



**DENDROBIUM AREA 3B
LONGWALL 16 END OF PANEL
LANDSCAPE REPORT
DECEMBER 2020**



EXECUTIVE SUMMARY

This report summarises the observed and measured subsidence effects on landscape features resulting from the extraction of Dendrobium Area 3B (DA3B) Longwall 16.

Longwall 16 is the eighth panel extracted from DA3B. Extraction began on 26 February 2020 and was completed on 4 November 2020.

The Illawarra Metallurgical Coal Environmental Field Team (IMCEFT) conducts detailed monitoring and inspections of landscape features including swamps, watercourses, rock outcrops and the general area within DA3B. This monitoring was conducted in accordance with:

- Dendrobium Area 3B Subsidence Management Plan (SMP);
- Dendrobium Area 3B Watercourse Impact, Monitoring, Management and Contingency Plan (WIMMCP) (February 2020);
- Dendrobium Area 3B Swamp Impact, Monitoring, Management and Contingency Plan (SIMMCP) (February 2020); and
- Dendrobium Subsidence, Landscape Monitoring and Management Plan (SLMMP) (November 2012).

The Watercourse, Swamp and Landscape Trigger Action Response Plans (TARPs) form the basis of the impact assessments in this report.

A total of 52 surface impacts were identified by IMCEFT. Of these, 28 were surface impacts observed on natural features and 24 occurring on fire roads and access tracks. This report also includes an update on two existing Longwall 14 impacts, an update on three existing Longwall 15 impacts, and an update to one Longwall 8 impact.

Swamp groundwater and water quality triggers were also recorded during Longwall 16 and will be addressed in detail in the specialist Surface Water and Shallow Groundwater Assessment.

Contents

1	Overview of Monitoring Program.....	5
2	Reference Site Monitoring.....	7
3	TARP Overview.....	7
4	Summary of Impacts.....	10
5	Impacts to First and Second Order Streams.....	18
5.1	LA2.....	18
5.2	WC15.....	18
6	Impacts to Other Landscape Features.....	23
7	TARP Triggers.....	46
7.1	Shallow Groundwater.....	46
7.2	Water Quality.....	48
8	Impacts to Built Features.....	52
8.1	Level 1 Surface Cracking.....	52
8.2	Level 2 Surface Cracking.....	60
8.3	Remediation.....	63
9	Current and Future Monitoring.....	63
10	Predicted and Observed Impacts.....	67
11	Appendix A – Trigger Action Response Plans.....	83

Figures

Figure 1:	Map showing monitoring sites for the Longwall 16 active mining area.....	9
Figure 2:	Map showing surface impacts and triggers recorded during Longwall 16.....	16
Figure 3:	Map showing surface impacts and triggers recorded during Longwall 16.....	17
Figure 5:	Logged water levels recorded at <i>WC15_Pool 34</i>	20
Figure 6:	Near-surface groundwater levels at <i>23_02</i>	47
Figure 7:	Near-surface groundwater levels at <i>11_H2</i>	48
Figure 8:	Dissolved oxygen results recorded at <i>LA4_S1</i> , a water quality monitoring site on Lake Avon tributary <i>LA4</i>	49
Figure 9:	Electrical conductivity results recorded at <i>LA4_S1</i> , a water quality monitoring site on Lake Avon tributary <i>LA4</i>	49
Figure 10:	pH results recorded at <i>LA4_S1</i> , a water quality monitoring site on Lake Avon tributary <i>LA4</i>	50
Figure 11:	Electrical conductivity results recorded at <i>Donalds Castle Creek (FR6)</i> over the past 12 months. .	51
Figure 12:	Monitoring sites relevant to Longwall 17.....	66

Tables

Table 1: Summary table of SLMMP sites relevant to Longwall 16.....	6
Table 2: History of management plan updates for DA3B. Highlighted Plans show those used for reporting during Longwall 16.	7
Table 3: Summary of impacts and triggers relevant to Longwall 16.	11
Table 4: Monitoring associated with Longwall 16 and recommendations for monitoring during extraction of Longwall 17.	63
Table 5: Dendrobium Area 3B Impacts, TARPs & Performance Measures – Longwall 16 End of Panel Report.	67
Table 6: Dendrobium Swamp Impacts, Triggers and Response.	83
Table 7: Dendrobium Watercourse Impacts, Triggers and Response.	88
Table 8: Dendrobium Landscape Impacts, Triggers and Response.	97

Abbreviations

CMA – Corrective Management Action

DPIE - Department of Planning, Industry and Environment

EoP – End of Panel

IMCEFT – Illawarra Metallurgical Coal Environmental Field Team

OEH - Office of Environment and Heritage (former agency)

SIMMCP – Swamp Impact, Monitoring, Management and Contingency Plan

SLMMP – Subsidence Landscape Monitoring and Management Plan

SMP – Subsidence Management Plan

TARP – Trigger Action Response Plan

WaterNSW – previously Sydney Catchment Authority

WIMMCP – Watercourse Impact, Monitoring, Management and Contingency Plan

Definitions

Active Mining Area – Within 400m of the active longwall.

1 OVERVIEW OF MONITORING PROGRAM

Landscape monitoring was conducted within the Longwall 16 mining area during baseline, active mining and post-mining periods. Baseline inspections were conducted up until the longwall was within 400m of each feature. When active mining occurred within 400m of each feature, inspections increased to weekly until the longwall was at least 400m past the feature. Post-mining inspections continue as outlined in the relevant management plans.

Surface Monitoring for Longwall 16

IMCEFT and external consultants conducted observations and measurements of surface and shallow groundwater levels, swamp soil moisture, surface water flows, surface water quality and inspections of key landscape features. This monitoring included targeted sites within swamps and watercourses as well as steep slopes, clifflines and other landscape features.

Landscape Monitoring Summary (SLMMP)

In accordance with the Dendrobium Area 3B SMP Approval, landscape monitoring sites (Subsidence Landscape Monitoring and Management Plan [SLMMP] photo points) within the active mining area were monitored at monthly intervals. Monitoring photos from SLMMP sites are compared to baseline photos at each site (Photo 1 and Photo 2). A total of 15 landscape sites (SLMMP photo points) were monitored before, during and after the Longwall 16 extraction period (Table 1). Longwall 16 post-mining inspections were undertaken, and four impacted sites were observed. These impacts are addressed in the Impacts to Other Landscape Features section.



Photo 1: A3b-SS16, baseline inspection. Taken on 27/12/17.



Photo 2: A3b-SS16, post-mining inspection. Taken on 28/09/20.

Table 1: Summary table of SLMMP sites relevant to Longwall 16.

Site Name	Easting	Northing	Impact Description
A3b-SS11	288686	6191850	Impacted during LW15
A3b-SS12	289098	6191676	No impacts observed
A3b-SS13	290056	6191749	Rock Fracturing
A3b-SS14	290060	6191587	Impacted during LW15. No changes during LW16.
A3b-SS15	288717	6191468	No impacts observed
A3b-SS16	289207	6191506	Rock Fracturing
A3b-SS17	290163	6191269	Rock Fracturing
A3b-SS18	288812	6190998	No impacts observed
A3b-SS19	289020	6191108	No impacts observed
A3b-SS21	289633	6190858	No impacts observed
AT3-slmmp	290566	6191598	No impacts observed
AT4-slmmp	289092	6191569	No impacts observed
AT5-slmmp	290140	6191224	Soil Cracking
AT6-slmmp	289502	6190991	No impacts observed
AT8-slmmp	2902241	6190769	No impacts observed

2 REFERENCE SITE MONITORING

Swamp reference sites are monitored in accordance with the SIMMCP (example reference swamps- Photo 3 and Photo 4). Data recorded from reference swamps is compared with data from impact monitoring sites relevant to previously mined and active longwalls.



Photo 3: Reference site S88_S01. Taken on 2/10/2020.



Photo 4: Reference site S22_S02. Taken on 22/09/2020.

3 TARP OVERVIEW

In accordance with the Dendrobium Area 3B SMP Approval, the SIMMCP and WIMMCP (and Environmental Management Plan) were revised during the extraction of Longwalls 9 and 10. Key government agencies including DPIE, WaterNSW and BCD were consulted during this process. This revision included updates to the TARPs, which address performance measures, specified in the approval conditions. Table 2 shows the TARPs used to date. In accordance with the Dendrobium Area 3B SMP Approvals, the SIMMCP and WIMMCP (and Environmental Management Strategy) were revised prior to the extraction of Longwall 14. Impacts to surface features observed during the extraction of Longwall 16 will be reported under the 2020 TARPs.

Table 2: History of management plan updates for DA3B. Highlighted Plans show those used for reporting during Longwall 16.

Aspect	Management Plan	TARP Date Range
Swamps	Swamp Impact, Monitoring, Management and Contingency Plan (October 2013)	10/10/2013 – 03/06/2014
	Swamp Impact, Monitoring, Management and Contingency Plan (June 2014)	04/06/2014 – 11/10/2015
	Swamp Impact, Monitoring, Management and Contingency Plan (October 2015)	12/10/2015 – 30/10/2017
	Swamp Impact, Monitoring, Management and Contingency Plan (October 2017)	31/10/2017 – 6/02/2020
	Swamp Impact, Monitoring, Management and Contingency Plan (February 2020)	07/02/2020 - present
Watercourse	Watercourse Impact, Monitoring, Management and Contingency Plan (December 2013)	19/12/2013 – 03/06/2014
	Watercourse Impact, Monitoring, Management and Contingency Plan (June 2014)	04/06/2014 – 11/10/2015
	Watercourse Impact, Monitoring, Management and Contingency Plan (October 2015)	12/10/2015 – 30/10/2017

	Watercourse Impact, Monitoring, Management and Contingency Plan (October 2017)	31/10/2017 – 13/02/2020
	Watercourse Impact Monitoring, Management and Contingency Plan (October 2020)	14/02/2020 - present
Landscape	Dendrobium Area 3B Subsidence Management Plant (SMP), Volume 2 – Table 1.2 Dendrobium Landscape Impacts, Triggers and Response (November 2012)	12/11/2012 – Present

4 SUMMARY OF IMPACTS

During the extraction of Longwall 16, 52 new surface impacts were identified (Table 3; Figure 2 and Figure 3). These impacts are labelled as *DA3B_LW16_001* to *DA3B_LW16_052*. Updates are provided for two existing Longwall 14 impacts; these impacts are labelled as *DA3B_LW14_017 (Update)* and *DA3B_LW14_019 (Update)*. Updates are provided for three existing Longwall 15 impacts; these impacts are labelled as *DA3B_LW15_002 (Update)*, *DA3B_LW15_008 (Update)* and *DA3B_LW15_026 (Update)*. Four water quality triggers and three shallow groundwater triggers were also recorded. These triggers will be addressed in the Longwall 16 Surface Water and Shallow Groundwater Assessment.

Impacts to Natural Features

Subsidence includes vertical and horizontal movement of the land surface, which can result in surface and subsurface cracking, uplifting, buckling, dilation and tilting. These impacts can affect watercourse hydrology and morphology, swamp hydrology and ecological function, and other landscape features by means of surface cracking, which can lead to erosion and rockfalls. Potential mine subsidence impacts within Dendrobium Area 3B are discussed in the Dendrobium Area 3B SMP, WIMMCP and SIMMCP.

An overview of impacts observed during the extraction of Longwall 16 is provided in the following sections. For specific details on the impacts listed in Table 3, refer to the relevant impact reports (attached separately to this report).

Landscape features

Fractures and cracking observed during the extraction of Longwall 16 were assessed against the relevant TARP (for landscape, swamp or watercourse) and assigned a trigger value (Level 1, Level 2 or Level 3 where applicable). Trigger values for fractures and cracks were determined based on characteristics such as:

- Width and length;
- Whether the fracture contributed to any observable loss of surface water or water diversion; and
- Any erosion or potential for erosion caused by a fracture or crack.

Table 3: Summary of impacts and triggers relevant to Longwall 16.

