Illawarra Coal

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Dendrobium Area 3B Longwall 10 End of Panel Report

May 2015

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Attachment A: Dendrobium Colliery Area 3B Longwalls 9 -13 Subsidence Management Plan Approval

Attachment B: End of Panel Subsidence Monitoring Review Report for Dendrobium Longwall 10, Revision A (MSEC737) MSEC 2015

Attachment C: Longwall 10 Landscape Report, Illawarra Coal Environmental Field Team, 2015

Attachment C2: Longwall 10 Impact Reports. Illawarra Coal Environmental Field Team, 2014 – 2015.

Attachment D: End of Panel Surface and Shallow Groundwater Impacts Assessment, Dendrobium Area 3B Longwall 10, Revision 2, Ecoengineers, 2015

Attachment E: Dendrobium Mine: End of Panel Groundwater Assessment Longwall 10 (Area 3B)

Attachment F: Dendrobium Area 3A Aquatic Ecology Monitoring 2008 to 2014, Revision 0, Cardno, 2015

Attachment G : Dendrobium Area 3B Longwall 10 End of Panel: Terrestrial Ecology Review, Final Version, Biosis, 2015

Attachment H: Dendrobium 3B, Longwall 10 End of Panel Report Cultural Heritage, Biosis, 2015

Important information about this report

Information relating to Aboriginal cultural heritage sites, including some details, images and maps showing the locations of sites, has been redacted from this report at the request of Registered Aboriginal Parties.

Executive Summary

This End of Panel (EoP) report has been prepared in accordance with Schedule 3 Condition 9 of the Dendrobium Development Consent (DA 60-03-2001). This EoP report outlines the measured and observed impacts during the extraction of Dendrobium Area 3B Longwall 10 and analyses the monitoring results against relevant impact assessment criteria and predictions made in the Area 3B SMP.

Dendrobium Longwall 10 is located within Consolidated Coal Lease No. 768 (CCL768) and was extracted using conventional longwall techniques and equipment during the period from the 20th of January 2014 to the 20th of January 2015.

Economic Effects

The extraction of underground coal reserves from Dendrobium Area 3B (DA3B) provides benefits at international, national, state and local levels due to the coal's unique characteristics. BHP Billiton Illawarra Coal (BHPBIC) provides 70% of BlueScope Steel's coking coal requirements. Continuing benefits occur through continuity of employment, expendable income, export earnings and government revenue.

The Company provides local jobs for approximately 2000 direct employees and contractors throughout its operations with an employment flow-on effect in the Illawarra and Wollondilly regions of 2.6 full time equivalent jobs (IRIS, 2011). More than 400 small to medium local businesses provide their goods and services to the company. The company is a major contributor to the economy of the local region, contributing 4.7 per cent of household income and 5.3 per cent of industry value added. As of January 2015 Dendrobium Mine had 292 full time employees and 60 contractors and fixed term employees. These jobs are reliant on maintaining continuity of longwall coal extraction.

Subsidence

Subsidence movements resulting from the extraction of Dendrobium Longwall 10 were monitored along various lines and points within the Subsidence Management Plan (SMP) Area. Monitoring was conducted to measure subsidence along creeks, landscape features and swamps within the zone of influence of Longwall 10.

Closure movements across Wongawilli Creek were measured using 2D survey techniques at the Wong X A-Line, Wong X B-Line and Wong X C-Line. Maximum observed closures at each of the Wongawilli Creek cross-lines were less than the predictions.

The far-field horizontal movements in the vicinity of Longwall 10 were measured using the DA3B 3D monitoring points. The observed incremental horizontal movements at the DA3B 3D monitoring points, resulting from the extraction of Longwall 10 were within the range of those measured at similar distances from previously extracted longwalls at Dendrobium Mine and elsewhere in the Southern Coalfield.

Observed subsidence and closures at the Wongawilli Creek tributary cross lines were generally similar to or less than those predicted. The observed closure for the WC21XD Line of 820 mm, however, exceeded the prediction of 725 mm.

The mine subsidence movements across Donalds Castle Creek lines were measured using 2D survey techniques using the DCCXA-Line, DCCXB-Line, DCCXC-Line, DCCXD-Line and DCCXE-Line. The observed subsidence at the Donalds Castle Creek Cross Lines is greater than predicted. The observed closure is less than predicted for Lines DCCXA, DCCXB, DCCXD and DCCXE and greater than predicted for Line DCCXC.

Mine subsidence movements across the Swamp Cross Lines were measured using 2D survey techniques using the SW5 Line, SW 1A Line and SW 1B Line. The observed subsidence at the Swamp Cross Lines exceeded those predicted. Observed closure also slightly exceeded predicted at the SW-1B Line.

Impacts to man-made features

The observed impacts on surface infrastructure following the extraction of Longwall 10 were within predictions. There were no reported impacts to the Maldon – Dombarton railway corridor as a result of Longwall 10 extraction. Impacts were observed to Access Track 6000, Fire Road 6A and one closed seismic line. No mitigation or remediation works were required as the impacts are expected to self-remediate.

Impacts to natural features

Impacts observed on natural features resulting from Longwall 10 were within predictions outlined in the DA3B SMP. In total twenty-five surface impacts were identified by the Illawarra Coal Environmental Field Team (ICEFT). Fourteen of these impacts were observed in watercourses, and eleven impacts were observed to landscape features such as access tracks, clifflines and steep slopes.

The mining of Longwall 10 has resulted in a lowering of the shallow groundwater levels. Whilst some swamps show evidence of drying out prior to extraction within Area 3B, there is a general trend of increasing rates of groundwater level recession following recharge events, and increased frequency of dry events during and following mining in shallow piezometers directly overlying Longwalls 9 and 10.

Ecoengineers (Attachment D) concluded that the observed impacts on surface water quality, shallow groundwater levels, and catchment hydrologic performances due to the mining of Longwall 10 have been consistent with the nature of predicted impacts set out in the DA3B SMP.

The results from the latest aquatic ecology survey (Cardno Ecology Lab) indicate that there is no evidence in macroinvertebrate and fish data of any impacts to the aquatic ecology within monitored sites in WC21 and Donalds Castle Creek. Any impacts to aquatic ecology upstream within monitored watercourses (i.e. loss of habitat due to flow diversions) appear to be localised to the affected areas. It is concluded that such impacts would be relatively minor in the context of the Sydney Catchment Area.

A terrestrial flora and fauna monitoring program is in place for Dendrobium Area 2, 3A and 3B. To date, no statistically significant change to swamp species composition, richness and distribution has been detected at impact sites monitored following the extraction of Longwall 10. Decline in pool water levels within suitable habitats for threatened frog species has been observed within the Donalds Castle and Wongawilli Creek catchments.

Two shelters with deposit were inspected as part of the Longwall 10 assessment. No changes have been observed since the last inspection on the 16th of April 2014.

Trigger Action Response Plans (TARPs)

In addition to the impacts described above, a number of TARPs were reached. One Level 1 TARP was triggered for threatened fauna and one Level 2 shallow groundwater trigger was reached in relation to water level recession within Swamp 5. Relevant notifications of these impacts were provided as outlined in the TARPs. Additionally, Dams Safety Committee (DSC) Level 2 groundwater TARPs have been reached in four bores monitoring the Bulgo Sandstone in Area 3A near Sandy Creek and Lake Cordeaux.

Conclusion

All impacts to man-made and natural features observed during monitoring associated with the extraction of Longwall 10 have been within prediction. Monitoring of man-made and natural features will continue in accordance with the SMP and as outlined in this report.

1. Introduction

1.1. Background

Dendrobium Longwall 10 is located within Consolidated Coal Lease No. 768 (CCL768). The extraction of Longwall 10 commenced on the 20th of January 2014 and was completed on the 20th of January 2015, using conventional longwall techniques and equipment.

This EoP report has been prepared in accordance with Condition 18 of the DA3B SMP approval. The EoP report outlines the measured and observed impacts of Longwall 10 and analyses the monitoring results against relevant impact assessment criteria and predictions made in the SMP and associated management plans and reports for Longwall 10.

Information in this report is based on monitoring and reports undertaken by BHPBIC and specialist consultants that have been involved with the monitoring and analysis of data relating to the DA3B SMP Area.

1.2. Approval and Legislative Requirements

The DA3B SMP was approved by Department of Trade and Investment, Regional Infrastructure and Services NSW (DTI) on the 5th of February 2013 and the Department of Planning and Environment (DP&E) on the 6th of February 2013. The SMP approval is provided as Attachment A.

Schedule 3 Conditions 9 and 10 of the Development Consent is provided in Table 1 below

Table 1: Longwalls 9 – 13 SMP Approval Condition for End of Panel Reporting

SMP Approval Condition	Relevant Section in EoP Report
Schedule 3 of Development Consent DA60-03-2001 – MOD 5 **9.** Within 4 months of the completion of each longwall panel, or as otherwise permitted by the Director-General, the Applicant shall: 1. prepare an end-of-panel report – reporting all subsidence effects (both individual and cumulative) for the panel and comparing subsidence effects with predictions; – describing in detail all subsidence impacts (both individual and cumulative) for the panel; – discussing the environmental consequences for watercourses, swamps, water yield, water quality, aquatic ecology, terrestrial ecology, groundwater, cliffs and steep slopes; and – comparing subsidence impacts and environmental consequences with predictions; and 2. Submit the report to the Department, DPI, SCA, DECC, DWE and any other relevant agency to the satisfaction of the Director-General **10.** The Applicant shall include a comprehensive summary, analysis and discussion of the results of monitoring of subsidence effects, subsidence impacts and environmental consequences in each AEMR.	*Sections 4 to 8, Attachments B to J*

1.3. Reports and Management Plans

The impact predictions associated with Longwall 10 are described in the following reports:

- BHPBIC, November 2012 -DA3B SMP

  This plan includes specialist reports on subsidence prediction, water quality, aquatic ecology, flora and fauna and cultural heritage as follows:

  - MSEC, September 2012 – Dendrobium Area 3B – Longwalls 9 to 18 Subsidence Predictions and Impact Assessments for Natural Features and Surface Infrastructure in Support of the SMP Application. Revision B, MSEC459.
  - Ecoengineers, 2012. Dendrobium Area 3B Subsidence Management Plan Surface and Shallow Groundwater Assessment.
  - Coffey Geotechnics, October 2012. Groundwater Study, Area 3B Dendrobium Mine Numerical Modelling.
  - Niche Environment and Heritage, September 2012. Dendrobium Area 3B Terrestrial Ecology Assessment.
  - Cardno Ecology Lab, May 2012.Dendrobium Area 3 Aquatic Ecology Monitoring 2008 – 2011.
  - Biosis Research, March 2012. Dendrobium Area 3B Longwalls 8 to 18: Heritage Impact Assessment.

- BHPBIC, June 2014 - Watercourse Impact Monitoring Management and Contingency Plan. Dendrobium Colliery Area 3B, Revision A.
- BHPBIC, June 2014 - Swamp Impact, Monitoring, Management and Contingency Plan. Dendrobium Area 3B, Revision A.

1.4. Report Outline

Impacts have been described by the BHPBIC Environmental Field Team (ICEFT) and specialist consultants during and following mining.

Economic effects associated with longwall extraction are discussed in Section 2. An overview of the consultation involved with Dendrobium operations is provided in Section 3. Subsidence movement predictions and measurements are in Section 4. Predicted and observed impacts of Longwall 10 on man-made and natural features are provided in Sections 5 and 6 respectively. The Longwall 10 monitoring program and proposed future monitoring in the SMP Area, and a summary of the TARPs including any remediation measures, are outlined in Sections 7 and 8.

2. Economic Effects

The extraction of underground coal reserves from Area 3B provides benefits at international, national, state and local levels due to the coal's unique characteristics. BHP Billiton Illawarra Coal provides 70% of BlueScope Steel's coking coal requirements. Continuing benefits occur through continuity of employment, expendable income, export earnings and government revenue.

The Company provides local jobs for approximately 2000 direct employees and contractors throughout its operations with an employment flow-on effect in the Illawarra and Wollondilly regions of 2.6 full time equivalent jobs (IRIS, 2011). More than 400 small to medium local businesses provide their goods and services to the company. The company is a major contributor to the economy of the local region, contributing 4.7 per cent of household income and 5.3 per cent of industry value added. As of January 2015 Dendrobium Mine had 292 full time employees and 60 contractors and fixed term employees. These jobs are reliant on maintaining continuity of longwall coal extraction.

3. Stakeholder Consultation

3.1. Social Impacts Associated with Subsidence

Impact monitoring and provision of ongoing information to the community has been undertaken by BHPBIC during the extraction of DA3B.

Information on BHPBIC operations is provided to the community through the following mechanisms:

- Community information sheets and letter box drops,
- Media releases and other media activities,
- General community surveys and reports,
- Coal News – an Illawarra Coal publication for employees,
- Coalition News – a quarterly Illawarra Coal publication distributed to the community,
- Internet site **www.bhpbilliton.com/regulatoryinformation**
- Dendrobium Community Consultative Committee Meetings (meeting minutes provided on the BHPB website and emailed direct to interested stakeholders),
- Landholder relations program,
- Annual review, and
- Information days.

BHPBIC aims to mitigate the potential impacts subsidence may cause on individuals through various means outlined in Table 2.

Table 2: Social Impact Variables Associated with Subsidence

Potential Impact	Monitoring Variables	Mechanism
Subsidence Impacts	- Level of community concern relating to subsidence - Awareness of subsidence and its effects and management - Level of perceived community risk associated with subsidence effects - Level of satisfaction with the company's subsidence management practices - The extent to which the community attributes environmental, social and economic change occurring within the community to mining activities	- The Dendrobium Community Consultative Committee meetings including presentation on the technical parameters and explanations of how and why subsidence occurs, and its potential impacts - A biennial random telephone survey of residents in the communities in which Illawarra Coal operates. The survey aims to determine the community's perception of the company's overall performance

4. Predicted and Observed Subsidence

Subsidence movements resulting from the extraction of Longwall 10 were monitored along various lines and points within the SMP Area. A comparison of the observed and predicted movements has been prepared by MSEC (MSEC737, 2015) and is included as Attachment B. The results are summarised below.

Monitoring points and lines associated with Longwall 10 include;

- Wongawilli Creek Closure Lines,
- Area 3B 3D Monitoring Points,
- Wongawilli Creek Tributary Cross Lines,
- Donalds Castle Creek Cross Lines,
- Swamp Cross Lines, and
- Airborne Laser Scans (ALS) of the area.

The locations of these monitoring lines and points are shown in Figure 5 (MSEC737, 2015).

4.1. Wongawilli Creek Closure Lines

Closure movements across Wongawilli Creek were measured using 2D survey techniques at the Wong X A-Line, Wong X B-Line and Wong X C-Line. The location of these monitoring lines is shown in Figure 5 (MSEC737, 2015). The maximum observed closures at each of the Wongawilli cross lines were less than predictions.

For further details on the observed and predicted movements, including specific measurements, refer to MSEC737, provided as Attachment B.

4.2. Dendrobium Area 3B 3D Monitoring Points

Vertical and horizontal movements above and in the vicinity of Longwall 10 were measured using the DA3B 3D points. The location of these monitoring points is shown in Figure 5.

