zones and hence overall nature of the channel morphology and to provide quantitative information that can document changes in channel cross-section, bed erosion and deposition; and
- Bed samples from each diversion channel and comparable representative sites in the remaining functional sections of the creek for statistical comparison of bed sediment transport and deposition.

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APPENDIX C – MANAGEMENT PROCEDURES

SURFACE CRACKING

Surface cracking that appears as the longwall face passes is to be monitored and recorded using GPS. Permanent subsidence cracks (i.e. they have not closed within one month of the longwall passing) will be repaired after full subsidence development for a given longwall by filling or ripping, and revegetated to prevent erosion and reduce safety risks. Species used for revegetation will be selected based on the strategic land use for the affected area (i.e. endemic species for creation of habitat, or pasture species for agricultural land) – refer to Rehabilitation Management Plan. Remediation of cracks within the Southern Woodland will only be completed in locations or using methods that prevent undue disturbance to vegetation or heritage sites. Temporary fencing may be necessary during the interim period between the longwall face passing and when remediation measures are undertaken (refer to Public Safety Management Plan).

Surface cracking identified on or immediately above steep slopes will be filled as soon as possible following passing of the longwall face and completion of subsidence movements. If the slope or vegetation limits the availability of ACOL to remediate surface cracks, a diversion bank will be constructed at the top of bank to divert stormwater from running off the slope. The diversion bank will be designed and constructed in accordance with the 'Blue Book' (Landcom, 2004 and DECCW, 2008). Any diversion banks that are installed will be removed once surface cracks have filled naturally to return the natural hydrologic regime to the impacted areas.

Where erosion along drainage lines has been identified from visual inspections or remote sensing, appropriate control measures as identified in the Erosion and Sediment Control Plan and Water Management Plan shall be implemented. If necessary advice will be sought from a qualified geomorphologist or other suitably qualified professional.

AGRICULTURAL AREAS

Pasture species will be regularly monitored as part of the rehabilitation program as outlined within Appendix B and the Rehabilitation Management Plan. The program is to identify composition of species and identify any requirements for pasture improvement to support cattle grazing. Areas with low ground pasture cover are to be supplementary planted with native grasses. Cattle access to these areas is to be restricted until sufficient ground cover is established and the soil stabilised.

In accordance with the Built Features Management Plan, dams in subsided areas are to be monitored for signs of cracking. Any cracks are to be assessed and remedial action such as sealing the crack or removing the dam completely is to be undertaken as necessary.

PREVENTION AND REHABILITATION OF LAND DEGRADATION

The dispersive nature of the soils on the ACP creates the potential for land degradation as a function of site disturbance. Preventative measures such as the use of native species to vegetate environmental bunds, seeding of stockpiles and incorporation of extensive habitat corridors are detailed within the Rehabilitation Management Plan and the Erosion and Sediment Control Plan.

DRAINAGE AND LANDFORM CHANGES

Subsidence across the Extraction Area will not be uniform and it is predicted that areas will form that are unable to drain and/or that are lower than the diverted and natural sections of Bowmans Creek. Ponding is most probably in areas of flatter slopes, such as on the floodplain adjacent to the creek, but can also occur on the nearby slopes where a trough forms perpendicular to the slope and drainage can no longer happen freely across the surface above the chain pillar. It is noted that the excised sections of Bowmans Creek channel are likely to form ponds that will be unable to be freely drained, and at this stage, there is no commitment to ensuring these areas can drain and they will likely remain to form additional aquatic habitat, provided that no adverse impacts to underground mining (i.e. ingress of excess water to the mine) are observed.

Following completion of the Bowmans Creek diversion, temporary stockpiles of alluvial material will remain on the floodplain which will be stabilised with grass species. Following subsidence, these stockpiles will be used to assist in reshaping the landform to achieve a free draining surface. Filling of the troughs is not uniformly proposed, and will depend on an assessment of the extent of ponding and works required. The general process to correct ponding and provide a free-draining landform will consist of:

- Identification of ponding areas during regular (daily) inspections of the surface above the current longwall position – should be particularly evident following runoff-producing rainfall events.
- Assessment of ponding area, and identification of possible solutions, including undertaking filling using stockpiled alluvial materials remaining from the creek diversion construction, or by undertaking earthworks to reshape the land, and or provide a drainage path to the nearest watercourse. Solutions will depend on the particular constraints of the affected area and will aim to minimise impacts to vegetation and cultural heritage.
- Undertaking works, in accordance with all relevant ACOL management plans, including the installation of erosion and sediment controls, careful stripping and stockpiling of topsoil material, vegetation clearance protocols, and the Aboriginal Cultural Heritage Management Plan.
- Confirmation that the area is free-draining by survey methods.
- Stabilisation of the remediated area by applying topsoil, and revegetating in accordance with the Rehabilitation Management Plan.

Monitoring of the works and revegetation until such time the area is considered stable.