Site ID	Easting	Northing	Impact Type	Feature Affected	Identification Date	Trigger Level	Description	Refer to Impact Report/s Dated
DA3B_LW16_001	288780	6191589	Soil Cracking	Access Track	16/04/2020	1	Soil cracking on access track between <i>Lake Avon</i> and <i>Fire Road 6A</i> .	17/04/2020
DA3B_LW16_002	288798	6191599	Soil Cracking	Access Track	16/04/2020	1	Soil cracking on access track between <i>Lake Avon</i> and <i>Fire Road 6A</i> .	17/04/2020
DA3B_LW16_003 (Update)	288849	6191590	Soil Cracking & Rock Fracturing	Access Track	16/04/2020	1	Soil cracking and rock fracturing on access track between <i>Lake Avon</i> and <i>Fire Road 6A</i> .	17/04/2020 & 22/04/2020
DA3B_LW16_004	288959	6191517	Rock Fracturing & Soil Cracking	Access Track	16/04/2020	1	Rock fracturing and soil cracking on access track between <i>Lake Avon</i> and <i>Fire Road 6A</i> .	17/04/2020
DA3B_LW16_005	288863	6191503	Soil Cracking	Access Track	21/04/2020	2	Soil cracking on access track between <i>Lake Avon</i> and <i>Fire Road 6A</i> .	22/04/2020
DA3B_LW16_006	288975	6191508	Soil Cracking	Access Track	21/04/2020	1	Soil cracking on access track between <i>Lake Avon</i> and <i>Fire Road 6A</i> .	22/04/2020
DA3B_LW16_007	288997	6191509	Soil Cracking	Access Track	21/04/2020	1	Soil cracking on access track between <i>Lake Avon</i> and <i>Fire Road 6A</i> .	22/04/2020
DA3B_LW16_008	289034	6191551	Soil Cracking	Access Track	27/04/2020	1	Soil cracking on access track between <i>Lake Avon</i> and <i>Fire Road 6A</i> .	30/04/2020
DA3B_LW16_009	289061	6191483	Soil Cracking	Closed Access Track	27/04/2020	1	Soil cracking on rehabilitated seismic track between <i>Lake Avon</i> and <i>Fire Road 6A</i> .	30/04/2020
DA3B_LW16_010	289001	6191423	Rock Fracturing	Rock Outcrop	27/04/2020	2	Rock fracturing to rock outcrop between <i>Lake Avon</i> and <i>Fire Road 6A</i> .	30/04/2020
DA3B_LW16_011	289034	6191253	Rockfall	Steep Slope/ Step	27/04/2020	1	Small rock fall at steep slope/step between <i>Lake Avon</i> and <i>Fire Road 6A</i> .	30/04/2020
DA3B_LW16_012	289001	6191423	Rock Fracturing	Steep Slope/ Step	28/04/2020	1	Rock fracturing at a steep slope/step between <i>Fire Road 6P</i> and <i>Swamp 14</i> .	30/04/2020
DA3B_LW16_013 (Update)	289119	6191571	Soil Cracking	Access Track	12/05/2020 & 28/05/2020 & 11/06/2020	2	Soil cracking on access track between <i>Lake Avon</i> and <i>Fire Road 6A</i> .	18/05/2020 & 29/05/2020 & 19/06/2020

Site ID	Easting	Northing	Impact Type	Feature Affected	Identification Date	Trigger Level	Description	Refer to Impact Report/s Dated
DA3B_LW16_014	289141	6191604	Soil Cracking	Access Track	12/05/2020	1	Soil cracking on access track between <i>Lake Avon</i> and <i>Fire Road 6A</i> .	18/05/2020
DA3B_LW16_015 (Update)	288719	6191497	Rock Fracturing	Steep Slope/ Step	15/05/2020	1	Rock fracturing at a steep slope/step between <i>Lake Avon</i> and <i>Fire Road 6A</i> .	18/05/2020
DA3B_LW16_016	289183	6191508	Rock Fracturing and Rockfall	Steep Slope/ Step	15/05/2020	1	Rock fracturing and rockfall at a steep slope/step between <i>Lake Avon</i> and <i>Fire Road 6A</i> .	18/05/2020
DA3B_LW16_017	289075	6191396	Rock Fracturing	Rock Outcrop	16/06/2020	1	Rock fracturing to outcrop between <i>Swamp 23</i> and <i>LA2</i> .	19/06/2020
DA3B_LW16_018	289206	6191509	Rock Fracturing	A3B-SS16	16/06/2020	1	Rock fracturing to SLMMP site A3B-SS16.	19/06/2020
DA3B_LW16_019 (Update)	289436	6191478	Soil Cracking	Fire Road 6A	19/06/2020 & 25/06/2020	2	Soil cracking across <i>Fire Road 6A</i> (now remediated).	24/06/2020 & 30/06/2020
DA3B_LW16_020	289469	6191376	Soil Cracking	Fire Road 6A	30/06/2020	1	Soil cracking across <i>Fire Road 6A</i> .	2/07/2020
DA3B_LW16_021	289366	6191418	Rock Fracturing	Steep Slope/ Step	30/06/2020	2	Rock fracturing to step with small rockfall.	2/07/2020
DA3B_LW16_022 (Update)	289564	6191418	Rock Fracturing	Railway Corridor	7/07/2020 & 6/08/2020	3	Rock fracturing to cut-through of railway corridor.	10/07/2020 & 10/08/2020
DA3B_LW16_023	289499	6191327	Soil Cracking	Fire Road 6A	7/07/2020	1	Soil cracking across <i>Fire Road 6A</i> .	10/07/2020
DA3B_LW16_024	289620	6191348	Rock Fracturing & Soil Cracking	Access Track	6/08/2020	1	Rock fracturing and soil cracking to rehabilitated access track between <i>Swamp 14</i> and <i>Fire Road 6A</i> .	10/08/2020
DA3B_LW16_025	289732	6191382	Rock Fracturing	Steep Slope/ Step	6/08/2020	1	Rock fracturing to steep slope between <i>Swamp 14</i> and <i>Fire Road 6A</i> .	10/08/2020
DA3B_LW16_026 (Update)	289839	6191445	Rock Fracturing	Steep Slope/ Step	6/08/2020 & 24/08/2020	1	Rock fracturing to steep slope between <i>Swamp 14</i> and <i>Fire Road 6P</i> .	10/08/2020 & 27/08/2020
DA3B_LW16_027	289641	6919508	Soil Cracking	Fire Road 6P	21/08/2020	1	Soil cracking to <i>Fire Road 6P</i> .	27/08/2020

Site ID	Easting	Northing	Impact Type	Feature Affected	Identification Date	Trigger Level	Description	Refer to Impact Report/s Dated
DA3B_LW16_028	289985	6191502	Rock Fracturing	WC15	31/08/2020	2	Rock fracture to rockbar/step above WC15_Pool 34.	1/09/2020
DA3B_LW16_029	290169	6191756	Rockfall	Steep Slope/ Step	31/08/2020	1	Rockfall to step on western slope of WC15 valley.	1/09/2020
DA3B_LW16_030 (Update)	290215	6191727	Erosion	WC15	31/08/2020 & 9/9/2020	1	Localised erosion on tributary WC15.	1/09/2020 & 14/09/2020
DA3B_LW16_031	290041	6191714	Rock Fracturing and Rockfall	Cliffline	14/09/2020	1	Rock fracturing on cliff line to the north-west of WC15.	30/09/2020
DA3B_LW16_032	290071	6191701	Soil Cracking	Bushland	28/09/2020	1	Soil cracking to the north-west of WC15.	30/09/2020
DA3B_LW16_033	290194	6191325	Soil Cracking	Access Track	28/09/2020	1	Soil cracking on an access track parallel to WC15.	30/09/2020
DA3B_LW16_034	290144	6191257	Soil Cracking	Access Track	28/09/2020	1	Soil cracking on an access track parallel to WC15.	30/09/2020
DA3B_LW16_035	290172	6191282	Soil Cracking and Displacement	Steep Slope/ Step	28/09/2020	1	Soil cracking and displacement near SLMMP site A3B-SS17.	30/09/2020
DA3B_LW16_036	290164	6191269	Rock Fracturing	A3B-SS17	28/09/2020	1	Rock fracturing to a cliff line at SLMMP site A3B-SS17.	30/09/2020
DA3B_LW16_037	290137	6191224	Soil Cracking	Access Track	28/09/2020	1	Soil cracking on an access track parallel to WC15.	30/09/2020
DA3B_LW16_038	289169	6191319	Iron Staining	LA2	14/09/2020	1	Ironing staining present at LA2_Pool/34.	30/09/2020
DA3B_LW16_039	290335	6191371	Soil Cracking	Access Track	7/10/2020	1	Soil cracking to access track, east of Swamp 14.	12/10/2020
DA3B_LW16_040	290300	6191345	Soil Cracking	Access Track	7/10/2020	1	Soil cracking to access track, east of Swamp 14.	12/10/2020
DA3B_LW16_041	290275	6191318	Soil Cracking and Displacement	Access Track	7/10/2020	1	Soil cracking to access track, east of Swamp 14.	12/10/2020

Site ID	Easting	Northing	Impact Type	Feature Affected	Identification Date	Trigger Level	Description	Refer to Impact Report/s Dated
DA3B_LW16_042	290245	6191310	Soil Cracking	Access Track	7/10/2020	1	Soil cracking to access track, east of <i>Swamp 14</i> .	12/10/2020
DA3B_LW16_043	290443	6191240	Soil Cracking	Access Track	7/10/2020	1	Soil cracking to access track, east of <i>Swamp 14</i> .	12/10/2020
DA3B_LW16_044	290234	6191201	Soil Cracking, Rock Fracturing & Displacement	Steep Slope	10/11/2020	2	Soil cracking, rock fracturing and displacement on steep slope east of <i>Swamp 14</i> .	16/11/2020
DA3B_LW16_045	290204	6191177	Rock Fracturing	Steep Slope	10/11/2020	1	Rock fracturing to a steep slope east of <i>Swamp 14</i> .	16/11/2020
DA3B_LW16_046	290173	6191245	Rock Fracturing	Steep Slope/ Step	25/11/2020	1	Rock fracture to a steep slope/step east of <i>Swamp 14</i> .	27/11/2020
DA3B_LW16_047	290168	6191200	Rock Fracturing	Steep Slope/ Step	30/11/2020	1	Rock fracturing to steep slope east of <i>Swamp 14</i> .	2/12/2020
DA3B_LW16_048	289783	6191423	Rock Fracturing	Rock Outcrop	30/11/2020	1	Rock fracture to rock outcrop west of <i>Swamp 14</i> .	2/12/2020
DA3B_LW16_049	289755	6191395	Rock Fracturing & Fragmentation	Steep Slope/ Step	30/11/2020	2	Rock fracturing and fragmentation to steep slope west of <i>Swamp 14</i> .	2/12/2020
DA3B_LW16_050	289800	6191455	Rock Fracturing	Steep Slope/ Step	30/11/2020	1	Rock fracture to steep slope west of <i>Swamp 14</i> .	2/12/2020
DA3B_LW16_051	289758	6191471	Rock Fracturing and Soil Cracking	Rock Outcrop & Bushland	30/11/2020	2	Rock fracturing and soil cracking to rock outcrop and bushland west of <i>Swamp 14</i> .	2/12/2020
DA3B_LW16_052	289916	6191759	Soil Cracking	Bushland	1/12/2020	1	Soil cracking in bushland to the west of <i>Swamp 14</i> .	2/12/2020
DA3B_LW14_017 (Update)	290276	6191786	Rock Fracturing & Displacement	WC15	9/09/2020	2	Additional rock fracturing and displacement on tributary WC15.	14/09/2020
DA3B_LW14_019 (Update)	290312	6191805	Rock Fracturing, Uplift & Displacement	WC15	9/09/2020	2	Additional rock fracturing, uplift and displacement near tributary WC15.	14/09/2020
DA3B_LW15_002 (Update)	288651	6191771	Rock Fracturing and Rockfall	Steep Slope/ Step	05/05/2020	1	Rock fracturing and rockfall at step adjacent to <i>Swamp 23</i> .	18/05/2020