The horizontal movement vectors for the marks located outside the extents of Longwall 10 were generally orientated towards the extracted goaf, but slightly orientated towards the longwall finishing end. The horizontal movement vectors for the marks located above the longwall were also generally oriented towards the finishing end.

The observed incremental horizontal movements at the DA3B 3D monitoring points, resulting from the extraction of Longwall 10 were within the range of those measured at similar distances from previously extracted longwalls at Dendrobium Mine and elsewhere in the Southern Coalfield. This is shown in Figure 1, Dendrobium longwalls are represented by colour.

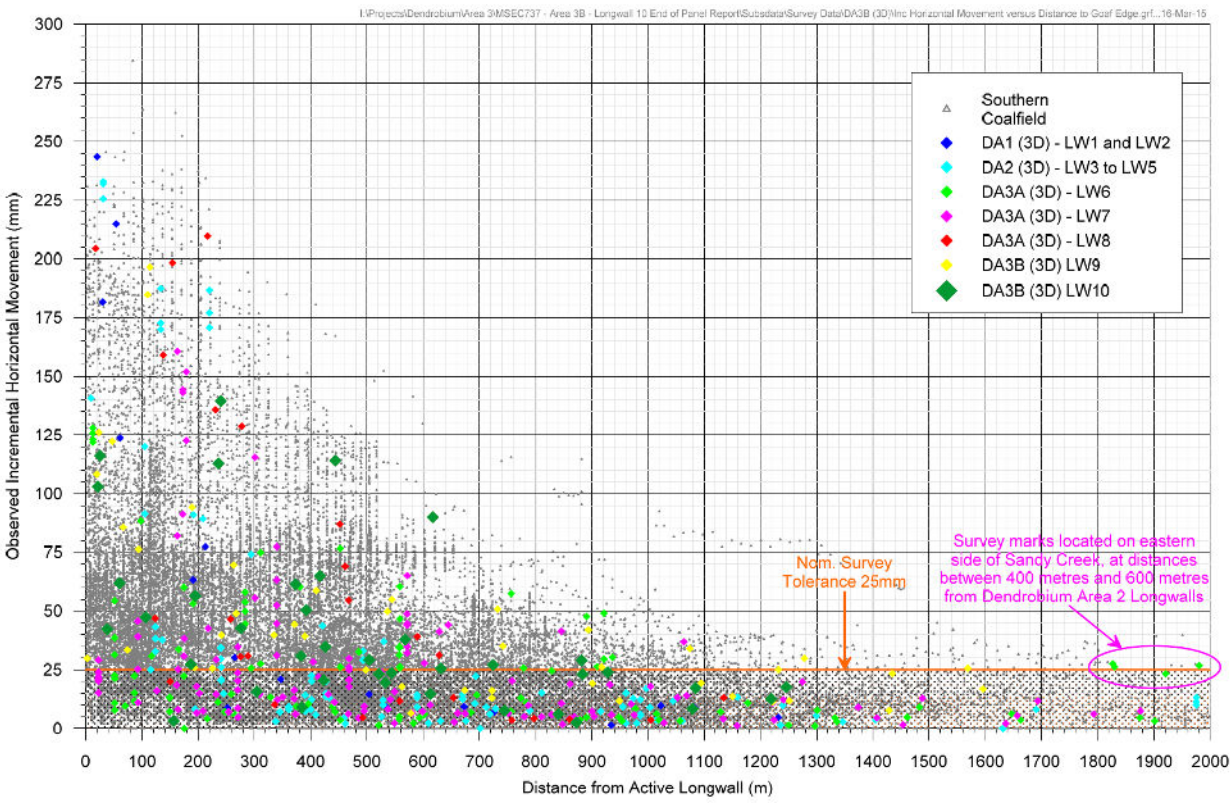

Figure 1: Observed Incremental Horizontal Movement for DA3B 3D Monitoring Points

4.3. Wongawilli Creek Tributary Cross Lines

Observed subsidence and closures at the Wongawilli Creek Tributary Cross Lines were measured using 2D survey techniques at the WC21XA Line, WC21XB Line, WC21XC Line, WC21XD Line, WC21XE Line, WC21XF Line and WC21XG Line. The locations of the tributary cross lines are shown in Figure 5.

The observed subsidence and closure at the Tributary Cross Lines were generally similar to or less than predicted. The observed closure for the WC21XD Line of 820 mm, however, exceeded the prediction of 725 mm.

For further details of the observed and predicted movements, including specific measurements, refer to MSEC737, provided as Attachment B.

4.4. Donalds Castle Creek Cross Lines

The mine subsidence movements across Donalds Castle Creek lines were measured using 2D survey techniques using the DCCXA-Line, DCCXB-Line, DCCXC-Line, DCCXD-Line and DCCXE-Line. The locations of the Donalds Castle Creek Lines are shown in Figure 5.

The observed subsidence at the Cross Lines has been greater than predicted. Maximum observed subsidence was 122mm at DCCX E-Line, compared to the predicted subsidence of <20mm. Observed closure was less than predicted for Lines DCCXA, DCCXB, DCCXD and DCCXE. Observed closure at DCCXC-Line was 550mm, compared with the predicted 325mm.

For further details of the observed and predicted movements, including specific measurements, refer to MSEC737, provided as Attachment B.

4.5. Swamp Cross Lines

The mine subsidence movements across the Swamp Cross Lines were measured using 2D survey techniques using the SW5 Line, SW 1A Line and the SW 1B Line. The locations of the swamp cross lines are shown in Figure 5. Observed subsidence at the Swamp Cross Lines was greater than predictions. Maximum observed subsidence was 1911mm at SW 1B Line, compared to the predicted subsidence of 1325mm.

Observed closure also slightly exceeded predictions within SW 1B Line, observed subsidence was 311mm, compared to 300mm predicted. For further details of the observed and predicted movements, including specific measurements, refer to MSEC 737, provided as Attachment B.

4.6. Airborne Laser Scan

The initial surface levels in Dendrobium Area 3B were determined using an ALS /LiDAR scan (Airborne Laser Scan / Light Distance and Ranging) in January 2013, prior to the commencement of Longwall 9. Subsequent post-mining scans were carried out in February 2014 after the completion of Longwall 9, and in January 2015 after the completion of Longwall 10.

The changes in surface level were determined by taking the differences between the surface levels measured before and after the extraction of Longwalls 9 and 10. The profile of predicted incremental and total subsidence is shown in Figure 2.

Figure 2: Observed Changes in Surface Level and Predicted Subsidence along Long-Section 1

The observed incremental and total subsidence along Long-section 1 are reasonably similar to those predicted along the centreline of Longwall 10. There are two locations along the base of the subsidence trough that are greater than predicted but are within the accuracy of modelling predictions of ±15% and the expected tolerance of the ALS / LiDAR for absolute vertical position of ±300 mm. The observed subsidence has also exceeded predicted subsidence at the commencing and finishing ends of Longwall 10 with the observed subsidence profiles at the ends of the subsidence trough being closer to the commencing end and finishing end of Longwall 10. The profile at the commencing end is slightly steeper than predicted. It is noted that the largest predicted maximum subsidence along the long-section was not exceeded by the largest observed subsidence along the long-section.

The profiles of the observed incremental and total subsidence along Cross-sections 1 and 2, after the extraction of Longwall 10, are shown by the green lines in Figure 3 and Figure 4 respectively. The profiles of predicted incremental subsidence are also shown in these figures as red lines for comparison.

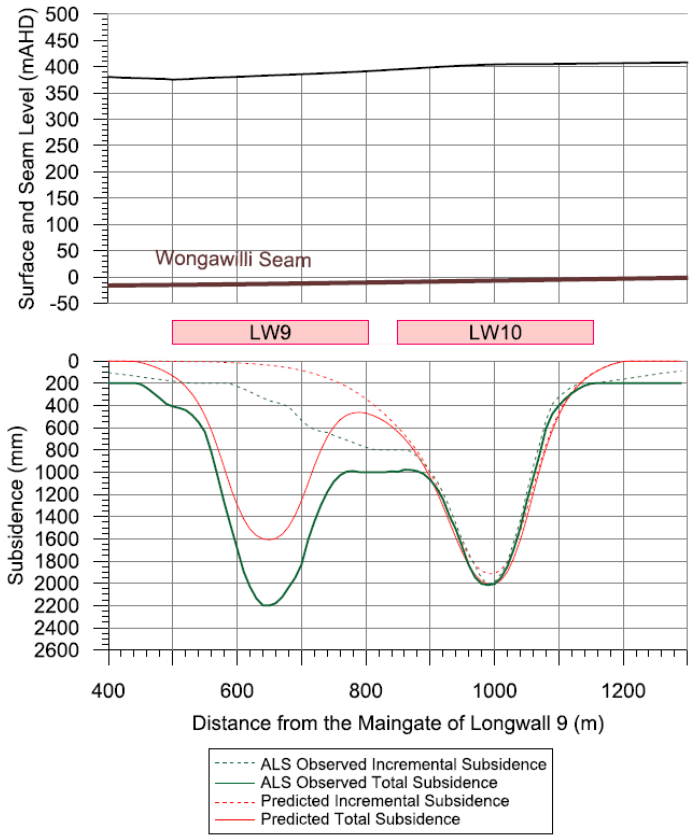

Figure 3: Observed Changes in Surface Level and Predicted Subsidence along Cross-section1

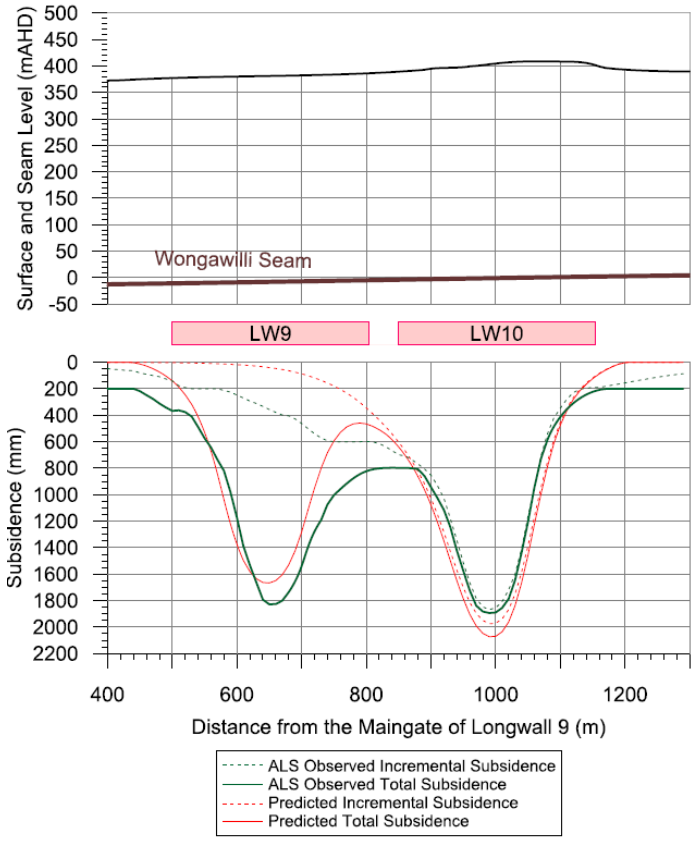

Figure 4: Observed Changes in Surface Level and Predicted Subsidence along Cross-section 2

It can be seen from the above figures, that the shapes of the observed profiles are reasonably similar to those predicted. The maximum observed incremental and total subsidence exceeded that predicted above Longwall 9 in Cross-section 1 and Cross-section 2. The maximum observed incremental and total subsidence slightly exceeded that above Longwall 10 in Cross-Section 1. The observed subsidence profiles in Cross-section 1 and Cross-section 2 also show greater subsidence and a flatter subsidence profile above the chain pillar between Longwall 9 and Longwall 10 indicating significant pillar compression.

It should be noted that a review of calibration of the subsidence prediction model is planned to be undertaken during the extraction of Longwall 11 using data from Longwall 9 and 10 and overburden geology. Results of the review will be reported in the Longwall 11 End of Panel Report.

5. Impacts to Man-Made Features

The built features in the vicinity of Longwall 10 are shown in Drawing MSEC737-03; and include:

- Fire Frails and four wheel drive tracks,
- Disused Maldon – Dombarton Railway Corridor, and
- Survey control marks.

Cordeaux Dam Wall is located in excess of 5 kilometres north of Longwall 10, at its closest point. The Upper Cordeaux No. 2 Dam Wall is located in excess of 6 kilometres south-east of Longwall 10, at its closest point. It is unlikely that these dam walls would experience any measurable far-field horizontal movements resulting from the extraction of Longwall 10 and, therefore, they have not been included in the following comparisons.

MSEC predicted impacts for the surface infrastructure, resulting from the extraction of Dendrobium Longwalls 9 to 18, and these were provided in Report No. MSEC459. Comparisons between the MSEC assessments and the observed impacts for the surface infrastructure listed above, resulting from the extraction of Longwall 10, are provided in Table 3.

Table 3: Summary of the Assessed and Observed Impacts for Surface Infrastructure Resulting from the Extraction of Longwall 10

Surface Infrastructure	MSEC Assessed Impacts	Observed Impacts
Fire Trails and Four Wheel Drive Tracks	Cracking of unsealed road surfaces	Localised surface cracking observed in Access Track 6000, Fire Road 6A and one closed seismic line. Refer to the attached report by IC for further details
Survey Control Marks	Vertical and horizontal movements which could require re-establishment	No reported impacts. Survey Control Marks to be re-established after completion of mining
Disused Maldon-Dombarton Railway	Possible fracturing of rock cuttings, spalling, and/or mobilisation of rock joints	No reported impacts

It can be seen from Table 3 that the observed impacts on surface infrastructure, resulting from the extraction of Longwall 10, were generally similar to or less than predicted.

6. Impacts to Natural Features

6.1. Landscape Features

The ICEFT have conducted detailed monitoring and inspections on landscape features including swamps, watercourses, rock outcrops and the general area within DA3B. This monitoring was conducted in accordance with the SMP, Dendrobium Area 3B Watercourse Impact, Monitoring, Management and Contingency Plan (WIMMCP) (versions dated December 2013 and June 2014) and the Dendrobium Area 3B Swamp Impact, Monitoring, Management and Contingency Plan (SIMMCP) (versions dated October 2013 and June 2014). Impacts to landscape features were incorporated into the monitoring program as they were identified. During the period of extraction updated Trigger Action Response Plans, for the WIMMCP and SIMMCP, were developed in consultation with relevant government agencies.

In total, twenty five surface impacts were identified by the ICEFT as a result of Longwall 10 extraction. Fourteen of these impacts were observed in watercourses, seven in the general area above Longwall 10 and four were observed on access tracks. Shallow groundwater TARP triggers (water level recession) were recorded in Swamp 5 during Longwall 10 extraction.

Seven impacts associated with Longwall 9 were identified during Longwall 10 extraction. Four impacts were attributed to Longwall 9 extraction, but were identified after the Longwall 9 EoP Report was submitted. The remaining three impacts are existing Longwall 9 impacts that have extended during Longwall 10 extraction.

The monitoring program for Longwall 10 was undertaken in accordance with SMP requirements for DA3B. The monitoring program is outlined in Section 6.1, Table 10.

6.2. Summary of Impacts

Twenty five impacts were identified during the monitoring of Longwall 10. These impacts have been labelled "DA3B_LW10_001" to "DA3B_LW10_026" and are summarized in Table 4. Please note that impact "DA3B_LW10_017" was identified to be an extension of a Longwall 9 impact and was therefore removed from the Longwall 10 impact list.

Impacts "DA3B_LW10_025" and "DA3B_LW10_026" were identified after the Landscape Report (Attachment C) was finalised and will be described in this report.

6.3. Results from Monitoring Program

The results of the ICEFT monitoring are provided in this section of the report, the Landscape Report (Attachment C) and the Impact Reports submitted during Longwall 10 extraction (Attachment C2). This section should be read in conjunction with other relevant reports by specialist consultants provided in the Attachments. Figure 6 illustrates the location of impacts identified during Longwall 10 extraction.

6.3.1. Fracturing

Fractures observed during the extraction of Longwall 10 were assessed against the relevant TARP (for watercourse, swamp or landscape) which results in assigning a trigger value to each impact (Level 1, Level 2, Level 3). Trigger values for fractures were determined based on characteristics such as:

- The width and length of the fracture,
- Whether the fracture contributed to any observable loss of surface water or water diversion, and
- Any erosion or potential for erosion caused by the fracture

Fracturing Observed in Watercourses

Wongawilli Creek

An extension of impact DA3B_LW9_017 was recorded during Longwall 10 extraction (Photo 1 and Photo **2**). Due to the weathered nature of the fracture, it does not appear to have occurred recently and was likely hidden from view due to sand and debris that typically lines the banks of Wongawilli Creek.

Photo 1: Impact DA3B_LW9_01. Taken on 16/12/2014

Photo 2: Impact DA3B_LW9_017. Taken on 16/12/2014

Table 4: Summary of Landscape Impacts

Site ID	Easting	Northing	Description	Feature Affected	Identification Date	Impact Level	TARPS Used	Refer to Impact Report/s Dated
DA3B_LW9_014	290211	6193760	Additional cracking identified to site as a result of Longwall 10	WC21	10/12/2013 (update on 5/12/2014)	Level 2	WIMMCP TARP dated 19/12/2013	05/12/2014
DA3B_LW9_016	290206	6193747	Extension of fracturing to rockbar downstream of WC21_Pool 18. Fracture lengths range from 0.5 m to 3.1 m with a width extending from hairline to 0.03 m	WC21	0412/2014	Level 2	WIMMCP TARP dated 19/12/2013	05/12/2014
DA3B_LW9_017	290817	6193692	Fracture at base of Pool 43a in Wongawilli Creek. An extension of the fracture was identified during LW10, Due to the weathered nature of the fracture, it does not appear to have occurred recently.	Wongawilli Creek	18/12/2013 (update on 24/12/2014)	Level 1	WIMMCP TARP dated 19/12/2013	24/12/2014
DA3B_LW9_019	290239	6193905	Iron staining identified in WC21_Pool 10 extended to WC21_Pool 4. Staining absent in Wongawilli Creek.	WC21	24/12/2013 (update on 24/12/2014)	Level 1	WIMMCP TARP dated 19/12/2013	24/12/2014
DA3B_LW9_030	289924	6193903	Rock fracturing and soil cracking beneath small overhang. Fracturing measured approximately 2m long and up to 0.05m wide.	Cliffline / Steep Slope	12/09/2014	Level 1	Dendrobium Area 3B SMP Volume 2 – Table 2, TARP dated 12/11/2012	12/09/2014
DA3B_LW9_031	289936	6193906	Vertical fracture to a rock outcrop approximately 40m east of Access Track 6000. Fracture measures 1m long and 0.03m wide.	Cliffline / Steep Slope	12/09/2014	Level 1	Dendrobium Area 3B SMP Volume 2 – Table 2, TARP dated 12/11/2012	12/09/2014
DA3B_LW9_032	289884	6193828	Rock fall on rock outcrop adjacent to Access Track 6000. The fall measured approximately 2.5m long, 0.47 wide and 0.25m deep. Ground disturbance was not significant.	Cliffline / Steep Slope	06/02/2015	Level 1	Dendrobium Area 3B SMP Volume 2 – Table 2, TARP dated 12/11/2012	06/02/2015
DA3B_LW10_001	288197	6193627	Soil crack adjacent to an access track that crosses Fire Road 6A. Crack is approximately 1.5m long and 0.005m wide.	Access Track	27/03/2014	Level 1	Dendrobium Area 3B SMP Volume 2 – Table 2, TARP dated	24/03/2014

			This impact has self-remediated.				12/11/2012	
DA3B_LW10_002	289661	6193440	Multiple soil cracks on Access Track 6000 up to 5m long, 0.05m wide and 0.32m deep. Self-remediation likely.	Access Track 6000	08/10/2014	Level 1	Dendrobium Area 3B SMP, Volume 2 - Table 1.2, TARP dated 12//11/2012	10/10/2014
DA3B_LW10_003	289687	6193483	Multiple soil cracks on Access Track 6000 up to 0.7m long, 0.05m wide and 0.14m deep. Self-remediation likely.	Access Track 6000	08/10/2014	Level 1	Dendrobium Area 3B SMP, Volume 2 - Table 1.2, TARP dated 12//11/2012	10/10/2014
DA3B_LW10_004	289775	6193488	Rock fall and multiple rock fractures on outcropping. Rock fall volume approximately 0.002m^3. Fractures measured a maximum of 2.2m long and 0.04m wide.	Cliffline / Steep Slope	27/10/2014	Level 1	Dendrobium Area 3B SMP, Volume 2 - Table 1.2, TARP dated 12//11/2012	27/10/2014
DA3B_LW10_005	289734	6193591	Soil crack on Access Track 6000. Measured 3.5m long, 0.05m wide and 0.01m deep. Self-remediation likely.	Access Track 6000	05/11/2014	Level 1	Dendrobium Area 3B SMP, Volume 2 - Table 1.2, TARP dated 12//11/2012	07/11/2014
DA3B_LW10_006	289708	6193528	Soil crack on Access Track 6000. Measured 1m long, 0.03m wide and 0.3m deep. Self-remediation likely.	Access Track 6000	05/11/2014	Level 1	Dendrobium Area 3B SMP, Volume 2 - Table 1.2, TARP dated 12//11/2012	07/11/2014
DA3B_LW10_007	290027	6193372	Rock fracturing and uplift on the downstream end of WC21_Rockbar 26. Maximum length of 1.8m, width and depth 0.02m. Localised flow diversion present. Additional fracturing 3m long and 0.015m wide was later identified.	WC21	18/11/2014	Level 2	WIMMCP TARP dated 19/12/2013	19/11/2014 and 25/11/2014
DA3B_LW10_008	290094	6193481	Rock fracturing and uplift at base of WC21_Pool 24. Fracture is approximately 2.4m long and 0.003m wide. Flow diversion is evident.	WC21	18/11/2014	Level 2	WIMMCP TARP dated 19/12/2013	19/11/2014
DA3B_LW10_009	290124	6193548	Multiple fractures and uplift on the downstream end of WC21_Rockbar 23. Largest fracture 3m long, 0.03m wide and 0.12m deep.	WC21	18/11/2014	Level 2	WIMMCP TARP dated 19/12/2013	19/11/2014

DA3B_LW10_010	290036	6193387	Dilation of an existing joint in WC21_Pool 26. Dilation is 1m long and 0.025m wide. No flow diversion is visible.	WC21	25/11/2014	Level 1	WIMMCP TARP dated 19/12/2013	25/11/2014
DA3B_LW10_011	290053	6193413	Multiple fractures and uplift within the upstream end of WC21_Rockbar 24. Maximum fracture length 4m and uplift 0.035m wide.	WC21	25/11/2014	Level 2	WIMMCP TARP dated 19/12/2013	25/11/2014
DA3B_LW10_012	290145	6193469	Soil cracking on a closed seismic track approximately 75m northwest of WC21_Rockbar 24. Cracking has a maximum length of 2.4m, width of 0.051m and depth of 0.02m.	Access Track	04/12/2014	Level 1	Dendrobium Area 3B SMP Volume 2 – Table 1.2 TARP dates 12/11/2012	05/12/2014
DA3B_LW10_013	290132	6193544	Rock fracturing identified at the base of WC21_Pool 23. Fracturing has a maximum length of 0.63m, width of 0.04m and depth of 0.12m. Flow diversion is not evident.	WC21	04/12/2014	Level 1	WIMMCP TARP dated 19/12/2013	05/12/2014
DA3B_LW10_014	290129	6193555	Multiple rock fractures were identified at the downstream end of WC21_Pool 23. Fractured range from 0.2m to 2.4m long and hairline to 0.002m wide.	WC21	04/12/2014	Level 2	WIMMCP TARP dated 19/12/2013	05/12/2014
DA3B_LW10_015	290130	6193580	Multiple rock fractures up to 0.9m in length and 0.001m wide. Surface flow was absent during inspection.	WC21	04/12/2014	Level 2	WIMMCP TARP dated 19/12/2013	05/12/2014
DA3B_LW10_016	290185	6193684	Multiple rock fractures in a rockbar upstream of WC21_Pool 19. Maximum length of 2.8m and a width of 0.004m. surface flow was absent during the inspection.	WC21	04/12/2014	Level 2	WIMMCP TARP dated 19/12/2013	05/12/2014
DA3B_LW10_017			*Removed from LW10 list as impact related to LW9*					
DA3B_LW10_018	290112	6193502	Rock fracture approximately 30m upstream of WC21_Rockbar 23. Fracture is approximately 1.5m long and had a	WC21	18/12/2014	Level 2	WIMMCP TARP dated 19/12/2013	24/12/2014

			maximum width of 0.004m. Surface flow was absent during the inspection.					
DA3B_LW10_019	290127	6193522	Multiple rock fractures upstream of WC21_Rockbar 23. Fractures range from 2.2m to 5m long and 0.002m to 0.006m wide. Surface flow was absent during the inspection.	WC21	18/12/2014	Level 2	WIMMCP TARP dated 19/12/2013	24/12/2014
DA3B_LW10_020	290082	6193449	Multiple rock fractures in the downstream section of Rockbar 24. Longest fracture measured 5.5m long and 0.003m side. No flow diversion was observed.	WC21	02/02/2015	Level 1	WIMMCP TARP dated 19/12/2013	02/02/2015
DA3B_LW10_021	289959	6193887	Vertical fracture on rock outcrop adjacent to Access Track 6000. No erosion or rock fall was observed during the inspection.	Cliffline / Steep Slope	06/02/2015	Level 1	Dendrobium Area 3B SMP Volume 2 – Table 1.2 TARP dates 12/11/2012	06/02/2015
DA3B_LW10_022	289927	6193849	Rock fracturing on a rock outcrop at SLMMP site A3B-SS2-SLMMP-Pt2. Fracture was approximately 0.3m long and 0.002m side.	Cliffline / Steep Slope	06/02/2015	Level 1	Dendrobium Area 3B SMP Volume 2 – Table 1.2 TARP dates 12/11/2012	06/02/2015
DA3B_LW10_023	290234	6193924	Fracture to rockbar upstream of WC21_Pool 10. Fracture measured 1.6m long and 0.01m, at its widest.	WC21	18/02/2015	Level 2	WIMMCP TARP dated 04/06/2014	19/02/2015
DA3B_LW10_024	289824	6193558	Soil crack approximately 20m long, 0.28m wide and 1.8m deep. The crack is in the process of infilling and will most likely self-remediate.	Cliffline / Steep Slope	18/02/2015	Level 2	Dendrobium Area 3B SMP Volume 2 – Table 1.2 TARP dates 12/11/2012	19/02/2015
DA3B_LW10_025	289835	6193613	Soil crack approximately 14m long, 0.1m wide and 1.4m deep. The crack is in the process of infilling and will most likely self-remediate.	Cliffline / Steep Slope	20/02/2015	Level 2	Dendrobium Area 3B SMP Volume 2 – Table 1.2 TARP dates 12/11/2012	26/02/2015
DA3B_LW10_026	290136	6193540	Multiple rock fractures in downstream section of WC21_Rockbar 23. Fractures ranged from 0.65 – 6m long and hairline to 0.005m wide. Surface flow was absent during the inspection.	WC21	03/03/2015	Level 2	WIMMCP TARP dated 04/06/2014	03/03/2015

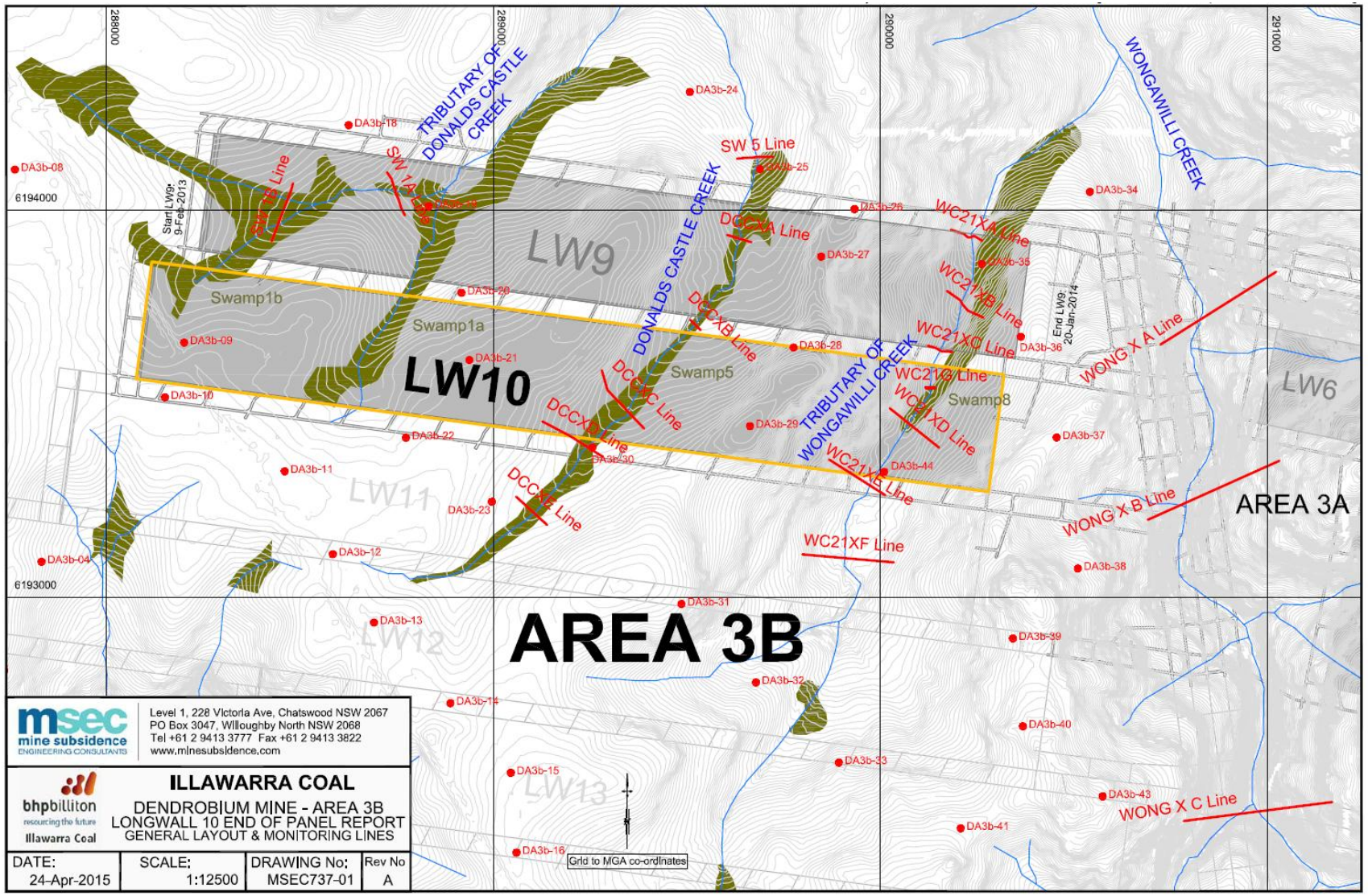

Figure 5: Location of monitoring points and lines in relation to Dendrobium Mine Area 3B Longwall 10