Site ID	Easting	Northing	Impact Type	Feature Affected	Identification Date	Trigger Level	Description	Refer to Impact Report/s Dated
DA3B_LW15_008 Update	2893221	6191783	Soil Cracking and Uplift	<i>Fire Road 6A</i>	12/05/2020	1	Soil cracking and uplift across <i>Fire Road 6A</i> .	18/05/2020
DA3B_LW15_026 Update	289839	6191445	Rock Fracturing	<i>Steep Slope/ Step</i>	24/08/2020	1	Rock fracturing to steep slope between <i>Swamp 14</i> and <i>Fire Road 6P</i> .	27/08/2020
DA3_LW8_158 (Update)	293300	6192455	Iron Staining	<i>Sandy Creek</i>	14/10/2020	2	Increase in iron staining for >2 consecutive months in <i>Sandy Creek</i> .	19/10/2020
14_01	289917	6191292	Shallow Groundwater Trigger	<i>Swamp 14</i>	9/09/2020	3	Rate of recession groundwater trigger in <i>Swamp 14</i> .	14/09/2020 & 16/11/2020
23_02	288664	6191689	Groundwater trigger	<i>Swamp 23</i>	27/04/2020	3	Near-surface groundwater trigger in <i>Swamp 23</i> (recession rate).	30/04/2020
11_H2	288567	6192364	Groundwater Trigger	<i>Swamp 11</i>	13/05/2020	2	Near-surface groundwater trigger in <i>Swamp 11</i> .	18/05/2020
LA4_S1	288134	6192561	Water Quality Trigger	<i>LA4</i>	3/08/2020	1	Trigger for dissolved oxygen at <i>LA4_S1</i> .	5/08/2020
LA4_S1	288134	6192561	Water Quality Trigger	<i>LA4</i>	3/08/2020 & 1/09/2020	2	Trigger for electrical conductivity at <i>LA4_S1</i> .	5/08/2020 & 14/09/2020
LA4_S1	288134	6192561	Water Quality Trigger	<i>LA4</i>	3/08/2020 & 1/09/2020	2	Trigger for pH at <i>LA4_S1</i> .	5/08/2020 & 14/09/2020
Donalds Castle Creek (FR6) (Update)	289395	6195367	Water Quality Trigger	<i>Donalds Castle Creek</i>	20/05/2020 & 1/06/2020 & 30/06/2020	3	Trigger for electrical conductivity.	26/05/2020 & 4/06/2020 & 2/07/2020

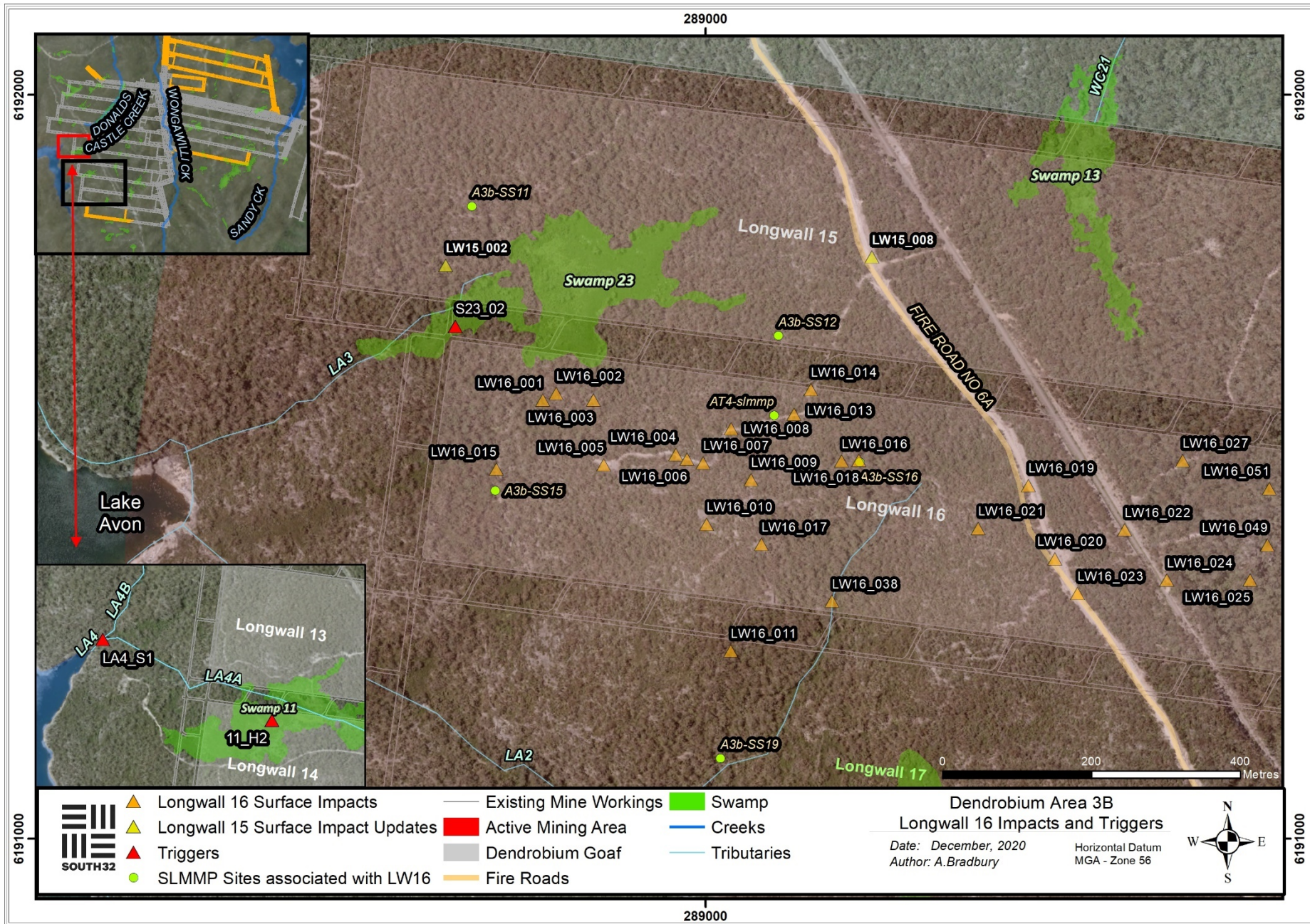


Figure 2: Map showing surface impacts and triggers recorded during Longwall 16.

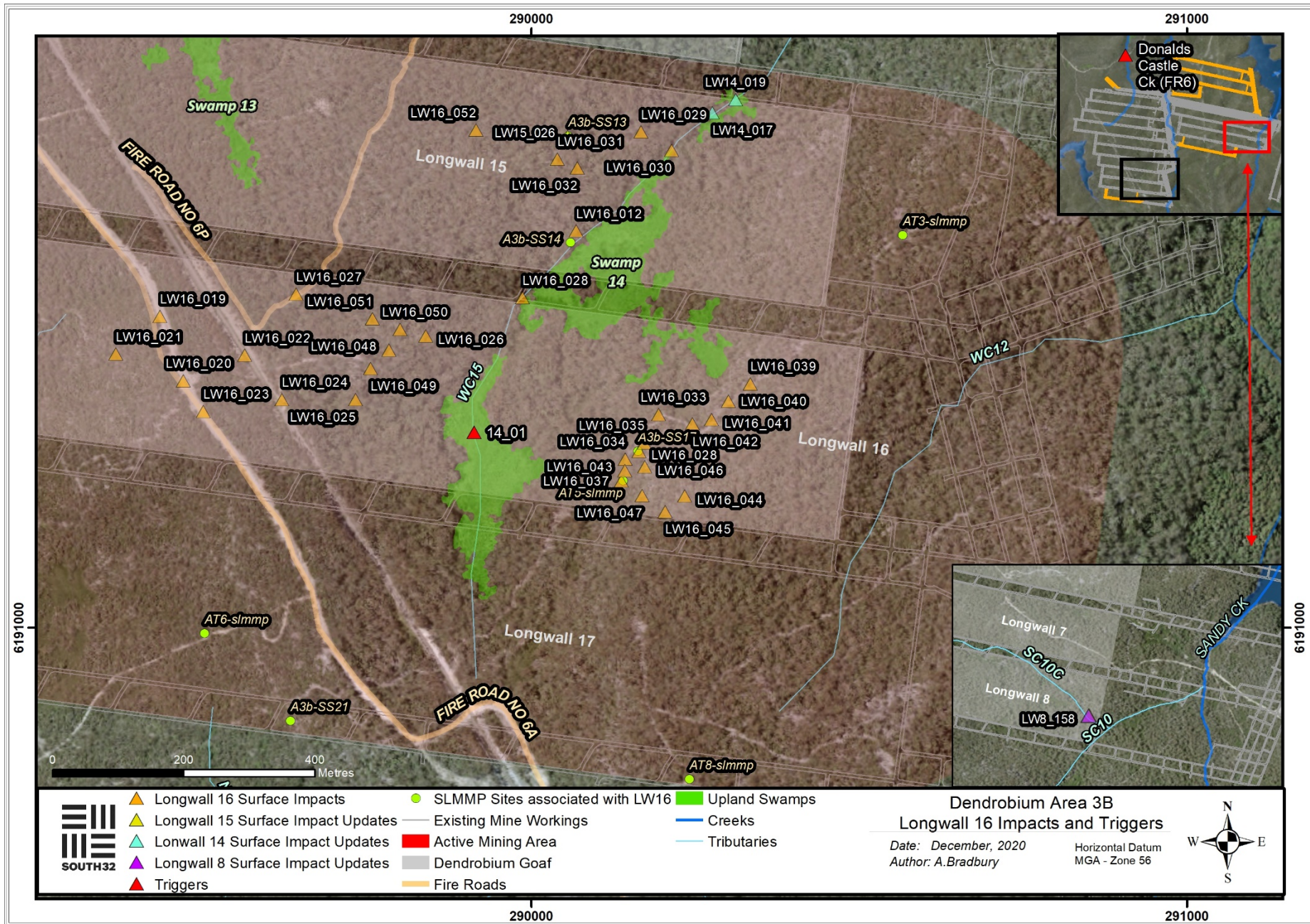


Figure 3: Map showing surface impacts and triggers recorded during Longwall 16.

5 IMPACTS TO FIRST AND SECOND ORDER STREAMS

Four first and second order streams were monitored as part of the Longwall 16 monitoring program- LA2, LA3, WC12 and WC15. Impacts observed at these streams during Longwall 16 are described below.

5.1 LA2

DA3B_LW16_038

DA3B_LW16_038 consists of iron staining observed in tributary LA2 following the passing of Longwall 16 (Figure 2). The impacted site, Pool 34, was mined beneath by Longwall 16 on 5 May 2020. Throughout the monitoring period the pool has generally been ephemeral, responding to rainfall events. Following a rainfall event, iron staining was observed for the first time (Photo 5 and Photo 6). The iron staining is localised to this pool and does not extend downstream.

Level 1: Observable increase in iron staining within the mining area.



Photo 5: LA2_Pool 34, looking upstream. Taken on 24/03/2020, prior to identification of the iron staining.



Photo 6: DA3B_LW16_038, iron staining at LA2_Pool 34, looking upstream. Taken on 14/09/2020.

5.2 WC15

DA3B_LW16_028

DA3B_LW16_028 consists of rock fracturing to a rockbar on tributary WC15, directly upstream from Pool 34 (Figure 3). The fracture is approximately 2.1m long and 0.01m wide (Photo 7 and Photo 8). There was a noticeable reduction in surface flow on the rockbar following identification of the fracture, with some surface seepage diverting in to the fracture. Pool 34, directly downstream, was also observed to be dry, with only surface seepage entering the pool from beneath the upstream step (Photo 9 and Photo 10). While Pool 34 has been observed to be dry during the baseline period, the rate of recession for this latest drying event is the fastest recorded and coincides with the passing of Longwall 16, approximately 10m at the closet horizontal distance (Figure 4). On 25 November 2020, the width of fracturing was observed to have increased to 0.02m with an uplift of 0.03m (Photo 11 and Photo 12).

Level 2: Crack or fracture that results in observable loss of surface water or erosion.



Photo 7: *DA3B_LW16_028*, rock fracture in foreground and edge of dry step and Pool 34 in background. Taken on 31/08/2020.



Photo 8: *DA3B_LW16_028*, rock fracture across rockbar. Taken on 31/08/2020.



Photo 9: *WC15_Pool 34*, looking downstream over step. Taken on 31/08/2020.



Photo 10: *WC15_Pool 34*, looking downstream over step. Taken on 24/08/2020.



Photo 11: *DA3B_LW16_028*, looking at additional rock fracturing. Taken on 25/11/2020.



Photo 12: *DA3B_LW16_028*, looking at rock uplift. Taken on 25/11/2020.