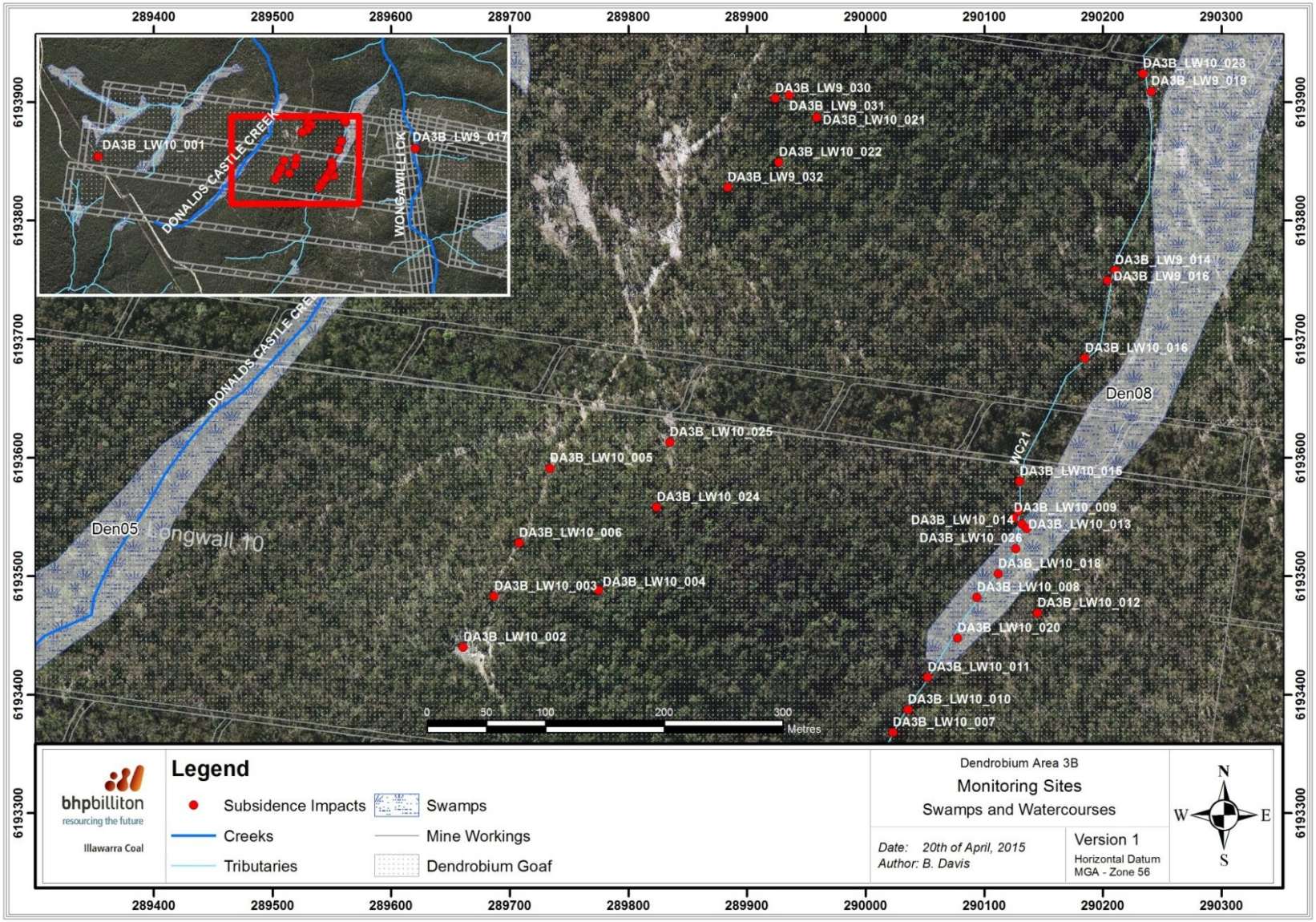

Figure 6: Location of Longwall 10 Surface Impacts

Donalds Castle Creek

Monitoring within Donalds Castle Creek continued as required by the DA3B SMP. No impacts were identified during the Longwall 10 extraction period.

First and Second Order Streams

Three first and second order streams were monitored as part of the Longwall 10 monitoring program; LA5, DC13 and WC21. Surface cracking and rock fracturing was observed in tributary WC21 within the zone of influence for Longwall 10. These impacts were assessed under the TARPs in the WIMMCP (December 2013) and Table 1.2 of Dendrobium Area 3B SMP, Volume 2 (November 2012).

Three TARP Level 1 fractures have been observed in WC21 (Photo 3, Photo **4** and Photo **5**) and have been identified as DA3B_LW10_010, 013 and 020 respectively (Figure 6). No water loss or flow diversion was observed from these impacts.

Photo 3: Impact DA3B_LW10_010 – Dilation of joint in base of pool. Taken on 25/11/2014

Photo 4: Impact DA3B_LW10_013 – Localised rock fracture at base of pool. Taken on 04/12/2014

Photo 5: Impact DA3B_LW10_020 Fracturing to WC21_Rockbar 24. Taken on 02/02/2015

Thirteen TARP Level 2 fractures have been identified in WC21 (Figure 6), resulting in an observable diversion of surface water (Photo 6 and Photo **7**). Two of these fractures were identified during Longwall 10 extraction as extensions of existing Longwall 9 impacts DA3B_LW9_014 and 016 (Photo 12 andPhoto **13**).

Photo 6: Impact DA3B_LW10_007 – rock fracture with reappearance of localised flow diversion. Taken on 18/11/2014

Photo 7: Impact DA3b_LW10_011 – Fracturing with dislodged fragment. Taken on 25/11/2014

Following an inspection of landscape features on the 3rd of March 2015, multiple rock fractures to the downstream section of WC21_Rockbar 23 were identified (DA3B_LW10_026). The fractures ranged from 0.35m to approximately 6m long and hairline to 0.005m wide (Photo 8 and Photo **9**). Surface flow was absent during the inspection. This impact is a Level 2 trigger according to the WIMMCP (June 2014), as shown in Table 13. Specifically:

- Any fracture which results in observable loss of surface water

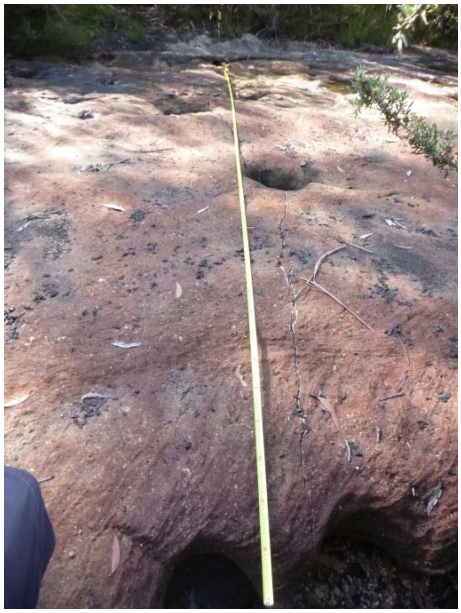

Photo 8: impact DA3B_LW10_026 – Longest fracture to Rockbar 23. Taken on 03/03/2015

Photo 9: Impact DA3B_LW10_026 – Widest observable fracture. Taken on 03/03/2015

Additionally, during the inspection carried out on the 3rd of March 2015, an extension of an existing impact was observed. Within impact DA3B_LW10_009 a zone of fracturing and uplift was identified below the lip of WC21 Rockbar 23 (Photo 10 and Photo **11**). The impact remains as a Level 2 trigger according to the WIMMCP TARPs dated June 2014.

Photo 10: Impact DA3B_LW10_009 – Length of longest fracture with uplift. Taken on 03/03/2015

Photo 11: Impact DA3B_LW10_009 – width of widest fracture. Taken on 03/03/2015

During Longwall 10 extraction, two extensions of existing Longwall 9 impacts were identified within WC21. Extensions of fractures were observed to impacts DA3B_LW9_014 and 016 (Photo 12 and Photo **13**). The fractures ranged from 0.5m to 3.1m long and hairline to 0.03m in width. These impacts are Level 2 Triggers according to the WIMMCP TARPs dated December 2013.

Photo 12: Impact DA3B_LW9_014 – Widest point of vertical fracture. Taken on 04/05/2015

Photo 13: Impact DA3B_LW9_016 - Rock fracturing extending across rockbar. Taken on 04/02/2015

No fractures were observed within tributaries DC13 and LA5 during the Longwall 10 extraction period.

Fracturing Observed to the Landscape

Seven fractures were observed within the general area DA3B during the Longwall 10 extraction period. Two fractures and one rock fall have been attributed to Longwall 9 due to the location, nature and timing of identification.

Of the five fractures attributed to Longwall 10, three are Level 1 and two are Level 2 impacts under TARPs in the Dendrobium Area 3B SMP, Volume 2 (November, 2012).

Impact DA3B_LW10_024 was identified approximately 90m east of Access Track 6000 and consisted of a soil crack. The crack measured approximately 20m long, 0.28m at its widest point with a depth of 1.8m. The crack is in the process of infilling and will most likely self-remediate (Photo 14 and Photo **15**). Due to the depth of the crack and density of ground cover it poses a potential risk to safety. As a result the crack has been identified with flagging tape and signage.

This impact is a Level 2 trigger under the TARPs set out in Table 1.2 of the DA3B SMP, Volume 2 (*November 2012*), as shown in Table 11, Specifically:

- Crack or fracture between 100 and 300mm width,
- Crack or fracture between 10 and 50m length, and
- A crack at the surface with the potential risk to safety and/or fauna entrapment.

Photo 14: Impact DA3B_LW10_024. Depth of crack. Taken on 18/02/2015

Photo 15: Impact DA3B_LW10_024. Width of crack. Taken on 18/02/2015

Impact DA3B_LW10_025 consisted of a single soil crack to a seismic track adjacent to Access Track 6000. The crack measured approximately 14m long, 0.1m wide and 1.4m deep (Photo 16 and Photo **17**). At the time of identification, the crack was in the process of infilling and will most likely self-remediate.

This impact is a Level 2 Trigger under the TARPs set out in Table 1.2 of the Dendrobium Area 3B SMP, Volume 2 (November, 2012), specifically:

- Crack or fracture between 100 an 300mm width, and
- Crack or fracture between 10 and 50m length

Photo 16: Impact DA3B_LW10_025. Taken on 20/02/2015

Photo 17: Impact DA3B_LW10_025. Taken on 20/02/2015

Review of Level 2 TARP Triggers

Following identification of these Level 2 impacts a review was conducted to assess whether any Corrective Management Actions (CMAs) are required as well as reviewing the monitoring frequency. Impacts DA3B_LW10_024 and 025 are located within Exposed Sandstone Scribbly Gum Woodland where the dominant soil type is 'Lucas Heights', which consists of interbedded shale, laminate and fine to medium grained quartz sandstone.

On review of the photos and impact reports for DA3B_LW10_024 and 25, and based on extensive monitoring experience, it is considered that the nature of identified cracks is minor and are likely to infill over the coming months and stabilise within the reporting period. The likelihood of these impacts causing erosion or sedimentation impacts is considered highly unlikely given the cracks are located in sandy soils, have resulted in negligible disturbance, are located on a flat area of the ridgeline away from watercourses and are in the process of infilling.

No CMAs are recommended at this stage. It is expected that the cracks will naturally stabilise without implementing CMAs and within the reporting period. Monitoring will continue in accordance with the SMP.

Longwall 9 Impacts

Both impacts attributed to Longwall 9 are Level 1 Triggers under TARPs in the Dendrobium Area 3B SMP, Volume 2 (November, 2012). Impacts DA3B_LW9_030 and 031 (Photo 18 and Photo **19**) were attributed to Longwall 9 due to the location and timing of identification. That is, the impacts were far enough away from the Longwall 10 mining at the time of identification to conclude that they were not a result of Longwall 10 extraction.

Photo 18: Impact DA3B_LW9_030 – Fracturing and soil cracking beneath step. Taken on 11/09/2014

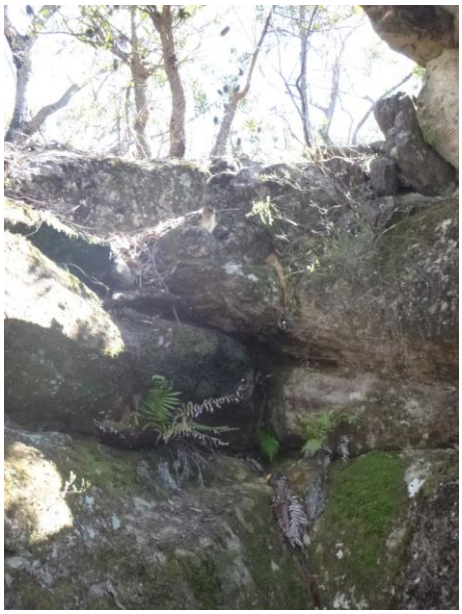

Photo 19: Impact DA3B_LW9_031 – Small fracture to step. Taken on 11/09/2014

6.3.2. Rock Fall

Two Level 1 rock falls, DA3B_LW9_032 and DA3B_LW10_004, were observed during the Longwall 10 monitoring period. Impact DA3B_LW9_032 consisted of a rock fall adjacent to Access Track 6000. The fall measured approximately 2.5m long, 0.47m wide and 0.25m deep. The volume of fallen rock was approximately 0.1m^3 (Photo 21). Ground disturbance at the site was not significant (Photo 20).

Photo 20: Impact DA3B_LW9_032 – Rockfall on outcropping. Taken on 06/02/2015

Photo 21: Impact DA3B_LW9_032 – Ground disturbance adjacent to rockfall. Taken on 06/02/2015

This impact was identified after Longwall 10 extraction had completed. However, due to the location of the rock fall (far eastern side of the longwall block) and the weathered nature of the rock fall it was determined to be associated with Longwall 9.

Impact DA3B_LW10_004 consists of a rock fall and multiple fractures in an area approximately 15m X 10m on a rock outcrop 90m east of Access Track 6000 above Longwall 10. The rock fall was approximately 0.5m long and 0.2m deep resulting in fallen rock fragments measuring approximately 0.002m^3 (Photo 22 and Photo **23**).

Photo 22: Impact DA3B_LW10_004 – Fracturing on cliff face. Taken on 27/10/2014

Photo 23: Impact DA3B_LW10_004 – Horizontal fracture on rock face. Taken on 27/10/2014

6.3.3. Groundwater

Shallow groundwater in swamps is monitored at boreholes from which measurements of water level and rates of water recession after rainfall are logged using vibrating wire piezometers. In accordance with TARPs set out in the SIMMCP *(October 2013)* and SIMMCP *(June 2014);* changes to groundwater are reported when measurements of water level drop below baseline levels or when rates of recession exceed those recorded during the baseline period. For further details refer to the relevant impact reports included in Attachment C2, Section 6.6 and Ecoengineers Report (Attachment D).

6.3.4. Appearance

First and Second Order Streams

Iron staining and water cloudiness have been previously observed in WC21 (DA3B_LW9_019, Photo 24). During Longwall 10 extraction the iron staining and cloudiness has extended from WC21_Pool 10 downstream to WC21_Pool 4 (Photo 25 and Photo **26**). An inspection of the confluence of WC21 and Wongawilli Creek indicated that the iron staining and water cloudiness is no longer visible at that point (Photo 27).

Photo 24: Impact DA3B_LW9_019 – WC21_Pool 10 looking upstream. Taken on 24/12/2013

Photo 25: Impact DA3B_LW9_019 – WC21_Pool 10 looking upstream. Taken on 18/12/2014

Photo 26: Impact DA3B_LW10_019 – WC21_Pool 4 looking downstream. Taken on 18/12/2014

Photo 27: Confluence of WC21 and Wongawilli Creek. Taken on 16/01/2015

6.4. Summary of TARP Triggers Observed

One shallow groundwater monitoring site in swamps relevant to Longwall 10 contributed to triggers being reported in relation to shallow groundwater recession rates. Post longwall mining terrestrial ecology monitoring concluded that a TARP trigger has been activated for Terrestrial Fauna – Threatened Frog Species. Four DSC groundwater monitoring bores have reached Level 2 triggers. A Summary of the TARP triggers identified during the Longwall 10 monitoring period is provided in Table 5. For a detailed description of triggers reached in relation to shallow groundwater levels refer to the Ecoengineers Report (Attachment D). For terrestrial fauna TARP triggers, refer to the Biosis Report (Attachment G). For Groundwater bore triggers, refer to the Hydro Simulations Report (Attachment E).

Table 5: Summary of TARP Triggers Observed

Site	Identification Date	Activating Longwall	Feature Affected	Type	Description	Trigger Level	TARPs Used	Refer to Impact Report/s Dated
05_02	02/10/2014	LW10	Swamp 5	Shallow Borehole	Increased rate of water level recession compared to baseline	Level 2	WIMMCP TARP dated 19/12/2013	02/02/2015
Donalds Castle Creek	26/03/2015	LW10	Donalds Castle Creek	Terrestrial Fauna	Reduction in habitat for one season	Level 1	WIMMCP TARP dated 12/11/2012	See Biosis Report
DDH84	07/05/2015	LW10	Groundwater Level	Deep Groundwater	One piezometer head below lake level	Level 2	Avon & Cordeaux Reservoirs DSC Notification Area Management Plans	See Hydro Simulations Report
DDH85	07/05/2015	LW10	Groundwater Level	Deep Groundwater	Two piezometers head below lake level	Level 2	Avon & Cordeaux Reservoirs DSC Notification Area Management Plans	See Hydro Simulations Report
DDH119	07/05/2015	LW10	Groundwater Level	Deep Groundwater	Two piezometers head below lake level	Level 2	Avon & Cordeaux Reservoirs DSC Notification Area Management Plans	See Hydro Simulations Report
DDH120	07/05/2015	LW10	Groundwater Level	Deep Groundwater	One piezometer head below lake level	Level 2	Avon & Cordeaux Reservoirs DSC Notification Area Management Plans	See Hydro Simulations Report

6.5. Surface Water

Ecoengineers have reviewed and assessed impacts to stream water quality, shallow groundwater levels, and catchment hydrologic performances within the Wongawilli Creek and Donalds Castle Creek catchment areas and their associated swamps as a result of mining Longwall 10. A summary of the assessment is provided below, and the full report is provided as Attachment D.

During the period 20th January 2014 to approximately 1st October 2014, Longwall 10 mined beneath the Donalds Castle Creek catchment. Key water quality parameters measured downstream of Longwall 10 and for the Upper Donalds Castle Creek catchment did not exceed TARP limits during that period or subsequently.

Longwall 10 mined beneath the catchment of Wongawilli Creek from approximately 1st October 2014 until completion of the longwall on 20th January 2015. Key water quality parameters measured immediately downstream of Longwall 10 on the Creek's tributary WC21 and for the 'greater' Wongawilli Creek catchment did not exceed TARP limits during that period, or subsequently. Water quality assessments carried out within the WC21 sub-catchment showed that there was a localised impact on water quality associated with the catchment being mined under.

All observed water quality impacts from the mining of Longwall 10 were fully consistent with predicted impacts set out in the DA3B SMP (December 2012).

Stream flow data for the pre-mining recessional and baseline periods were used to determine key baseline hydrologic performance parameters, and for estimating catchment water balances for the Upper Donalds Castle Creek catchment, two relevant Upper Donalds Castle Creek sub-catchments, the Wongawilli Creek catchment, a relevant sub-catchment of Wongawilli Creek, and a Lake Avon sub-catchment.

The hydrologic evidence indicates that the mining of Longwall 10 produced negligible hydrologic impact on the overall catchment recessional and baseflow behaviour and associated water balances of Wongawilli Creek, Donalds Castle Creek and the non-mined under Lake Avon sub-catchment denoted LA4. It is concluded that observed hydrologic impacts on surface water hydrology of two local catchments which report to Cordeaux River and one catchment which reports to Lake Avon, which have been mined-under by Longwall 10, were consistent with the nature of predicted maximum impacts as set out in the DA3B SMP.

Shallow groundwater heads in piezometers in Swamps 1a and 5, lying within the Upper Donalds Castle Creek Catchment, were seen to reach levels lower than those which were observed during the pre-mining baseline period for piezometers which were directly undermined by Longwall 10. Rates of recession of groundwater levels in these piezometers were shown to increase significantly following being mined beneath. There was no piezometer mined under by Longwall 10 in Swamp 8.

Shallow groundwater level data are consistent with the Swamp TARP (December 2013) Level 2 for Swamps 1a, 1b and 5 as a result of both Longwall 9 and 10 extraction.

It was concluded that there was no evidence from the hydrologic performances of the Upper Donalds Castle Creek and the Greater Wongawilli catchments or the DC13 and WC21 sub-catchments that the observed impacts on shallow groundwater levels in the installed piezometers in swamps 1a, 1b, 5 and 8 had adversely affected the overall hydrology.

It is concluded that; the observed impacts on surface water quality, shallow groundwater levels, and catchment hydrologic performances due to the mining of Longwall 10 have been consistent with the nature of predicted impacts set out in the DA3B SMP (BHP Billiton, 2012b).

6.6. Groundwater

The hydrogeological analysis has been based primarily on an examination of spatial and temporal responses measured in downhole vibrating wire piezometers, and comparison of observed groundwater head drawdowns with those anticipated by numerical groundwater modelling. In addition, the measured groundwater make in the mine has been compared to the flows anticipated by the numerical model. Variations in groundwater salinity have also been examined in several geological formations.

Modelled Area 3A plus Area 3B inflows between the commencement of Longwall 6 and the end of Longwall 9 were similar to but generally higher than observed inflows, by around 0.5 ML/d on average. The performance of the model is similar during Longwall 10, with combined Area 3A and 3B inflow being about 0.5-1.5 ML/d lower than predicted, with the average difference being 1 ML/d. The difference between the modelled and observed inflow during this time is due to differences in Area 3A. During the extraction of Longwall 10, recorded inflow to Area 3B has agreed well with modelled or predicted inflow (average inflow for that period within 5% of predicted).

Based on field electrical conductivity (EC) measurements, there is no clear spatial pattern in the distribution of groundwater quality in Hawkesbury Sandstone and Bulgo Sandstone bores. There is however a clear increase in salinity with depth from the Hawkesbury Sandstone to the Bulgo Sandstone and down to the goaf waters drawn from coal and from the overlying coal measure formations.

As expected, the lowest Wongawilli Seam heads occurred in the vicinity of Longwall 10 during the completion of Longwall 10, however depressurisation around Longwall 10 was largely complete prior to mining due to the earlier mining of Longwall 9, completion of development headings and Area 3A extraction. Additional head reduction in the Bulli Seam in Area 3B during Longwall 10 excavation was of a similar order to that in the Wongawilli Seam (typically 10-20 m).

The Scarborough Sandstone experienced some of the largest observed drawdowns in Area 3B during Longwall 10 mining (up to 32 m). This is considered to be due to subsidence, caving and fracturing above Longwall 10 and Longwall 9. These drawdowns are restricted to the north and centre of Area 3B, with little drawdown to the west and east.

The peak incremental drawdown during Longwall 10 in the Bulgo Sandstone and Scarborough Sandstone was about 30 m, with the cone of depression being more extensive in the deeper Scarborough Sandstone. Actual drawdown in the Bulgo Sandstone during Longwall 10 has been less than the predicted (modelled) drawdown in the Bulgo Sandstone.

Bulgo Sandstone heads on the western side of Sandy Creek (adjacent to Area 2) have been reducing steadily since 2011, and in recent times some of these have fallen below the Cordeaux Reservoir water level. Based on the criteria set in the *Avon and Cordeaux Reservoirs Management Plans* for Dendrobium Mine, TARP Level 2 has been reached in four bores monitoring the Bulgo Sandstone near to where Sandy Creek flows into Lake Cordeaux. Further monitoring and some additional actions regarding data capture and review have been recommended.

There was an increased drawdown observed in the lower Hawkesbury Sandstone in the area immediately south of Longwall 10 in Area 3B during the mining of Longwall 10 (up to 16 m additional drawdown) and about 10 m above Longwalls 9 and 10. Elsewhere in this unit the incremental drawdown was typically 2 m or less, and a recovery of about 2 m was observed in bores on the western side of Sandy Creek in Area 3A. The observed drawdown in the lower Hawkesbury Sandstone in Area 3B and due to the extraction of Longwall 10 is less than the predicted (modelled) drawdown.

The existing groundwater model predictions have been compared with observed drawdown and mine inflow for the Longwall 10 extraction period. The model predicted inflows, especially to Area 3B, with good accuracy, while groundwater drawdown is usually over-estimated by the model. Based on the requirements and requests of various agencies, e.g. DSC and DP&E, the groundwater model is proposed for updating in mid-2015, as per the *Groundwater Monitoring and Modelling Plan* for Dendrobium (HydroSimulations, 2015).

For further detail on the assessment of groundwater, refer to Attachment E.

Table 6: Summary of Predicted and Observed Groundwater Impacts

Predicted Impact	Observed Impact
Large drawdowns (about 60 m) were expected in the Wongawilli Seam after Longwall 10 in the western parts of Longwall 10 of Area 3B. Lesser reductions in head were expected in the Wongawilli Seam around the main roadways due to substantial depressurisation having already occurred in these areas. Drawdowns of 10-30 m were expected in the south-western parts of Area 3B.	Large reductions in head of 20-30 m were observed in the middle and western parts of Area 3B in the Wongawilli Seam during Longwall 10. Small drawdowns (1-5 m) were observed in the north-eastern part of Area 3B during Longwall 10, due to earlier extraction of, and depressurisation associated with, Area 3A and Longwall 9. In other parts of Area 3B 5-15 m of drawdown was observed in the Wongawilli Seam. In the south-western parts of Area 3B, observed drawdown reached as much as 15-30 m (in piezometers S2194, S1932, S2001 and S1911), similar to expected.
Little further drawdown in deeper formations in Area 3A was expected, as heads there should have stabilised since mining of Longwalls 6, 7 and 8. Minor drawdown (up to 5 m) could occur in the Bulgo Sandstone over Area 3A, with less than 5 m drawdown in the deeper, more depressurised strata.	Less than 2 m drawdown was generally observed in the Wongawilli Seam in Area 3A and also the western part exhibited about 1-2 m of recovery during Longwall 10, whilst the available data for the Bulli Seam suggests up to 5 m drawdown. In the Scarborough Sandstone, observed Area 3A drawdowns reached 9 m at one piezometer (S1870), whilst all other piezometers exhibited up to 5 m drawdown. In the Bulgo Sandstone drawdowns to 5 m were observed.
Large drawdowns of about 100 m, focused over the mined panel, were predicted to occur in the Bulli Seam during the extraction of Longwall 10.	During Longwall 10, observed drawdowns in Bulli Seam were up to 10 m. This is significantly less than predicted, and is possibly due to greater depressurisation before Longwall 10 (and Longwall 9) commenced.
Large drawdowns of 60-80 m were predicted for the Scarborough Sandstone during the mining of Longwall10. Further south of Longwall 11 drawdown was expected to be around 10-40 m.	Near to Longwall 10 observed drawdown within the Scarborough Sandstone was up to 20 m. Observed drawdown generally ranged from 5-20 m further to the south of Longwall 11.
Drawdowns of more than 40-45 m were predicted in the Bulgo Sandstone over the western half of Longwall10, and 35-45 m drawdown was expected in the eastern half of Longwall10. Drawdown was expected to decline to 25 m over a short distance to the south (above Longwall 11). Drawdown magnitude was predicted to decline to less than 10 m further to the south.	The observed drawdown in the Bulgo Sandstone during the mining of Longwall 10 was about 20-25 m above the eastern half of Longwall 10 and 15-20 m above the western half. Further to the south of Longwall 11, the drawdown observed was generally in the range 0-15 m.
Modelled drawdowns in the lower Hawkesbury Sandstone above Longwall 10 was in the range10-26 m.	In the lower Hawkesbury Sandstone, observed drawdowns ranged from 8-14 m over Longwall 10 in Area 3B, increasing in a southerly direction across the longwall.