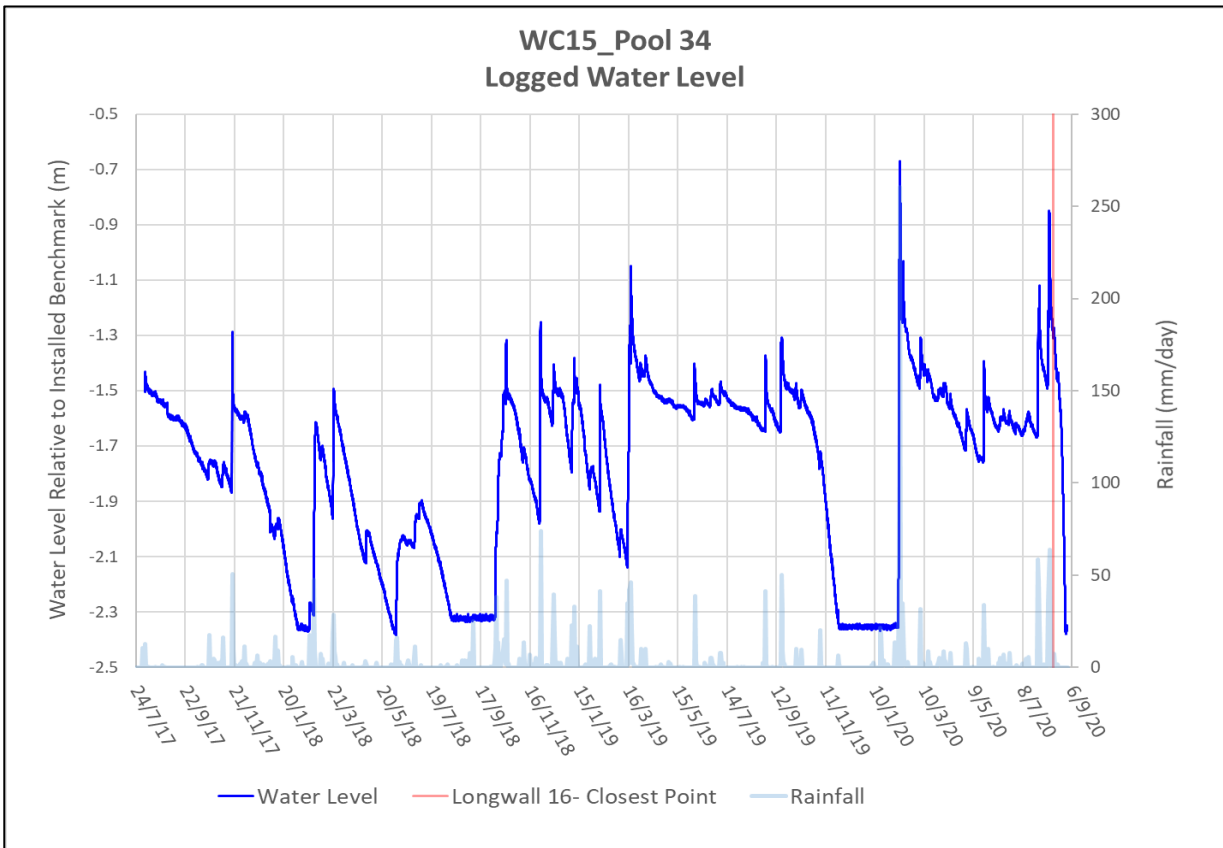


Figure 4: Logged water levels recorded at WC15_Pool 34.

DA3B_LW14_017 Update

DA3B_LW14_017 is located on WC15, a tributary to Wongawilli Creek. The impacted feature is WC15_Channel 30 which is situated approximately 325m north of Longwall 16 at its closest point (Figure 3). The impact was originally comprised of two rock fractures (Photo 13). The original rock fracturing had a measurable length of 0.8m, a width of 0.025m and a maximum measurable depth of 0.17m. On 9 September 2020, an additional rock fracture and associated rock fragmentation was identified. The 1m rock fracture resulted in the displacement of a rock fragment, approximately 0.25m x 0.03m x 0.07m (Photo 14).

Level 2: Crack or fracture that results in observable loss of surface water or erosion.



Photo 13: DA3B_LW14_017, looking at the original rock fracturing. Taken on 20/02/2019.



Photo 14: DA3B_LW14_017, looking at the rock fracturing and displacement. Taken on 9/09/2020.

DA3B_LW14_019 Update

DA3B_LW14_019 is located near WC15, a tributary to Wongawilli Creek. The impacted feature is situated approximately 350m north of Longwall 16 at its closest point (Figure 3). The impact was originally comprised of rock fracturing and uplift. The original rock fracturing had a length of 4.5m, a width of 0.05m and a maximum measurable depth of 0.7m. On 9 September 2020, additional rock fracturing, uplift and rock displacement were identified within a 10m x 10m area (Photo 15 to Photo 18). The fracturing has a length of 6.8m, a width of 0.1m and a maximum measurable depth of 0.4m. The largest rock fragment displaced is 2m x 2m and uplift was measured up to 0.2m. DA3B_LW14_019 was inspected on 25 November 2020 and remains unchanged from original identification.

Level 2: Crack or fracture between 100 and 300mm width at its widest point, and/or, crack or fracture that results in observable loss of surface water or erosion.



Photo 15: DA3B_LW14_019, looking at a section of rock fracturing and uplift. Taken on 9/09/2020.



Photo 16: DA3B_LW14_019, looking at a section of rock fracturing. Taken on 9/09/2020.



Photo 17: DA3B_LW14_019, looking at a section of rock fracturing and displacement. Taken on 9/09/2020.



Photo 18: DA3B_LW14_019, looking at a section of rock fracturing and uplift. Taken on 9/09/2020.

DA3_LW8_158 Update

DA3_LW8_158 Update consists of iron staining in Sandy Creek. Iron staining was first reported in SC10C, a tributary in the Sandy Creek sub-catchment, on 11 March 2013 following the extraction of Longwall 8 (Figure 3). SC10C_Pool 3 is the furthest upstream location where iron staining has been identified (Photo 19). Iron staining was also observed in SC10, downstream from SC10C following the extraction of Longwall 8. Iron staining was observed at SC10_Rockbar 3 during a recent inspection (Photo 20). On 14 October 2020, the iron staining was observed to have extended downstream into Sandy Creek. The increase in iron staining is evident between the

Sandy Creek-SC10 confluence and the Sandy Creek-Cordeaux Dam confluence (Photo 21 and Photo 22). On 15 October 2020, no iron staining was observed within Cordeaux Dam (Photo 23).

Level 2: Increase in iron staining, algal growth, or other observed changes, for >2 consecutive months in Sandy Creek, determined by comparing baseline photos with photos during the mining period.



Photo 19: SC10C_Pool 3, looking upstream at the furthest upstream location of the iron staining. Taken on 3/09/2020.



Photo 20: SC10_Rockbar 3, looking upstream during the latest inspection. Taken on 14/10/2020.



Photo 21: SCK_Rockbar 5, looking upstream prior to observed changes in stream appearance. Taken on 19/08/2020.



Photo 22: SCK_Rockbar 5, looking upstream at the increase in iron staining. Taken on 14/10/2020.



Photo 23: Sandy Creek Arm, looking upstream towards Sandy Creek. Taken on 15/10/2020.

6 IMPACTS TO OTHER LANDSCAPE FEATURES

DA3B_LW16_010

DA3B_LW16_010 is situated on a rock outcrop between *Lake Avon* and *Fire Road 6A* (Figure 2). The site was undermined by Longwall 16 on 14 April 2020. The impact is comprised of rock fracturing (Photo 24 and Photo 25). The rock fracturing has a maximum length of 16m, a maximum width of 0.02m and a maximum measurable depth of 2m. DA3B_LW16_010 was inspected on 19 November 2020 and remains unchanged from original identification.

Level 2: Crack or fracture between 10m and 50m length.



Photo 24: DA3B_LW16_010, an overview of the rock fracture. Taken on 27/04/2020.



Photo 25: DA3B_LW16_010, an overview of the rock fracture. Taken on 27/04/2020.

DA3B_LW16_011

DA3B_LW16_011 is located at the base of a steep slope/step between *Lake Avon* and *Fire Road 6A* (Figure 2). The impact is situated approximately 70m south of Longwall 16 at its closest point. The impact is comprised of a small rock fall (Photo 26 and Photo 27). The largest rock fragment resulting from the rockfall is approximately 0.25m x 0.2m x 0.1m. DA3B_LW16_011 was inspected on 19 November 2020 and remains unchanged from original identification.

Level 1: Rockfall from a cliff (step) which is left mostly intact (<10% length) resulting in insignificant ground disturbance.



Photo 26: DA3B_LW16_011, overview of the rockfall. Taken on 27/04/2020.



Photo 27: DA3B_LW16_011, an overview of the rockfall. Taken on 27/04/2020.

DA3B_LW16_012

DA3B_LW16_012 is located at a steep slope/step between *Swamp 14* and *Fire Road 6P*, approximately 20m from SLMMP site A3b-SS14 and 7m from cultural heritage site DM21 (Figure 3). It is likely that this impact occurred during the extraction of Longwall 15, however access to the site was restricted during mining due to site safety concerns. The site was undermined by Longwall 15 on 31 October 2019. The impact is comprised of rock fracturing (Photo 28 to Photo 30). The rock fracturing has a maximum length of 2.75m, a maximum width of 0.037m and a maximum measurable horizontal depth of 1.2m. DA3B_LW16_011 was inspected on 25 November 2020 and remains unchanged from original identification.

Level 1: Crack or fracture up to 100mm width, and/or, crack or fracture up to 10m length.



Photo 28: DA3B_LW16_012, looking at a section of rock fracturing. Taken on 28/04/2020.



Photo 29: DA3B_LW16_012, looking at the maximum width of the rock fracture. Taken on 28/04/2020.



Photo 30: DA3B_LW16_012, looking at a section of rock fracturing. Taken on 28/04/2020.

DA3B_LW16_015 (Update)

DA3B_LW16_015 is located at the base of a steep slope/step between *Lake Avon* and *Fire Road 6A* (Figure 2). The site was undermined by Longwall 16 on 9 March 2020. The impact is comprised of rock fracturing (Photo 31 and Photo 32). The rock fracturing has a length of 1.2m, a width of 0.014m and a maximum measurable horizontal depth of 0.19m. On 19 November 2020, the maximum width of rock fracturing was observed to have increased to 0.04m (Photo 33).

Level 1: Crack or fracture up to 100mm width, and/or, crack or fracture up to 10m length.



Photo 31: DA3B_LW16_015, overview of the rock fracturing. Taken on 15/05/2020.



Photo 32: DA3B_LW16_015, looking at the width of rock fracturing. Taken on 15/05/2020.



Photo 33: *DA3B_LW16_015*, looking at the rock fracturing. Taken on 19/11/2020.

DA3B_LW16_016

DA3B_LW16_016 is located at a steep slope/step between *Lake Avon* and *Fire Road 6A* (Figure 2). The site was undermined by Longwall 16 on 1 May 2020. The impact is comprised of a rock fall and rock fracturing (Photo 34 to Photo 36, next page). Four boulders were dislodged from the step with the largest boulder measuring 0.8m x 0.9m x 0.5m. The rock fracturing has a length of 2m and a width of 0.015m. *DA3B_LW16_016* was inspected on 19 November 2020 and remains unchanged from original identification.

Level 1: *Crack or fracture up to 100mm width, and/or, crack or fracture up to 10m length, and/or, rockfall from a cliff (step) which is left mostly intact (<10% length) resulting in insignificant ground disturbance.*

DA3B_LW16_017

DA3B_LW16_017 is situated on a rock outcrop between *Swamp 23* and tributary *LA2* (Figure 2). The site was mined beneath by Longwall 16 on 22 April 2020. The impact is comprised of rock fracturing with a maximum length of 9m, a maximum width of 0.005m and a maximum measurable depth of 0.16m (Photo 37 and Photo 38, next page). *DA3B_LW16_017* was inspected on 19 November 2020 and remains unchanged from original identification.

Level 1: *Crack or fracture up to 100mm width, and/or, crack or fracture up to 10m length.*



Photo 34: DA3B_LW16_016, overview of the rockfall. Taken on 15/05/2020.