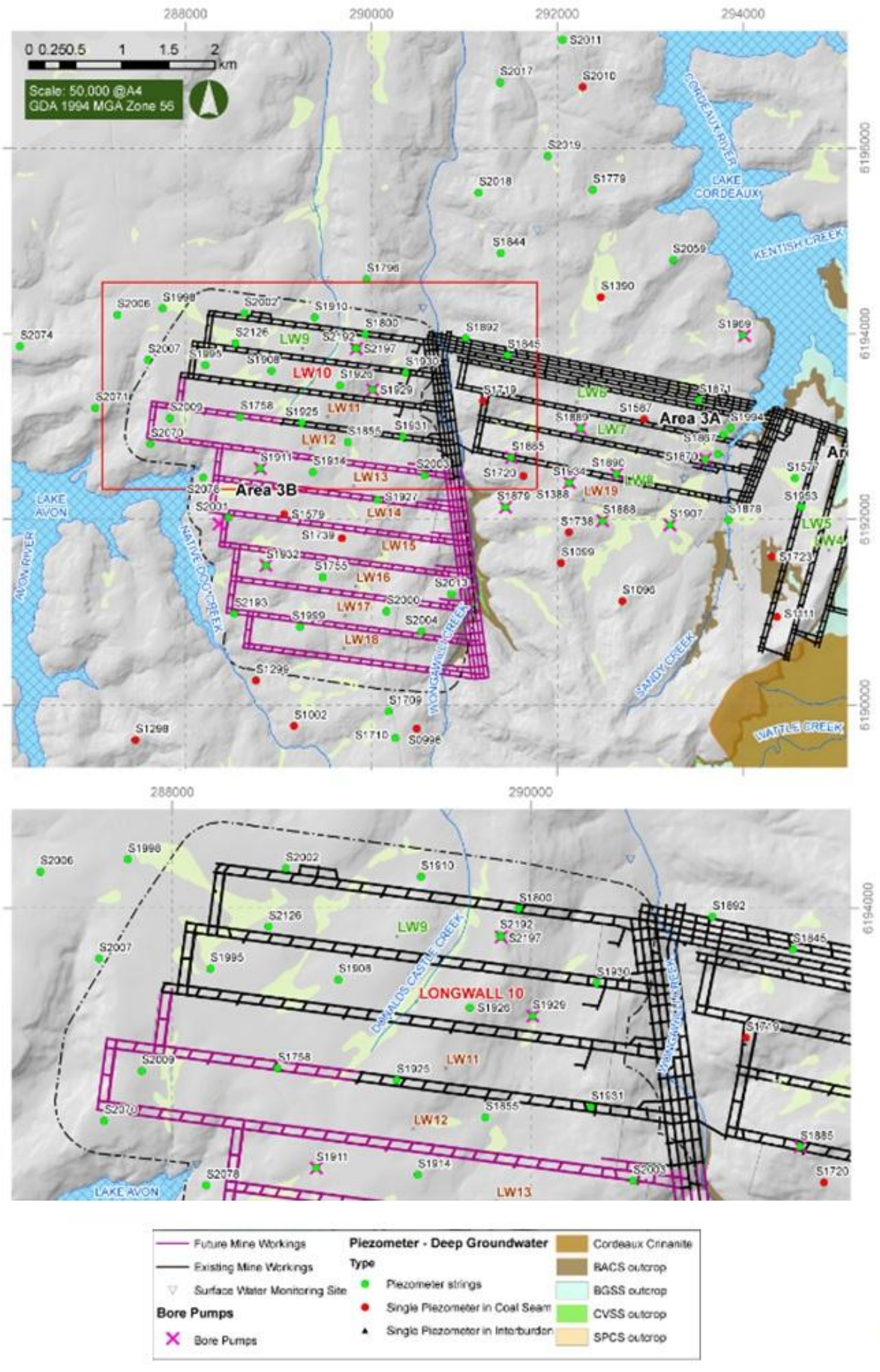

Figure 7: Location of Deep Groundwater Monitoring Sites

6.7. Aquatic Ecology

Cardno Ecology Lab was commissioned by BHPBIC to develop and conduct a monitoring program designed to detect potential impacts on aquatic ecology due to mining-related subsidence. The monitoring program is based on a Before, After, Control, Impact (BACI) design that provides a measure of natural spatial and temporal variability in key aquatic ecology indicators at Potential Impact and Control Sites before, during and after coal extraction. This enables changes in the key indicators associated with mining-related impacts to be distinguished from those due to natural variability. The full report is provided as Attachment F.

However, there was no evidence in macroinvertebrate and fish data of any impacts to the aquatic ecology at Site 6 on WC21 or Site 14 on Donalds Castle Creek. Both these sites are downstream of the physical mining impacts observed in WC21 and Donalds Castle Creek by the ICEFT. Thus, if any impacts to aquatic ecology did occur further upstream in these drainage lines (e.g., loss of aquatic habitat due to flow diversions) they appear to have been localised to these directly affected areas. As is with the case with impacts to the aquatic ecology of DA3A drainage lines, such impacts would be relatively minor in the context of the Sydney Catchment Area.

6.8. Terrestrial Ecology

A terrestrial flora and fauna monitoring program is in place for Dendrobium Area 2 3, 3A and 3B. The attached report by Biosis (2015) found in Attachment G assesses post-mining conditions of terrestrial ecology within the area of influence for Longwall 10.

The monitoring conducted is a BACI experimental design which caters for comparison of before and after mining (Before-After) and comparing this to control sites that have not been mined beneath (Control-Impact).

Following mining of Longwalls 9 and 10, the landscape monitoring program and ecological monitoring program detected a drop in pool water levels at several locations along Donalds Castle Creek, DC1 and WC21 where Littlejohn's Tree Frog has been recorded and is monitored. A Level 1 Trigger was activated under the WIMMCP (June 2014) TARPs in DC13, specifically:

- Reduction in habitat for 1 season

6.8.1. Endangered Ecological Communities

The predicted and observed impacts on Endangered Ecological Communities and threatened species (and their habitats) resulting from DA3B is provided in Table 7. The table focuses on the three main ecological values that were the subject of the assessment undertaken by Niche (2012) for the development of DA3B.

Table 7: Predicted and Observed Impacts to Terrestrial Ecology

Terrestrial Ecology Feature	Monitoring	Predicted Impacts	Observed Impacts	Trigger Level Reached	Within Prediction
Swamp Impact Monitoring, Management and Contingency Plan TARP, June 2014					
Threatened Ecological Communities – Coastal Upland Swamp	Observational, Photo Point And Water Monitoring – completed by the Illawarra Coal Environmental Field Team	Fracturing of rockbars and the bedrock base of pools resulting in loss of pool water level and/or surface flow within the swamp.	Biosis incidentally observed several holes were located north of flora monitoring point S5-V3 in Swamp 5, while slumping of a section of swamp was located at another location in the swamp. Similar holes and dieback were observed in the pre-impact swamp, Swamp 11.	Data is consistent with a **Level 1** Trigger (SIMMCP) at Swamp 5. The following actions are required: • Continue monitoring program. • Submit an Impact Report to OEH, DoPI, DPI, SCA and other relevant resource managers. • Report in the End of Panel Report. • Summarise actions and monitoring in AEMR. • Provide environmental offset as required by Conditions 6 and 7 of the SMP Approval for the predicted impacts.	Yes
Threatened Ecological Communities – Coastal Upland Swamp	Terrestrial Flora – Composition and Distribution of Species in Swamp 1A, Swamp 1B, Swamp 5 and Swamp 11	No significant change to the composition or distribution of species within the swamps.	To date, no statistically significant change in species composition, richness and distribution has been detected at impact sites monitored following the extraction of Longwall 10.	None	Yes
Threatened Ecological Communities – Coastal Upland Swamp	Terrestrial Flora – Ecosystem Function	Minor changes in the ecosystem functionality of the swamps.	It is too early to detect change in Ecosystem Function using LiDAR and ground-truthing. It is recommended that this monitoring technique be repeated five years following a change detected in groundwater at Coastal Upland Swamp monitoring sites.	None – too early to detect change	Yes
Threatened Ecological Communities – Coastal Upland Swamp	Terrestrial Flora – Swamp Size	Minor changes in the size of the swamps.	It is too early to detect change in Ecosystem Function using LiDAR and ground-truthing. It is recommended that this monitoring technique be repeated five years following a change detected in	None – too early to detect change	Yes

			groundwater at Coastal Upland Swamp monitoring sites.		
Watercourse Impact Monitoring, Management and Contingency Plan TARP					
Threatened Fauna – Threatened Frog Species	Applicable to Longwall 9 and Longwall 10, monitoring of suitable habitat within: • Wongawllli Creek catchment – WC21 • Donalds Castle Creek catchment – Donalds Castle Creek and DC13	Terrestrial flora and fauna are likely to be impacted where subsidence modifies water flow, pool retention time and/or water quality along Wongawilli Creek and its tributaries, Donalds Castle Creek and drainage lines (Table 11.1 SMP Vol 1). Significant impact on local populations of Littlejohn's tree Frog, Giant Burrowing Frog and Red-crowned Toadlet is likely (WIMMCP, p. 92).	Baseline monitoring of suitable habitat has determined the presence of Littlejohn's Tree Frog in waterways Donalds Castle Creek, DC13 and WC21. Following mining of Longwall 10 declines in water levels in the pools listed below were observed: <u>Donalds Castle Creek (detected 2014)</u>: • DC(1)-P31 • DC(1)-P32 • DC(1)-P33 • DC(1)-P34 • DC(1)-P35 <u>DC13 (detected 2013 and 2014)</u>: • DC13-P19 • DC13-P20 • DC13-P21 <u>WC21 (detected 2014)</u>: • WC21-P16 • WC21-17 In addition, decline in abundance of Littlejohn's Tree Frog has been observed in Donalds Castle Creek, DC13 and WC21 following declines in water levels in the pools listed above.	A Level 1 Trigger "*reduction in habitat for one season*" under the WIMMCP dated 04/06/2014 would be activated following the second monitoring event recording habitat reduction. That is, one full year of the habitat reduction being recorded. Therefore, data is consistent with a **Level 1** Trigger (WIMMCP) at DC13. The following actions are required: • Continue monitoring program. • Submit an Impact Report to OEH, DoPI, DPI, SCA and other relevant resource managers. • Report in the End of Panel Report. • Summarise actions and monitoring in AEMR.	Yes

6.9. Cultural Heritage

The assessment of cultural heritage and archaeological sites potentially impacted by Longwall 10 was conducted by Biosis. Two shelters with deposit were inspected as part of the assessment. Figure 8 illustrates the location of monitored sites. These sites were inspected because they were within the zone of possible subsidence associated with Longwall 10. There were no European heritage sites identified as being potentially affected by the extraction of Longwall 10.

The full report by Biosis is provided as Attachment H, and a summary is provided below. The results of the inspection are provided below in Table 8 and compared with predictions in Table 9.

Table 8: Aboriginal Archaeological Sites in Relation to Longwall 10

AHIMS Number	Site Name	Site Type	Changes observed
52-2-2208	Dendrobium 1	Shelter with Deposit	No changes since the minor expansion during Longwall 9
52-2-3878	DM2	Shelter with Deposit	No Changes observed

Table 9: Summary of Predicted Versus Observed Impacts

Site	Predicted Impacts	Observed Impacts
52-2-2208	Possible fracturing and shear movement of strata and rock falls. Impacts to heritage values are unlikely as the shelter has a volume larger than 50 cubic metres and maximum predicted subsidence of greater than 300mm. Overall risk of impact is low	No observed impacts since the minor expansion and extension of vertical cracking in horizontal bedding plane during Longwall 9 extraction
52-2-3878	Possible fracturing and shear movement of strata and rock falls. Impacts to heritage values are unlikely as the shelter has a volume larger than 50 cubic metres and maximum predicted subsidence of greater than 300mm. Overall risk of impact is low	No observed impacts

Figure 8: Location of Archaeological Sites Monitored following Longwall 10 Extraction

7. Longwall 10 Monitoring Program

A Comprehensive monitoring program for Longwall 10 is in place as required by the DA3B SMP Approval. The monitoring commitments outlined in the SMP (and as amended by applicable management plan) is shown in Table 10.

Table 10: Monitoring Associated with Longwall 10

Aspect	Monitored Sites Associated with Longwall 10	Monitoring Frequency	Recommended Future Monitoring
Watercourses	**Observational, Photo Point and Water Monitoring**		
	• Wongawilli Creek • Donalds Castle Creeks • WC21 • DC13 • LA5 • Swamps 1a, 1b, 3, 5 and 8	• SLMMP Sites: pre and post mining, monthly when longwall is within 400m of monitoring site • Monthly 2 years pre and post mining, weekly when longwall is within 400m of monitoring site	• Wongawilli Creek – Continue as required • Donalds Castle Creek – Continue as required • WC21 – Continue as required with additional upstream sites • DC13 – Continue as required • Swamps 5, 1a, 1b and 8 – Continue as required • LA5 – Continue as required • Swamp 3 – Target sites within the subsidence zone of Longwall 11
	Water Quality		
	• WWU1 (Wongawilli Creek headwaters) • WWU4 (Wongawilli Creek upstream) • WC Pool 49 (Wongawilli Creek adjacent to LW15) • WWM1 (Wongawilli Creek adjacent to LW12) • WWM2 (Wongawilli Creek adjacent to LW11) • WWM3 (Wongawilli Creek downstream of LW9) • WWL2 (Wongawilli Creek downstream) • WC21S1 (Wongawilli Creek tributary downstream of mining) • WC21 Pools 30 (Wongawilli Creek tributaries over mining) • WC15S1 (Wongawilli Creek tributary downstream of mining) **Lake Avon** • LA4_S1, LA4_S2, LA5_S1, LA5_S2 **Donalds Castle Creek:** • DCU3 (Donalds Castle Creek lower) • DCL3 (Donalds Castle Creek @ Cordeaux River) • DCS2 (Donalds Castle Creek downstream of mining) • DC13S1 (Donalds Castle Creek tributary downstream of mining)	• Monthly monitoring during and post mining for two years or until required	• Continue water quality sample sites as required by the SMP
Swamps	**Observational, Photo Point and Water Monitoring**		
	Swamps 01a, 01b,03, 05 and 08	• SLMMP sites: pre and post mining, monthly when longwall is within 400m of monitoring site • Other sites: monthly 2 years pre and	• Swamps 1a, 1b, 3, 4, 5, 8 and 10 – Continue as required by the SMP