Photo 35: DA3B_LW16_016, looking at a section of rock fracturing. Taken on 15/05/2020.



Photo 36: DA3B_LW16_016, looking at a section of rock fracturing. Taken on 15/05/2020.



Photo 37: DA3B_LW16_017, looking at the length of rock fracturing. Taken on 16/06/2020.



Photo 38: DA3B_LW16_017, looking at width of rock fracturing. Taken on 16/06/2020.

DA3B_LW16_018

DA3B_LW16_018 is situated at SLMMP Site A3b-SS16, located between Swamp 23 and tributary LA2 (Figure 2). The site was mined beneath by Longwall 16 on 6 May 2020. The impact is comprised of two rock fractures and minor rock fragmentation (Photo 39 and Photo 40). The rock fracturing has a maximum continuous length of 4.5m, a maximum width of 0.004m and a maximum measurable depth of 0.21m. The rock fragmentation has a maximum length of 0.1m and a maximum width of 0.05m. DA3B_LW16_018 was inspected on 19 November 2020 and remains unchanged from original identification.

Level 1: Crack or fracture up to 100mm width, and/or, crack or fracture up to 10m length.



Photo 39: DA3B_LW16_018, looking at a section of rock fracturing. Taken on 16/06/2020.



Photo 40: DA3B_LW16_018, looking at a section of rock fragmentation. Taken on 16/06/2020.

DA3B_LW16_021

DA3B_LW16_021 consists of rock fracturing and a small rockfall to a 2m high step over Longwall 16 (Figure 2). The fracture is approximately 2m long, 0.12m wide and has a maximum measurable depth of 1m (Photo 41 and Photo 42). The largest rock fragment fallen from step is 0.35m long, with several smaller pieces also observed (Photo 43). On 1 December 2020, an additional rock fracture with a rock fall was observed with a maximum volume of 0.35m x 0.1m x 0.2m (Photo 44).

Level 2: Crack or fracture between 100mm and 300mm width.



Photo 41: DA3B_LW16_021, looking at fracture on step. Taken on 30/06/2020.

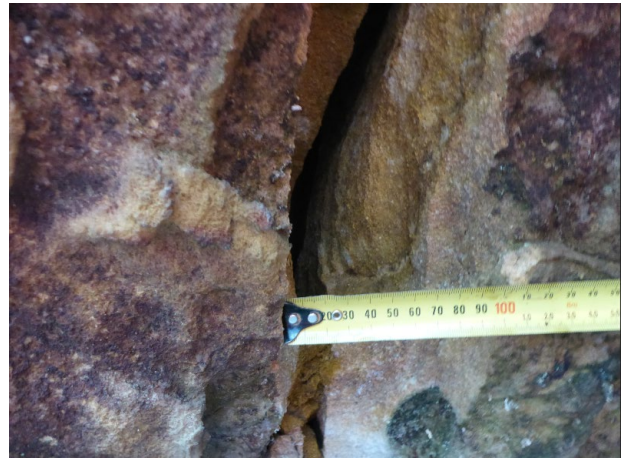


Photo 42: DA3B_LW16_021, looking at width of fracture on step. Taken on 30/06/2020.



Photo 43: DA3B_LW16_021, looking at small rock fragments fallen from step. Taken on 30/06/2020.



Photo 44: DA3B_LW16_021, looking at additional rock fracturing and rock fall. Taken on 1/12/2020.

DA3B_LW16_022 Update

DA3B_LW16_022 consists of rock fracturing to the face of a cut through which forms part of the Maldon Dombarton railway corridor adjacent to Fire Road 6A (Figure 2). The impact was initially observed on 7 July 2020, with a maximum continuous length of 15m, a width up to 0.08m and a maximum measurable depth of 2.9m (Photo 45 and Photo 46). A follow-up inspection on 6 August 2020 identified multiple small rockfalls and changes to the fracturing (Photo 47 and Photo 48). The fracturing is now largely continuous on both the eastern and western side of the corridor for a distance of approximately 190m. Maximum values relating to the fracturing width and depth did not change from the original inspection. The largest fragment resulting from the rockfall was 0.3m x 0.3m x 0.05m.

The site was inspected by a geotechnical engineer who determined that there was a low likelihood of additional movements at the site. No corrective management actions were recommended. As a precaution, the site was cordoned off until completion of Longwall 16. No additional impacts were observed at the site at completion of Longwall 16.

Level 3: Crack or fracture over 50m length.



Photo 45: DA3B_LW16_022, fracturing down face of cut-through. Taken on 7/07/2020.



Photo 46: DA3B_LW16_022, fracturing down face of cut-through. Taken on 7/07/2020.



Photo 47: DA3B_LW16_022, fracturing down face of cut-through. Taken on 6/08/2020.



Photo 48: DA3B_LW16_022, looking at a section of rock fracturing. Taken on 6/08/2020.

DA3B_LW16_024

DA3B_LW16_024 is situated on a rehabilitated access track between *Swamp 14* and *Fire Road 6A* (Figure 2). The site was mined beneath by Longwall 16 on 1 July 2020. The impact is comprised of rock fracturing and soil cracking (Photo 49 and Photo 50). The impact has a maximum length of 3.2m, a maximum width of 0.03m and a maximum depth of 0.45m. DA3B_LW16_024 was inspected on 30 November 2020 and remains unchanged from original identification.

Level 1: Crack or fracture up to 100mm width, and/or, crack or fracture up to 10m length.



Photo 49: DA3B_LW16_024, looking at a section of rock fracturing. Taken on 06/08/2020.



Photo 50: DA3B_LW16_024, looking at the width of rock fracturing. Taken on 06/08/2020.

DA3B_LW16_025

DA3B_LW16_025 is situated at a steep slope/step between *Swamp 14* and *Fire Road 6A* (Figure 2). The site was mined beneath by Longwall 16 on 15 July 2020. The impact is comprised of multiple rock fractures (Photo 51 and Photo 52). The rock fracturing has a maximum length of 2.5m, a maximum width of 0.035m and a maximum depth of 0.34m. On 30 November an additional rock fracture was identified at the base of the steep slope/step with a maximum length of 5m, maximum width of 0.004m and maximum measurable depth of less than 0.1m (Photo 53).

Level 1: Crack or fracture up to 100mm width, and/or, crack or fracture up to 10m length.



Photo 51: DA3B_LW16_025, looking at a section of rock fracturing. Taken on 06/08/2020.



Photo 52: DA3B_LW16_025, looking at a section of rock fracturing. Taken on 06/08/2020.



Photo 53: *DA3B_LW16_025*, looking at additional rock fracturing. Taken on 30/11/2020.

DA3B_LW16_026

DA3B_LW16_026 is situated at a steep slope/step between *Swamp 14* and *Fire Road 6P* (Figure 3). The site was mined beneath by Longwall 16 on 30 July 2020. The impact is comprised of multiple rock fractures (Photo 54 and Photo 55). The rock fracturing has a maximum length of 2m and a maximum width of 0.02m. *DA3B_LW16_026* was inspected on 30 November 2020 and remains unchanged from original identification.

Level 1: Crack or fracture up to 100mm width, and/or, crack or fracture up to 10m length.



Photo 54: *DA3B_LW16_026*, looking at a section of rock fracturing. Taken on 06/08/2020.



Photo 55: *DA3B_LW16_026*, looking at a section of rock fracturing. Taken on 06/08/2020.

DA3B_LW16_029

DA3B_LW16_029 consists of a rockfall from a step on the western slope of the WC15 valley (Figure 3). The rockfall is primarily made up of one large rock fragment, approximately 5m³ in volume (Photo 56), with some smaller broken rock fragments in the path of the fall (Photo 57). On 25 November 2020, additional soil cracking, rock fracturing and displacement was observed. The soil cracking has a maximum continuous length of 6m and a maximum width of 0.05m (Photo 58). The rock fracturing has a maximum length of 1.5m and a maximum width of 0.01m (Photo 59). The rock has been displaced 0.05m from the soil for a length of 3m.

Level 1: Rock fall from a cliff (step) which is left mostly intact (<10% length), resulting in insignificant ground disturbance.



Photo 56: DA3B_LW16_029, rockfall from step, looking at main large rock fragment. Taken on 31/08/2020.



Photo 57: DA3B_LW16_029, rockfall from step, looking at top of step where fragment originated. Taken on 31/08/2020.



Photo 58: DA3B_LW16_029, looking at soil cracking. Taken on 25/11/2020.



Photo 59: DA3B_LW16_029, looking at rock fracturing. Taken on 25/11/2020.

DA3B_LW16_030

DA3B_LW16_030 consists of localised erosion on tributary WC15 (Figure 3). The erosion has formed a hole in the soil and root matter in a section of the tributary which has displayed surface and subsurface flow during the baseline period. The hole has length of 1.8m, a width of 0.5m and a measurable depth of 1.1m (Photo 60 to Photo 63). On 25 November 2020, width of erosion has increased to 0.62m. There is no evidence of subsidence cracking or fracturing associated with the erosion. The hole has been flagged to for safety reasons and will continue to be monitored to identify any potential changes.

Level 1: Erosion in a localised area which would be expected to naturally stabilise without CMA and within the period of monitoring.



Photo 60: DA3B_LW16_030, localised erosion observed on tributary WC15. Taken on 31/08/2020.



Photo 61: DA3B_LW16_030, looking at length of localised erosion. Taken on 31/08/2020.



Photo 62: DA3B_LW16_030, looking at width of localised erosion. Taken on 31/08/2020.



Photo 63: DA3B_LW16_030, looking at measurable depth of localised erosion. Taken on 31/08/2020.

DA3B_LW16_031

DA3B_LW16_031 is located on a step to the north-west of tributary WC15 (Figure 3). The impact is comprised of two vertical rock fractures and a rockfall (Photo 64 and Photo 65). The largest rock fracture has an approximate length of 1.5m and approximate maximum width of 0.005m. The rockfall consists of 10 pieces with an average volume of approximately 0.1m x 0.2m x 0.1m. The impact appears to be from a previous longwall, likely Longwall 15. DA3B_LW16_031 was inspected on 1 December 2020 and remains unchanged from original identification.

Level 1: Crack or fracture up to 100mm width, and/or, crack or fracture up to 10m length, and/or, rockfall from a cliff (step) which is left mostly intact (<10% length) resulting in insignificant ground disturbance.



Photo 64: DA3B_LW16_031, looking at the rock fracturing. Taken on 28/09/2020.



Photo 65: DA3B_LW16_031, looking at the rockfall. Taken on 28/09/2020.

DA3B_LW16_032

DA3B_LW16_032 is located approximately 220m north of Longwall 16 and to the north-west of WC15, a tributary to Wongawilli Creek (Figure 3). The impact is comprised of three separate soil cracks within a 10m length (Photo 66 and Photo 67). The largest soil crack has a maximum length of 0.55m, a maximum width of 0.095m and a maximum measurable depth of 0.48m. On 30 November 2020, signs of natural remediation to the soil cracking were observed.

Level 1: Crack or fracture up to 100mm width, and/or, crack or fracture up to 10m length.



Photo 66: DA3B_LW16_032, looking at the length of soil cracking. Taken on 28/09/2020.



Photo 67: DA3B_LW16_032, looking at the width of soil cracking. Taken on 28/09/2020.

DA3B_LW16_035

DA3B_LW16_035 is located approximately 15m from SLMMP site A3B-SS17 and was mined beneath by Longwall 16 on 11 September 2020 (Figure 3). The impact is comprised of soil cracking and displacement underneath a boulder (Photo 68 and Photo 69). The soil cracking has an approximate length of 1m and an approximate width of 0.015m. The rock displacement has an approximate width of 0.015m. Measurements have been approximated due to safety concerns accessing beneath a step during active subsidence. On 30 November 2020, signs of natural remediation to the soil cracking and displacement were observed. An additional rockfall was also present with a maximum volume of 0.04m x 0.15m x 0.4m.

Level 1: Crack or fracture up to 100mm width, and/or, crack or fracture up to 10m length, and/or, surface movement or rock displacement with negligible soil surface exposed.



Photo 68: DA3B_LW16_035, looking at a section of soil cracking. Taken on 28/09/2020.



Photo 69: DA3B_LW16_035, looking at a section of displacement. Taken on 28/09/2020.



Photo 70: DA3B_LW16_035, looking at the rock fall. Taken on 30/11/2020.