		post mining, weekly when longwall is within 400m of monitoring site	
	Shallow Groundwater Level		
	• Swamp 01A: 01a_01, 01a_02, 01a_03, 01a_04, 01a_04i, 01a_04ii, 01a_04iii, 01a_04iv, 01a_04v • Swamp 01B: 01b_01, 01b_02, 01b_02i, 01b_02ii, 01b_02iii, 01b_02iv, 01b_03 • Swamp 3: 03_01. • Swamp 05: 05_01, 05_02, 05_03, 05_03i, 05_03ii, 05_03iii, 05_04, 05_05, 05_06 • Swamp 08: 08_01, 08_02, 08_03, 08_04, 08_05, 08_06 • Swamp 10: 10_01	**For open hole sites:** • Monthly baseline monitoring • Weekly monitoring during active subsidence • Monthly monitoring post mining for two years to be reviewed annually **For instrumented sites:** • Automatic groundwater level monitoring (4 hour interval or similar) • Monitoring post mining for five years to be reviewed annually	• Swamp 01a: 01a_01, 01a_02, 01a_03, 01a_04, 01a_04i, 01a_04ii, 01a_04iii, 01a_04iv, 01a_04v - Continue as required • Swamp 01b: 01b_01, 01b_02, 01b_02i, 01b_02ii, 01b_02iii, 01b_02iv, 01b_03 - Continue as required • Swamp 05: 05_01, 05_02, 05_03, 05_03i, 05_03ii, 05_03iii, 05_04, 05_05, 05_06 - Continue as required • Swamp 08: 08_01, 08_02, 08_03, 08_04, 08_05, 08_06 - Continue as required • Swamp 10: 10_01 - Continue as required • Swamp 03: 03_01 - Continue as required
	Soil Moisture		
	• Swamp 01A: S01a_S01, S01a_S02, S01a_S03, S01a_S04, S01a_S04i, S01a_S04ii, S01a_S04iii, S01a_S04iv • Swamp 01B: S01b_S01, S01b_S02, S01b_S02i, S01b_S02ii, S01b_S02iii, S01b_S02iv, S01b_S03, S01b_S04 • Swamp 05: S05_S01, S05_S02, S05_S03, S05_S03i, S05_S03ii, S05_S03iii, S05_S04, S05_S05, S05_S08 • Swamp 08: S08_S01, S08_S02, S08_S03, S08_S04, S08_S05, S08_S06	• 6 monthly baseline and reference site monitoring • Weekly monitoring when longwall is within 400m of swamp • 6 monthly monitoring for 2 years post mining	• Remove surface soil moisture and pH, see SIMMCP for further detail • Deep soil moisture as required by latest SIMMCP at the following sites: **Impact Sites:** • Swamp 03: (thin soil profile) • Swamp 04: (thin soil profile) • Swamp 05: S05_S01, S05_S02, S05_S05, S05_S08 • Swamp 08: S08_S05 • Swamp 11: S11_S01, S11_S02, S11_S05 • Swamp 13: S13_S01, S13_S02, S13_S03 • Swamp 14: 14_01, 14_02 • Swamp 23: 23_01, 23_02 • Swamp 35A: 35a_01 • Swamp 35B: 35b_01 Refer to Figures 2-2 to 2-11 **Reference Sites:** • Swamp 2: S02_S01 • Swamp 7: S07_S05, S07_S06 • Swamp 15A: S15a_S01, S15a_Piezo, S15a_S04, S15a_S06 • Swamp 22: 22_01, 22_02 • Swamp 24: S24_S01 • Swamp 25: S25_S01 • Swamp 33: S033_S01, S033_S03 • Swamp 84: S84_S02 • Swamp 85: S85_S01, S85_S02 • Swamp 86: S86_S01, S86_S02 • Swamp 87: S87_S01, S87_S02 • Swamp 88: S88_S01, S88_S02
Landscape	**Targeted Sites**		
	Cliffs No clifflines associated with Longwall 10 **Fire Trails** Fire Road No.6A (across LWs 10-18)	• Baseline monitoring campaign prior to mining • Monthly monitoring during any subsidence period • Monitoring to continue 6 monthly for 2 years following the completion of mining	**Cliffs** No clifflines associated with Longwall 11 **Fire Trails** Fire Road No.6A (across LWs 10-18) - Continue as required by the SMP

	Inspection of Active Mining Area – Landscape Features, Vegetation, Watercourses		
	All mapped cliff, steep slopes, watercourse, swamp and fire trail sites in subsidence area	• Weekly monitoring when longwall extraction is within 400m of feature	Continue monitoring of all mapped cliffs, steep slopes, watercourse, swamp and fire trail sites in subsidence area
	General observation of active mining areas		Continue general observation of active mining areas

8. Management of Impacts and Remediation

The DA3B SMP outlines features that may require preventative, mitigative, and/or remedial measures as mining occurs. Management and rehabilitation of features are considered in respective management plans (SIMMCP and WIMMCP).

8.1. Trigger Action Response Plans

The TARPs for Dendrobium Area 3B are provided in the following tables. Table 11 provides the TARP for landscape features (including cultural heritage), the effect of Longwall 10 and any subsequent actions. Table 12 and Table 13 provide SIMMCP and WIMMCP TARPs respectively.

8.2. Remediation

No remedial measures have been required to date as a result of Longwall 10 extraction. Where impacts have occurred, these have been within prediction. Ongoing monitoring and assessments will confirm whether or not remediation works will be required. Sites within Area 3B have been identified for research into swamp rehabilitation, these proposed sites and techniques have been submitted to DP&E.

Table 11: Dendrobium Area 3B Landscape TARP

Monitoring	Trigger	Action
LANDSCAPE FEATURES		
AREA 2 **Cliffs** A2-CL1 (above LW4) **Steep Slopes** A2-SL1 and A2-SL2 (above LWs 4 & 5) **Watercourses** A2-WC10 and A2-WC11 (above LW3) A2-WC13 & A2-WC16 (above LWs 4 & 5) **Swamp** A2-SW1 (above LWs 4 & 5) **4WD Track** A2-FT1 (above LWs 4 & 5) **Crinanite Surface Extent** A2-CN1 & A2-CN2 (above LWs 3 & 4) **AREA 3A** **Cliffs** All mapped cliff sites in subsidence area (Refer to Dendrobium Area 3A SMP Figures 19.3 for location of sites) **Steep Slopes** All mapped steep slopes in subsidence area *Refer to Dendrobium Area 3A SMP Figures 19.3 for location of sites* **Watercourses/ Swamps** All mapped watercourse and swamps in subsidence area *Refer to Dendrobium Area 3A SMP Figure 19.3* **Fire Trails** All mapped fire trails in subsidence area *Refer to Dendrobium Area 3A SMP Figure 19.3* **AREA 3B**	***Level 1*** * • Rock fall from a cliff which is left mostly intact (<10% length), resulting in insignificant ground disturbance • Surface movement or rock displacement with negligible soil surface exposed • Crack at the surface, which should not result in any significant erosion or further ground movement • Crack in a fire trail which should not result in erosion or impede access • Crack or fracture up to 100mm width • Crack or fracture up to 10m length • Erosion in a localised area which would be expected to naturally stabilise without CMA and within the period of monitoring	• Continue monitoring program • Report impacts to key stakeholders • Summarise impacts and Report in the End of Panel Report and AEMR
	Level 2 * • Rock fall or overhang collapse at a cliff site, where characteristics of the cliff have changed, and there has been significant ground disturbance • Surface movement or rock displacement that has exposed significant areas of soil • A crack at the surface, which could result in significant erosion or movement at the surface • A crack at the surface with potential risk to safety and/or fauna entrapment • A crack in the fire trail, which could result in significant erosion or impede vehicle access • Crack or fracture between 100 and 300mm width • Crack or fracture between 10 and 50m length • Significant erosion at any location, which is not likely to naturally stabilise within the period of monitoring, or is located in a sensitive area e.g. swamps, creek, lake shore, and may result in increased sediment transport to Cordeaux Dam, or has been previously identified as Level 1, but is not likely to naturally stabilise within the monitoring period	• *Actions as stated for Level 1* • Review monitoring frequency • Notify relevant technical specialists and seek advice on any CMA required • Provide safety signage and barricades as appropriate • Implement approved repairs to ensure safety and serviceability on fire trails • Implement agreed CMAs as approved *Note: CMAs are to be proposed based on appropriate management of environmental and other consequences of impacts i.e. cracking at the surface with insignificant consequences may not require specific CMAs other than ongoing monitoring to confirm there are no ongoing impacts*

Monitoring	Trigger	Action
Cliffs All mapped cliff sites in subsidence area *Refer to Dendrobium Area 3B SMP Figures 18.1 for location of sites*	***Level 3 **** • Major cliff collapse where the characteristics of the cliff change significantly and there is significant ground disturbance that is unlikely to naturally stabilise within the monitoring period • Crack or fracture over 300mm width • Crack or fracture over 50m length • Mass movement of a slope causing large areas of exposed soil with potential for further movement	• *Actions as stated for Level 2* • Immediately notify DoPI, DPIM, SCA, resource managers and relevant technical specialists and seek advice on any CMA required • Site visits with stakeholders if required • Review monitoring program and modify if necessary within 1 month • Implement increased monitoring if required within 2 weeks • Develop site CMA in consultation with key stakeholders within 1 month, (pending stakeholder availability) and seek approvals • Completion of works following approvals • Issue CMA report within 1 month of works completion • Conduct initial follow up monitoring & reporting within 2 months of CMA completion • Review the relevant TARP and Management Plan in consultation with key stakeholders *Note: CMAs are to be proposed based on appropriate management of environmental and other consequences of impacts i.e. cracking at the surface with insignificant consequences may not require specific CMAs other than ongoing monitoring to confirm there are no ongoing impacts*
Sandy Creek Waterfall	***Exceeding Prediction*** • Rock fall at Sandy Creek Waterfall or from its overhang • Structural integrity of the waterfall, its overhang and its pool are impacted • More than negligible cracking within 30 m of the waterfall • More than negligible diversion of water from the lip of the waterfall	• Actions as stated for Level 3 • Investigate reasons for the exceedance • Update future predictions based on the outcomes of the investigation
TERRESTRIAL FLORA AND FAUNA		
A number of sites located across and around Areas 2, 3A and 3B *Refer Dendrobium Area 3A SMP Figure 21.1, 21.2 and 21.3 and Dendrobium Area 3B Figure 20.1 for location of sites* General observation of active mining areas	***Level 1 **** • Vegetation impacted by mining (by rockfalls, soil slippage, gas emissions) that is likely to naturally regenerate within the monitoring period	• Continue monitoring program • Report impacts to key stakeholders • Summarise impacts and Report in the End of Panel Report and AEMR
	Level 2 * • Vegetation impacted by mining (by rockfalls, soil slippage, gas emissions) that is unlikely to naturally regenerate within the monitoring period • Statistically significant difference between Before After Control Impact sites as a result of mining	• Actions as stated for Level 1 • Review monitoring frequency • Notify relevant technical specialists and seek advice on any CMA required • Implement agreed CMAs as approved

Monitoring	Trigger	Action
	Level 3 * • Vegetation impacted by mining that is not responding to CMAs	• Actions as stated for Level 2 • Immediately notify OEH, DoPI, DPI, SCA, other resource managers and relevant technical specialists and seek advice on any CMA required • Site visits with stakeholders if required • Review monitoring program and modify if necessary within 1 month • Implement increased monitoring if required within 2 weeks • Develop site CMA in consultation with key stakeholders within 1 month, (pending stakeholder availability) and seek approvals • Completion of works following approvals • Issue CMA report within 1 month of works completion • Conduct initial follow up monitoring & reporting within 2 months of CMA completion • Review the relevant TARP and Management Plan in consultation with key stakeholders

Table 12: Dendrobium Area 3B Swamp TARP

Monitoring	Trigger	Action
OBSERVATIONAL, PHOTO POINT AND WATER MONITORING		
Swamps 01A, 01B, 03, 04, 05, 08, 10, 11, 13, 14, 23, 35A and 35B General observation of swamps in active mining areas when longwall is within 400m of swamp	***Level 1 **** • Crack or fracture up to 100mm width at its widest point with no observable loss of surface water or erosion • Crack or fracture up to 10m length with no observable loss of surface water or erosion • Erosion in a localised area (not associated with cracking or fracturing) which would be expected to naturally stabilise without CMA and within the period of monitoring	• Continue monitoring program • Submit an Impact Report to OEH, DoPI, DPI, SCA and other relevant resource managers • Report in the End of Panel Report • Summarise actions and monitoring in AEMR • Provide environmental offset as required by Conditions 6 and 7 of the SMP Approval for the predicted impacts
	Level 2 * • Crack or fracture between 100 and 300mm width at its widest point or any fracture which results in observable loss of surface water from the swamp or erosion • Crack or fracture between 10 and 50m length • Soil surface crack that causes erosion that is likely to stabilise within the monitoring period without intervention • Gully knickpoint forms or an existing gully knickpoint becomes active	• *Actions as stated for Level 1* • Review monitoring frequency • Notify relevant technical specialists and seek advice on any CMA required • Implement agreed CMAs as approved (subject to stakeholder feedback)

	Level 3 * • Crack or fracture over 300mm width at its widest point • Crack or fracture over 50m length • Fracturing observed in the bedrock base of any significant permanent pool which results in observable loss of surface water from the swamp • Soil surface crack that causes erosion that is unlikely to stabilise within the monitoring period without intervention • The structural integrity of the controlling rockbar of a swamp is impacted which results in observable loss of surface water from the swamp	• *Actions as stated for Level 2* • Site visit with OEH, DoPI, DPI, SCA and other resource manager/s (if requested) • Implement additional monitoring or increase frequency if required • Develop site CMA (subject to stakeholder feedback). This may include: grouting of rockbar and bedrock base of any significant pool where it is appropriate to do so in consultation with OEH, DoPI, DPI, SCA and other stakeholders • Completion of works following approvals and at a time agreed between BHPBIC, DoPI, DPI and SCA (i.e. may be after mining induced movements and impacts are complete), including monitoring and reporting on success • Review relevant TARP and Management Plan in consultation with key stakeholders
	Exceeding Prediction • Structural integrity of the bedrock base of any significant permanent pool or controlling rockbar cannot be restored i.e. pool water level within the swamp after CMAs continues to be lower than baseline period (measured after a rainfall recharge event)	• *Actions as stated for Level 3* • Investigate reasons for the exceedance • Update future predictions based on the outcomes of the investigation • Develop site CMA (subject to stakeholder feedback). This may include: installation of coir logs and water spreading where it is appropriate to do so in consultation with OEH, DoPI, DPI, SCA and other stakeholders • Provide residual environmental offset for any mining impact where CMAs are unsuccessful in accordance with Conditions 6 and 7 of the SMP Approval

Table 13: Dendrobium Area 3B Watercourse TARP

Monitoring	Trigger	Action
OBSERVATIONAL, PHOTO POINT AND WATER MONITORING		
Native Dog, Wongawilli and Donalds Castle Creeks, WC21, WC15, LA4, DC13, LA6, ND1, WC6, WC7, WC8, WC9, WC12, WC16 and WC18 General observation of streams in active mining areas when longwall is within 400m	***Level 1 **** • Crack or fracture up to 100mm width at its widest point with no observable loss of surface water or erosion • Crack or fracture up to 10m length with no observable loss of surface water or erosion • Erosion in a localised area (not associated with cracking or fracturing) which would be expected to naturally stabilise without CMA and within the period of monitoring • Observable release of strata gas at the surface • Observable increase in iron staining within the mining area	• Continue monitoring program • Submit an Impact Report to OEH, DoPI, DPI, SCA and other relevant resource managers • Report in the End of Panel Report • Summarise actions and monitoring in AEMR
	Level 2 * • Crack or fracture between 100 and 300mm width at its widest point or any fracture which results in observable loss of surface water or erosion	• *Actions as stated for Level 1* • Review monitoring frequency • Notify relevant technical specialists and seek advice on any CMA required

Monitoring	Trigger	Action
	• Crack or fracture between 10 and 50m length • Soil surface crack that causes erosion that is likely to stabilise within the monitoring period without intervention • Observable increase in iron staining within the mining area continues to outside the mining area i.e. 400m from the longwall	• Implement agreed CMAs as approved (subject to stakeholder feedback)
	Level 3 * • Crack or fracture over 300mm width at its widest point • Crack or fracture over 50m length • Fracturing observed in the bedrock base of any significant permanent pool which results in observable loss of surface water • Soil surface crack that causes erosion that is unlikely to stabilise within the monitoring period without intervention • Gas release results in vegetation dieback, mortality or loss of aquatic habitat	• *Actions as stated for Level 2* • Site visit with OEH, DoPI, DPI, SCA and other resource manager/s (if requested) • Implement additional monitoring or increase frequency if required • Develop site CMA (subject to stakeholder feedback). This may include: grouting of rockbar and bedrock base of any significant pool where it is appropriate to do so in consultation with OEH, DoPI, DPI, SCA and other stakeholders • Completion of works following approvals and at a time agreed between BHPBIC, DoPI, DPI and SCA (i.e. may be after mining induced movements and impacts are complete), including monitoring and reporting on success • Review relevant TARP and Management Plan in consultation with key stakeholders
	Exceeding Prediction • Structural integrity of the bedrock base of any significant pool or controlling rockbar cannot be restored i.e. pool water level within the pool after CMAs continues to be lower than baseline period • Gas release results in vegetation dieback that does not revegetate • Gas release results in mortality of threatened species or ongoing loss of aquatic habitat • Iron staining and associated increases in dissolved iron resulting from the mining is observed in water at Wongawilli Creek downstream monitoring site WWL2 • Iron staining and associated increases in dissolved iron resulting from the mining is observed in water at the Donalds Castle Creek downstream monitoring site DCU3 • Rock fall at WC-WF54 or its overhang • Impacts on the structural integrity of WC-WF54, its overhang or its pool	• *Actions as stated for Level 3* • Investigate reasons for the exceedance • Update future predictions based on the outcomes of the investigation • Provide residual environmental offset for any mining impact where CMAs are unsuccessful as required by Condition 14 Schedule 3 of the Development Consent
WATER QUALITY		

Monitoring	Trigger	Action
Wongawilli Creek Wongawilli Creek at Fire Road 6 (WWL2) Baseline means: • pH 5.98 • EC 98.8 uS/cm • DO 89.5%	***Level 1*** * • One exceedance of the ±3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean during the monitoring period: – pH 4.45 – EC 154.1 uS/cm – DO 50.5%	• Continue monitoring program • Submit an Impact Report to OEH, DoPI, DPI, SCA and other relevant resource managers • Report in the End of Panel Report • Summarise actions and monitoring in AEMR
	Level 2 * • Two exceedances of the ±3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean during the monitoring period: – pH 4.45 – EC 154.1 uS/cm – DO 50.5%	• *Actions as stated for Level 1* • Review monitoring frequency • Notify relevant technical specialists and seek advice on any CMA required • Implement agreed CMAs as approved (subject to stakeholder feedback)
	Level 3 * • Three exceedances of the ±3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean during the monitoring period: – pH 4.45 – EC 154.1 uS/cm – DO 50.5%	• *Actions as stated for Level 2* • Site visit with OEH, DoPI, DPI, SCA and other resource manager/s (if requested) • Implement additional monitoring or increase frequency if required • Review relevant TARP and Management Plan in consultation with key stakeholders • Develop site CMA (subject to stakeholder feedback). This may include: – Limestone emplacement to raise pH where it is appropriate to do so – Grouting of fractures in rockbar and bedrock base of any significant pool where flow diversion results in pool water level lower than baseline period • Completion of works following approvals and at a time agreed between BHPBIC, DoPI, DPI and SCA (i.e. may be after mining induced movements and impacts are complete), including monitoring and reporting on success
	Exceeding Prediction • Mining results in two conecutive exceedances of the ±3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean during the monitoring period: – pH 4.45 – EC 154.1 uS/cm – DO 50.5%	• *Actions as stated for Level 3* • Investigate reasons for the exceedance • Update future predictions based on the outcomes of the investigation • Provide residual environmental offset for any mining impact where CMAs are unsuccessful as required by Condition 14 Schedule 3 of the Development Consent

Monitoring	Trigger	Action
Donalds Castle Creek Donalds Castle Creek at Fire Road 6 (DCU3) Baseline means: • pH 5.41 • EC 116.0 uS/cm • DO 85.6%	***Level 1*** * • One exceedance of the ±3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean during the monitoring period: – pH 3.60 – EC 185.8 uS/cm – DO 40.1%	• Continue monitoring program • Submit an Impact Report to OEH, DoPI, DPI, SCA and other relevant resource managers • Report in the End of Panel Report • Summarise actions and monitoring in AEMR
	Level 2 * • Two exceedances of the ±3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean during the monitoring period: – pH 3.60 – EC 185.8 uS/cm – DO 40.1%	• *Actions as stated for Level 1* • Review monitoring frequency • Notify relevant technical specialists and seek advice on any CMA required • Implement agreed CMAs as approved (subject to stakeholder feedback)
	Level 3 * • Three exceedances of the ±3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean during the monitoring period: – pH 3.60 – EC 185.8 uS/cm – DO 40.1%	• *Actions as stated for Level 2* • Site visit with OEH, DoPI, DPI, SCA and other resource manager/s (if requested) • Implement additional monitoring or increase frequency if required • Review relevant TARP and Management Plan in consultation with key stakeholders • Collect laboratory samples and analyse for: – pH, EC, major cations, major anions, Total Fe, Mn & Al – Filterable suite of metals • Develop site CMA (subject to stakeholder feedback). This may include: – Limestone emplacement to raise pH where it is appropriate to do so – Grouting of fractures in rockbar and bedrock base of any significant pool where flow diversion results in pool water level lower than baseline period • Completion of works following approvals and at a time agreed between BHPBIC, DoPI, DPI and SCA (i.e. may be after mining induced movements and impacts are complete), including monitoring and reporting on success
	Exceeding Prediction • Mining results in two conecutive exceedances of the ±3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean during the monitoring period:	• *Actions as stated for Level 3* • Investigate reasons for the exceedance • Update future predictions based on the outcomes of the investigation • Provide residual environmental offset for any mining impact where CMAs

Monitoring	Trigger	Action
	– pH 3.60 – EC 185.8 uS/cm – DO 40.1%	are unsuccessful as required by Condition 14 Schedule 3 of the Development Consent
Lake Avon Lake Avon tributary (LA4_S1) Baseline means: • pH 5.50 • EC 91.8 uS/cm • DO 87.9% (to be updated with additional baseline data)	***Level 1*** * • One exceedance of the ±3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean during the monitoring period: – pH 5.16 – EC 134.7 uS/cm – DO 62.9%	• Continue monitoring program • Submit an Impact Report to OEH, DoPI, DPI, SCA and other relevant resource managers • Report in the End of Panel Report • Summarise actions and monitoring in AEMR
	Level 2 * • Two exceedances of the ±3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean during the monitoring period: – pH 5.16 – EC 134.7 uS/cm – DO 62.9%	• *Actions as stated for Level 1* • Review monitoring frequency • Notify relevant technical specialists and seek advice on any CMA required • Implement agreed CMAs as approved (subject to stakeholder feedback)
	Level 3 * • Three exceedances of the ±3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean during the monitoring period: – pH 5.16 – EC 134.7 uS/cm – DO 62.9%	• *Actions as stated for Level 2* • Site visit with OEH, DoPI, DPI, SCA and other resource manager/s (if requested) • Implement additional monitoring or increase frequency if required • Review relevant TARP and Management Plan in consultation with key stakeholders • Collect laboratory samples and analyse for: – pH, EC, major cations, major anions, Total Fe, Mn & Al – Filterable suite of metals • Develop site CMA (subject to stakeholder feedback). This may include: – Limestone emplacement to raise pH where it is appropriate to do so – Grouting of fractures in rockbar and bedrock base of any significant pool where flow diversion results in pool water level lower than baseline period • Completion of works following approvals and at a time agreed between BHPBIC, DoPI, DPI and SCA (i.e. may be after mining induced movements and impacts are complete), including monitoring and reporting on success

Monitoring	Trigger	Action
	Exceeding Prediction • Mining results in two conecutive exceedances of the ±3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean of the Lake Avon inflows during the monitoring period: – pH 5.16 – EC 134.7 uS/cm – DO 62.9%	• *Actions as stated for Level 3* • Investigate reasons for the exceedance • Update future predictions based on the outcomes of the investigation • Provide residual environmental offset for any mining impact where CMAs are unsuccessful as required by Condition 14 Schedule 3 of the Development Consent
POOL WATER LEVEL		
Mapped pools in the mining area: • Wongawilli Creek • Donalds Castle Creek	***Level 1*** * • Fracturing not resulting in diversion of flow	• Continue monitoring program • Submit an Impact Report to OEH, DoPI, DPI, SCA and other relevant resource managers • Report in the End of Panel Report • Summarise actions and monitoring in AEMR
	Level 2 * • Fracturing resulting in diversion of flow	• *Actions as stated for Level 1* • Review monitoring frequency • Notify relevant technical specialists and seek advice on any CMA required • Implement agreed CMAs as approved (subject to stakeholder feedback)
	Level 3 * • Fracturing resulting in diversion of flow such that <10% of the pools have water levels lower than baseline period	• *Actions as stated for Level 2* • Site visit with OEH, DoPI, DPI, SCA and other resource manager/s (if requested) • Implement additional monitoring or increase frequency if required • Review relevant TARP and Management Plan in consultation with key stakeholders • Develop site CMA (subject to stakeholder feedback). This may include: grouting of rockbar and bedrock base of any significant pool where it is appropriate to do so in consultation with OEH, DoPI, DPI, SCA and other stakeholders • Completion of works following approvals and at a time agreed between BHPBIC, DoPI, DPI and SCA (i.e. may be after mining induced movements and impacts are complete), including monitoring and reporting on success
	Exceeding Prediction • Fracturing resulting in diversion of flow such that >10% of the pools have water levels lower than baseline period	• *Actions as stated for Level 3* • Investigate reasons for the exceedance • Update future predictions based on the outcomes of the investigation • Provide residual environmental offset for any mining impact where CMAs

Monitoring	Trigger	Action
		are unsuccessful as required by Condition 14 Schedule 3 of the Development Consent
Waterfall WC-WF54	***Exceeding Prediction*** • Fracturing in Wongawilli Creek within 30m of the waterfall which results in observable flow diversion • Fracturing in Wongawilli Creek which results in observable flow diversion from the lip of the waterfall	• *Actions as stated for Level 3* • Investigate reasons for the exceedance • Update future predictions based on the outcomes of the investigation • Provide residual environmental offset for any mining impact where CMAs are unsuccessful as required by Condition 14 Schedule 3 of the Development Consent
MODELLED PERIODS OF RECESSIONAL, BASEFLOW AND SMALL STORM UNIT HYDROGRAPH PERIODS		
Subcatchments of Wongawilli and Donalds Castle Creeks and Lake Avon tributaries **	***Level 1 **** • Change 6-12% less than average annual precipitation ***	• Continue monitoring program • Submit an Impact Report to OEH, DoPI, DPI, SCA and other relevant resource managers • Report in the End of Panel Report • Summarise actions and monitoring in AEMR
	Level 2 * • Change 12-18% less than average annual precipitation ***	• *Actions as stated for Level 1* • Review monitoring frequency • Notify relevant technical specialists and seek advice on any CMA required • Implement agreed CMAs as approved (subject to stakeholder feedback)
	Level 3 * • Change >18% less than average annual precipitation ***	• *Actions as stated for Level 2* • Site visit with OEH, DoPI, DPI, SCA and other resource manager/s (if requested) • Implement additional monitoring or increase frequency if required • Develop site CMA (subject to stakeholder feedback). This may include: grouting of rockbar and bedrock base of any significant pool where it is appropriate to do so in consultation with OEH, DoPI, DPI, SCA and other stakeholders • Completion of works following approvals and at a time agreed between BHPBIC, DoPI, DPI and SCA (i.e. may be after mining induced movements and impacts are complete), including monitoring and reporting on success • Review relevant TARP and Management Plan in consultation with key stakeholders
Inflows to Lake Avon and Cordeaux River **	***Exceeding Prediction*** • Measured surface water flow reduction in Wongawilli Creek at its confluence with Cordeaux River that is greater than predicted by the groundwater model (to the satisfaction of the Director General - Condition 13 of the SMP) that cannot be attributed to	• *Actions as stated for Level 3* • Investigate reasons for the exceedance • Update future predictions based on the outcomes of the investigation • Provide residual environmental offset for any mining impact where CMAs

Monitoring	Trigger	Action
	natural variation • Surface water flow reduction into Lake Avon is greater than predicted by the groundwater model (to the satisfaction of the Director General - Condition 13 of the SMP) that cannot be attributed to natural variation	are unsuccessful as required by Condition 14 Schedule 3 of the Development Consent
AQUATIC ECOLOGY		
Pool water level, interconnectivity between pools and loss of connectivity, noticeable alteration of habitat • Wongawilli Creek catchment – 8 sites • Donalds Castle Creek catchment – 1 site	***Level 1 **** • Reduction in aquatic habitat for 1 season	• Continue monitoring program • Submit an Impact Report to OEH, DoPI, DPI, SCA and other relevant resource managers • Report in the End of Panel Report • Summarise actions and monitoring in AEMR
	Level 2 * • Reduction in aquatic habitat for 2 seasons following the active subsidence period	• *Actions as stated for Level 1* • Review monitoring frequency • Notify relevant technical specialists and seek advice on any CMA required • Implement agreed CMAs as approved (subject to stakeholder feedback)
	Level 3 * • Reduction in aquatic habitat for >2 seasons or complete loss of habitat following the active subsidence period	• *Actions as stated for Level 2* • Site visit with OEH, DoPI, DPI, SCA and other resource manager/s (if requested) • Implement additional monitoring or increase frequency if required • Review relevant TARP and Management Plan in consultation with key stakeholders • Develop site CMA (subject to stakeholder feedback). This may include: grouting of rockbar and bedrock base of any significant pool where it is appropriate to do so in consultation with OEH, DoPI, DPI, SCA and other stakeholders • Completion of works following approvals and at a time agreed between BHPBIC, DoPI, DPI and SCA (i.e. may be after mining induced movements and impacts are complete), including monitoring and reporting on success
TERRESTRIAL FAUNA – THREATENED FROG SPECIES		
Pool water level, interconnectivity between pools and loss of connectivity, noticeable alteration of habitat • Wongawilli Creek catchment – 2 sites • Donalds Castle Creek catchment – 2 sites • Lake Avon tributary – 1 site • Native Dog tributary – 1 site	***Level 1 **** • Reduction in habitat for 1 season	• Continue monitoring program • Submit an Impact Report to OEH, DoPI, DPI, SCA and other relevant resource managers • Report in the End of Panel Report • Summarise actions and monitoring in AEMR
	Level 2 * • Reduction in habitat for 2 seasons following the active	• *Actions as stated for Level 1* • Review monitoring frequency

Monitoring	Trigger	Action
	subsidence period	• Notify relevant technical specialists and seek advice on any CMA required • Implement agreed CMAs as approved (subject to stakeholder feedback)
	Level 3 * • Reduction in habitat for > 2 seasons or complete loss of habitat following the active subsidence period	• *Actions as stated for Level 2* • Site visit with OEH, DoPI, DPI, SCA and other resource manager/s (if requested) • Implement additional monitoring or increase frequency if required • Review relevant TARP and Management Plan in consultation with key stakeholders • Develop site CMA (subject to stakeholder feedback). This may include: grouting of rockbar and bedrock base of any significant pool where it is appropriate to do so in consultation with OEH, DoPI, DPI, SCA and other stakeholders • Completion of works following approvals and at a time agreed between BHPBIC, DoPI, DPI and SCA (i.e. may be after mining induced movements and impacts are complete), including monitoring and reporting on success