DA3B_LW16_036

DA3B_LW16_036 is located at SLMMP site A3B-SS17 and was mined beneath by Longwall 16 on 11 September 2020 (Figure 3). The impact is comprised of a rock fracture to the base of a 2.5m step (Photo 71). The rock fracture has an approximate length of 1m and approximate width of 0.04m. Measurements have been approximated due to safety concerns accessing beneath a step during active subsidence. DA3B_LW16_036 was inspected on 30 November 2020 and remains unchanged from original identification.

Level 1: Crack or fracture up to 100mm width, and/or, crack or fracture up to 10m length.



Photo 71: *DA3B_LW16_036*, looking at a section of rock fracturing. Taken on 28/09/2020.

DA3B_LW16_044

DA3B_LW16_044 consists of approximately 20m of discontinuous soil cracking, rock fracturing and rock-soil displacement along a steep slope, to the east of *Swamp 14* (Figure 3). The site was undermined by Longwall 16 on 21 September 2020. The longest single crack or fracture is 2m in length, with a maximum width of 0.15m and a maximum measurable depth of up to 0.6m (Photo 72 to Photo 74). The rock displacement is up to 0.05m wide (Photo 75). *DA3B_LW16_044* was inspected on 30 November 2020 and remains unchanged from original identification.

Level 2: Crack or fracture between 100mm and 300mm width.



Photo 72: *DA3B_LW16_044*, looking at length of soil cracking. Crack runs in orientation of tape measure. Taken on 10/11/2020.

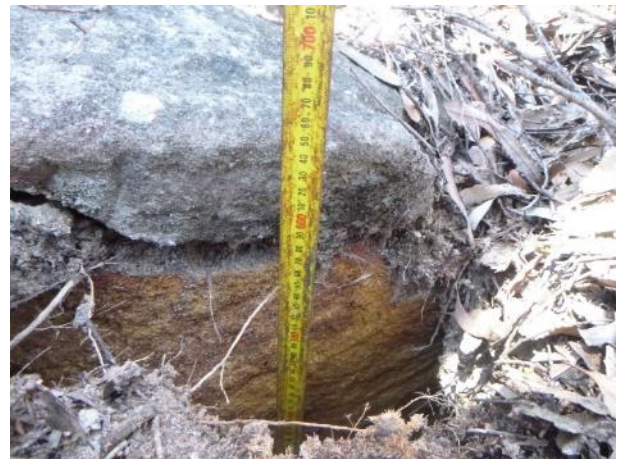


Photo 73: *DA3B_LW16_044*, looking at depth of rock fracturing. Taken on 10/11/2020.



Photo 74: DA3B_LW16_044, looking at width of rock fracturing. Taken on 10/11/2020.



Photo 75: DA3B_LW16_044, looking at rock displacement from soil. Taken on 10/11/2020.

DA3B_LW16_045

DA3B_LW16_045 consists of rock fracturing to a steep slope east of *Swamp 14* (Figure 3). The site was undermined by Longwall 16 on 17 September 2020. The rock fracturing has a maximum length of 2m, a maximum width of 0.06m and a maximum measurable depth of 1.1m (Photo 76 and Photo 78). DA3B_LW16_045 was inspected on 30 November 2020 and remains unchanged from original identification.

Level 1: Crack or fracture up to 100mm width, and/or, crack or fracture up to 10m length.



Photo 76: DA3B_LW16_045, looking at depth of rock fracturing. Taken on 10/11/2020.



Photo 77: DA3B_LW16_045, looking at length of rock fracturing. Taken on 10/11/2020.



Photo 78: DA3B_LW16_045, looking at width of rock fracturing. Taken on 10/11/2020.

DA3B_LW16_046

DA3B_LW16_046 consists of a rock fracture to a steep slope/step east of *Swamp 14* (Figure 3). The site was mined beneath by Longwall 16 on 10 September 2020. The rock fracture has a length of 1.8m, a maximum width of 0.01m and a maximum measurable horizontal depth of 0.5m (Photo 79 and Photo 80).

Level 1: Crack or fracture up to 100mm width, and/or, crack or fracture up to 10m length.



Photo 79: DA3B_LW16_046, looking at the rock fracture. Taken on 25/11/2020.



Photo 80: DA3B_LW16_046, looking at the rock fracture. Taken on 25/11/2020.

DA3B_LW16_047

DA3B_LW16_047 consists of three rock fractures on a steep slope/step to the east of *Swamp 14* (Figure 3). The site was mined beneath by Longwall 16 on 11 September 2020. The rock fracturing has a maximum length of 1.2m, a maximum width of 0.005m and a maximum measurable depth of 0.11m (Photo 81 and Photo 82)

Level 1: Crack or fracture up to 100mm width, and/or, crack or fracture up to 10m length.



Photo 81: DA3B_LW16_047, looking at a section of the rock fracturing. Taken on 30/11/2020.



Photo 82: DA3B_LW16_047, looking at the width of the rock fracturing. Taken on 30/11/2020.

DA3B_LW16_048

DA3B_LW16_048 consists of a rock fracture to a rock outcrop to the west of *Swamp 14* (Figure 3). The site was mined beneath by Longwall 16 on 22 July 2020. The rock fracture has a maximum length of 5.3m, a maximum width of 0.035m and a maximum measurable depth of 0.76m (Photo 83 and Photo 84).

Level 1: Crack or fracture up to 100mm width, and/or, crack or fracture up to 10m length.



Photo 83: DA3B_LW16_048, looking at the length of rock fracturing. Taken on 30/11/2020.



Photo 84: DA3B_LW16_048, looking at the width of rock fracturing. Taken on 30/11/2020.

DA3B_LW16_049

DA3B_LW16_049 consists of five rock fractures and associated fragmentation to a steep slope/step to the west of *Swamp 14* (Figure 3). The site was mined beneath by Longwall 16 on 18 July 2020. The rock fracturing has a maximum continuous length of 12m and a maximum width of 0.004m. The rock fragmentation has maximum dimensions of 0.15m x 0.05m x 0.02m (Photo 85 and Photo 86).

Level 2: Crack or fracture between 10m and 50m length.



Photo 85: DA3B_LW16_049, looking at a section of rock fracturing. Taken on 30/11/2020.



Photo 86: DA3B_LW16_049, looking at the rock fragmentation. Taken on 30/11/2020.

DA3B_LW16_050

DA3B_LW16_050 consists of a rock fracture to a steep slope/step to the west of *Swamp 14* (Figure 3). The site was mined beneath by Longwall 16 on 24 July 2020. The rock fracture has a maximum length of 2.5m, a maximum width of 0.055m and a maximum measurable depth of 0.56m (Photo 87 and Photo 88).

Level 1: Crack or fracture up to 100mm width, and/or, crack or fracture up to 10m length.



Photo 87: DA3B_LW16_050, looking at the length of the rock fracture. Taken on 30/11/2020.

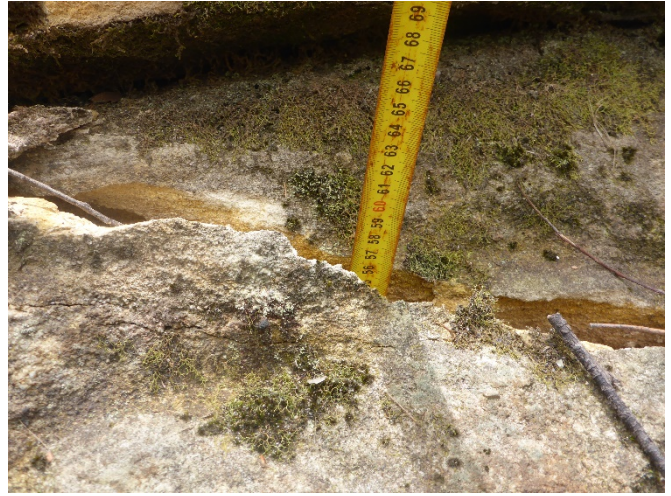


Photo 88: DA3B_LW16_050, looking at the depth of the rock fracture. Taken on 30/11/2020.

DA3B_LW16_051

DA3B_LW16_051 consists of 32m of discontinuous soil cracking, rock fracturing and rock movement to a rock outcrop and bushland to the west of *Swamp 14* (Figure 3). The site was mined beneath by Longwall 16 on 17 July 2020. The impact has a maximum continuous length of 20m, maximum width of 0.2m and a maximum measurable depth of 0.93m (Photo 89 to Photo 91). The cracking has been flagged with caution tape to highlight the cracking to anyone walking in the area.

Level 2: Crack or fracture between 10m and 50m length, and/or, crack or fracture between 100 and 300mm width.



Photo 89: DA3B_LW16_051, looking at the maximum width. Taken on 30/11/2020.



Photo 90: DA3B_LW16_051, looking at the maximum depth. Taken on 30/11/2020.



Photo 91: DA3B_LW16_051, looking at a section of soil cracking and rock fracturing. Taken on 30/11/2020.

DA3B_LW16_052

DA3B_LW16_052 consists of 4.7m of discontinuous soil cracking in bushland to the west of *Swamp 14* (Figure 3). The site was mined beneath by Longwall 15 on 8 October 2019. The impact has a maximum continuous length of 1.3m, a maximum width of 0.09m and a maximum measurable depth of 0.2m (Photo 92 and Photo 93).

Level 1: Crack or fracture up to 100mm width, and/or, crack or fracture up to 10m length.



Photo 92: DA3B_LW16_052, looking at a section of soil cracking. Taken on 1/12/2020.



Photo 93: DA3B_LW16_052, looking at the maximum width. Taken on 1/12/2020.

DA3B_LW15_002 Update

DA3B_LW15_002 is located on a 4m step adjacent to Swamp 23 (Figure 2). The site was undermined by Longwall 15 on 25 April 2019 and is located approximately 100m from the start of Longwall 16. The impact was previously reported as a rockfall. On 5 May 2020, additional rock fracturing was identified 5m from the rockfall (Photo 94 and Photo 95). The rock fracturing has a maximum length of 1.3m, a maximum width of 0.005m and maximum measurable depth of 0.15m. On 2 December 2020, the maximum width of fracturing was observed to have increased to 0.01m (Photo 96).

Level 1: Crack or fracture up to 100mm width, and/or, crack or fracture up to 10m length, and/or, rockfall from a cliff (step) which is left mostly intact (<10% length) resulting in insignificant ground disturbance.



Photo 94: DA3B_LW15_002, looking at a section of rock fracturing. Taken on 05/05/2020.



Photo 95: DA3B_LW15_002, looking at the width of rock fracturing. Taken on 05/05/2020.



Photo 96: DA3B_LW15_002, looking at a section of rock fracturing. Taken on 2/12/2020.

DA3B_LW15_026 Update

DA3B_LW15_026 is an impact site located at SLMMP monitoring location A3b-SS13, situated at a steep slope/step between *Swamp 14* and *Fire Road 6P* (Figure 3). Impacts were originally identified on 21 January 2020 after being mined beneath by Longwall 15. On 24 August 2020, an update to the rock fracturing was observed. An additional fracture was observed, up to 1.6m long and 0.005m wide, with the fracture extending under a slight overhang (Photo 97). A second fracture to a boulder/outcrop was also observed and is approximately 0.02m wide and 0.65m long, extending 0.25m in to the boulder (Photo 98).

Level 1: Crack or fracture up to 100mm width, and/or, crack or fracture up to 10m length.



Photo 97: DA3B_LW15_026, looking at a section of rock fracturing. Taken on 24/08/2020.



Photo 98: DA3B_LW15_026, looking at fracture to boulder. Taken on 24/08/2020.

7 TARP TRIGGERS

7.1 Shallow Groundwater

14_01 (Swamp 14)

A near-surface groundwater trigger was recorded at borehole 14_01 during analysis of piezometer data for Swamp 14 (Figure 3). Longwall 15 triggers for water level and soil moisture were reported on 16 January 2020. On 21 June 2020, the site entered the 400m buffer zone of Longwall 16 and on 8 August 2020 was mined under by Longwall 16. Both water level and soil moisture fully recovered following the August rainfall. Following the recovery, the rate of water level recession (3.37 mm/hour calculated between 5/09/20 0:00 and 9/09/20 9:00) has exceeded the rate recorded at the same depth interval before mining (1.96 mm/hour calculated between 8/09/18 7:00 and 15/09/18 19:00) (Figure 5). Groundwater level at the site continued to recede and on 27 September 2020, the borehole was observed to be dry. This is the first time the borehole has been observed as dry since groundwater monitoring commenced at the site.

Level 3: Rate of groundwater level reduction exceeds rate of groundwater level reduction during baseline period at >80% of monitoring sites (within 400 m of mining) within the swamp.

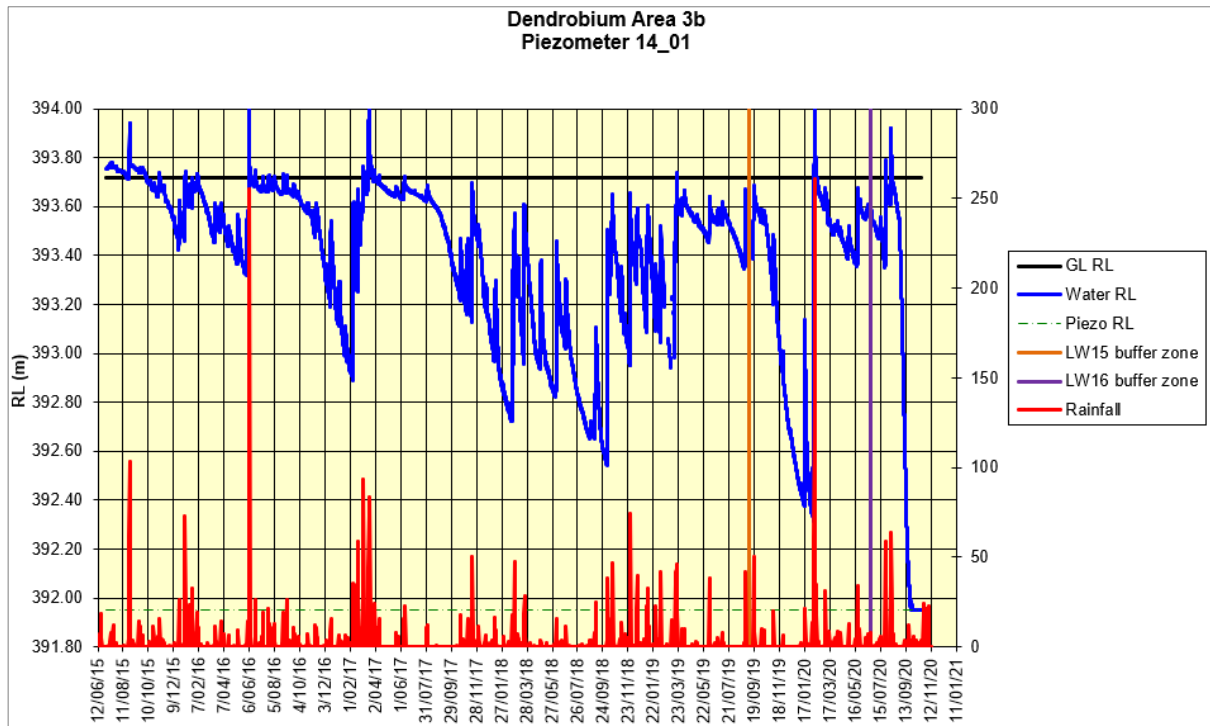


Figure 5: Near-surface groundwater levels at 14_01, logged hourly. Date range: 02/07/2015 to 20/10/2020.

23_02 (Swamp 23)

A near-surface groundwater trigger was recorded at borehole 23_02 during analysis of piezometer data for Swamp 23. The borehole is located approximately 20m to the north of Longwall 16 (Figure 2). The rate of water level recession (0.94 mm/hour calculated between 04/04/2020 04:00 and 27/04/2020 09:00) has exceeded the rate recorded at the same depth interval before mining (0.73 mm/hour calculated between 13/02/2016 12:00 and 14/03/2016 16:00) (Figure 6).

Level 3: Rate of groundwater level reduction exceeds rate of groundwater level reduction during baseline period at >80% of monitoring sites (within 400 m of mining) within the swamp.

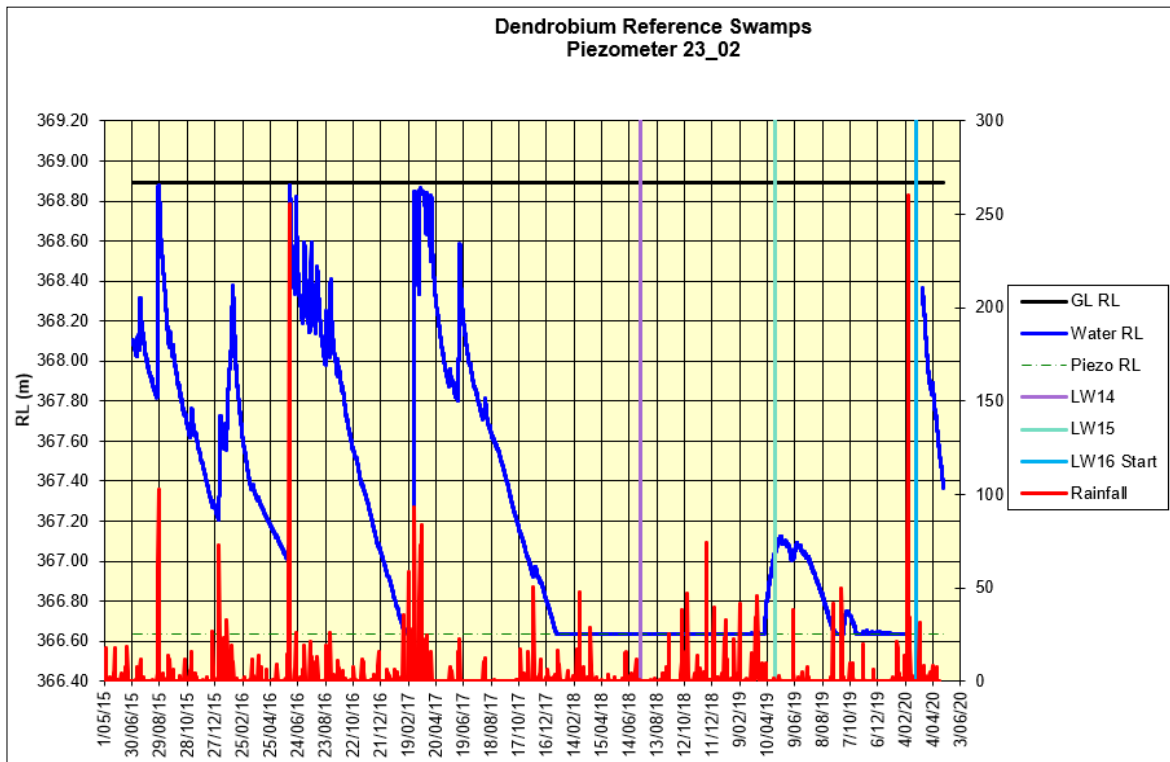


Figure 6: Near-surface groundwater levels at 23_02, logged hourly. Date range: 01/05/2015 to 27/04/2020.

11_H2 (Swamp 11)

A near-surface groundwater trigger was recorded at borehole 11_H2 during analysis of piezometer data for Swamp 11 (Figure 2). Piezometer 11_H2 was mined beneath by Longwall 14 on 12 June 2018. Analysis of records at 11_H2 show the groundwater level being lower than the lowest data recorded during the baseline period (Figure 7). At that time water level recessing below the baseline was considered to be a result of a very low rainfall because this occurred nine months after longwall 13 passed the hole. A groundwater level trigger for borehole 11_H1 was reported on 20 July 2018 during the extraction of Longwall 13.

Level 2: Groundwater level lower than baseline level at 50% of monitoring sites (within 400m of mining) within a swamp (in comparison to reference swamps).

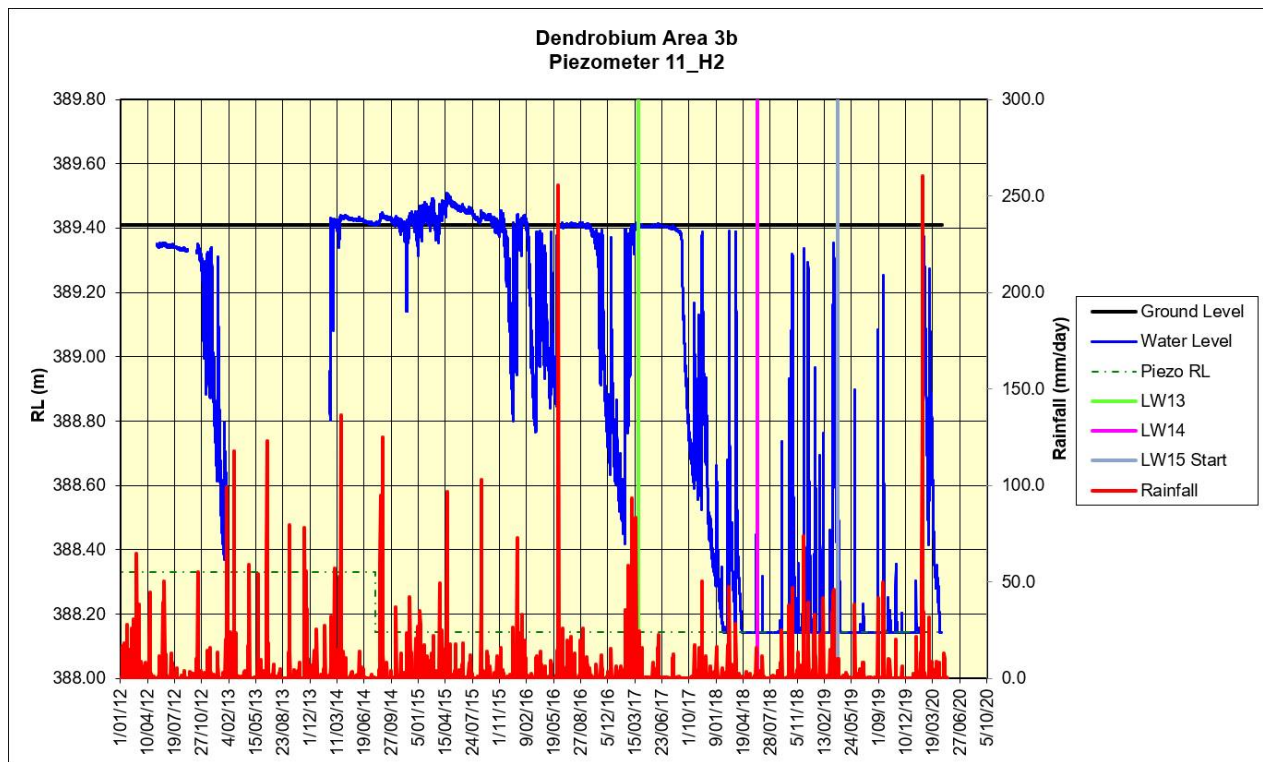


Figure 7: Near-surface groundwater levels at 11_H2, logged hourly. Date range: 16/05/2012 to 20/04/2020.

7.2 Water Quality

LA4_S1

LA4 is a small tributary of Lake Avon that flows southward from DA3B mining operations (Figure 2). The LA4 sub catchment was mined beneath by Longwall 12 in April 2016 and Longwall 13 in March 2017. Rock fracturing and subsequent flow diversion was recorded in the tributary following extraction of Longwall 12 and 13. This led to a reduction of surface water at the site. As a result, water sampling was unable to be undertaken at the site from mid-2017 until 3 August 2020, following 160mm rainfall event (as recorded at Cordeaux Colliery, in the previous 7-day period). On 3 August 2020, water quality parameters exceeded the TARP level for dissolved oxygen (DO), electrical conductivity (EC), and pH (Figure 8 to Figure 10). On 1 September 2020, water quality parameters exceeded the TARP level for EC and pH. On both occasions, surface flow was observed entering the site; however, flow was then diverted subsurface directly downstream through existing surface fractures.

Level 1: One exceedance of the ± 3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean within six months:

- DO 69.5%

Level 2: Two exceedance of the ± 3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean within six months:

- pH 4.90
- EC 129.8 $\mu\text{S/cm}$

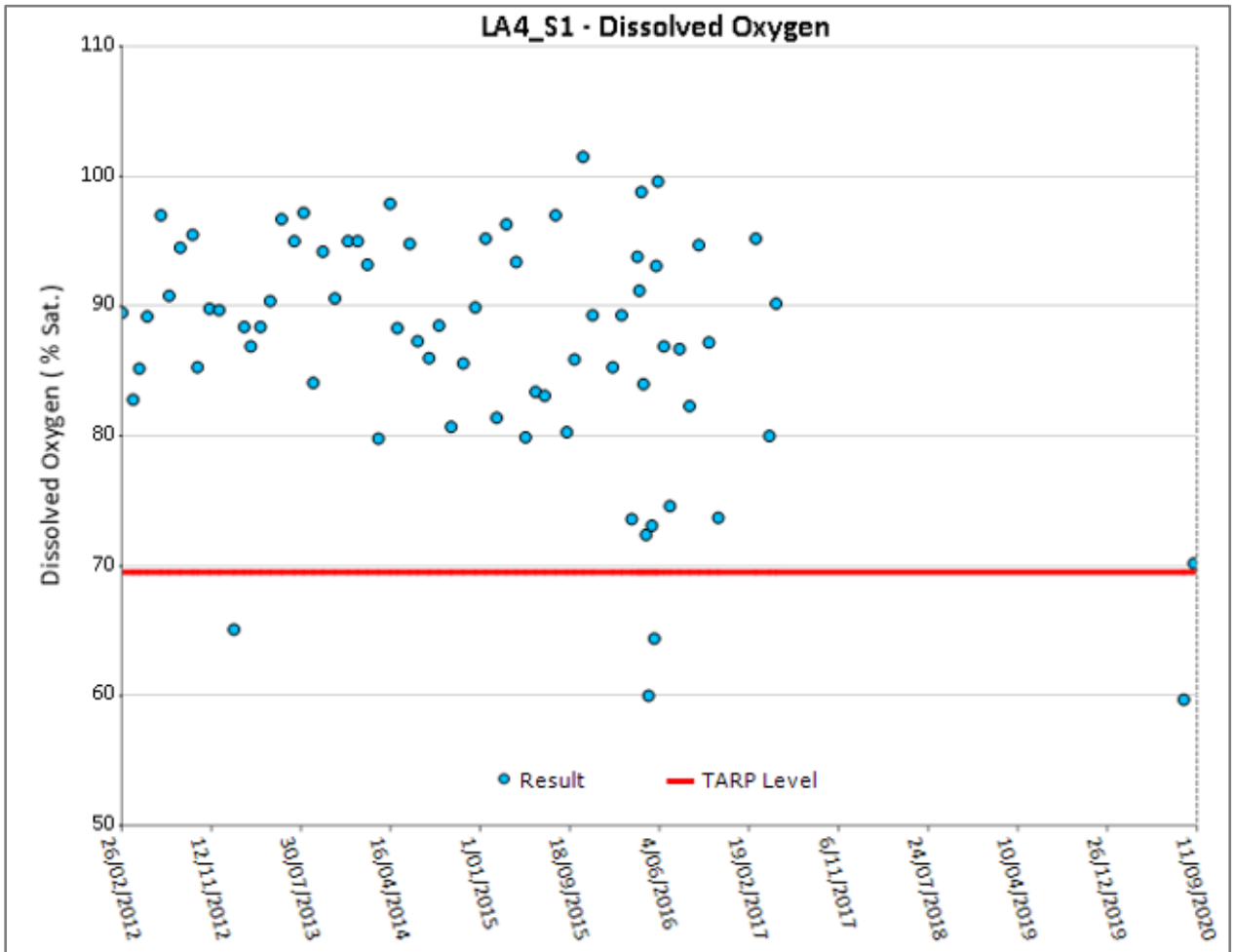


Figure 8: Dissolved oxygen results recorded at LA4_S1, a water quality monitoring site on Lake Avon tributary LA4.

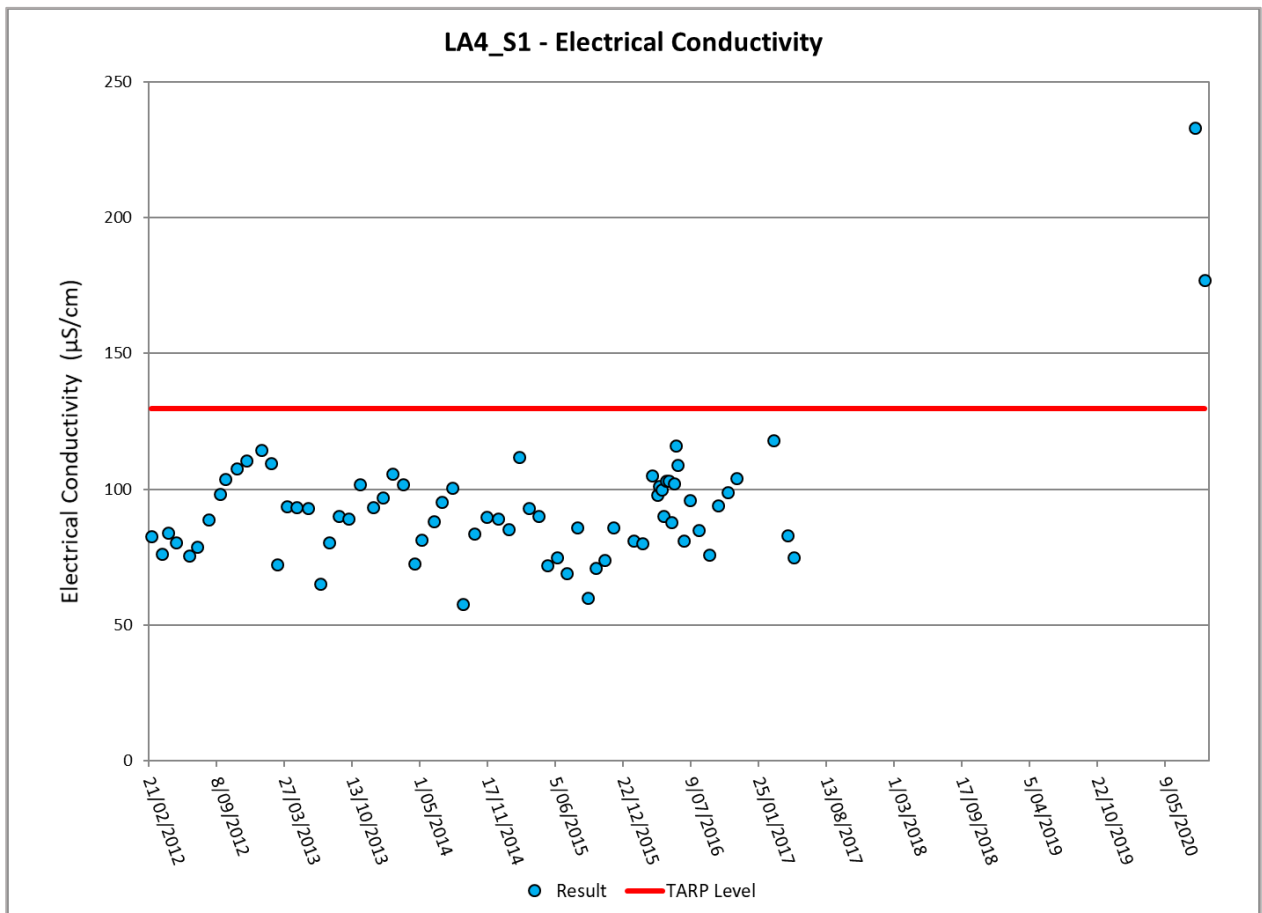


Figure 9: Electrical conductivity results recorded at LA4_S1, a water quality monitoring site on Lake Avon tributary LA4.

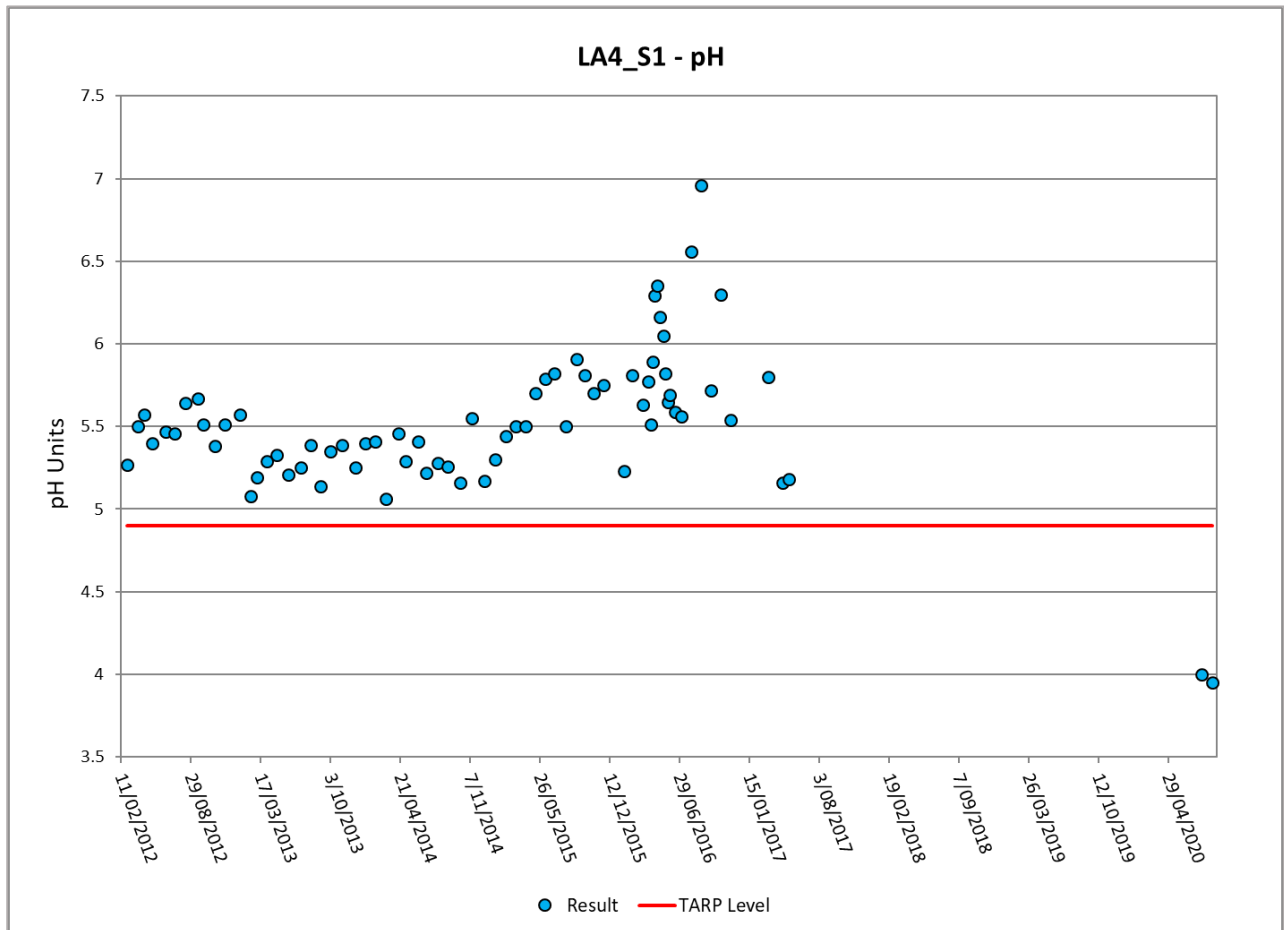


Figure 10: pH results recorded at LA4_S1, a water quality monitoring site on Lake Avon tributary LA4.

Donalds Castle Creek (FR6)

Donalds Castle Creek runs northwards from DA3B. Its headwaters were mined beneath by early DA3B panels (Figure 3). During inspection of *Donalds Castle Ck (FR6)*, EC exceeded the trigger level of 185.8µS/cm on 5 occasions; between 20 May 2020 and 21 July 2020 (Figure 11). EC values during this period ranged from 158µS/cm to 196µS/cm. Quarterly longitudinal surveys are being completed in response to the water quality triggers, as per specialist recommendations. Further specialist advice and assessment will be provided in the Surface and Shallow Groundwater Assessment.

Level 3: Three non-consecutive exceedances of the ±3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean within six months:

- pH <3.60
- EC >185.8 µS/cm
- DO <40.1%

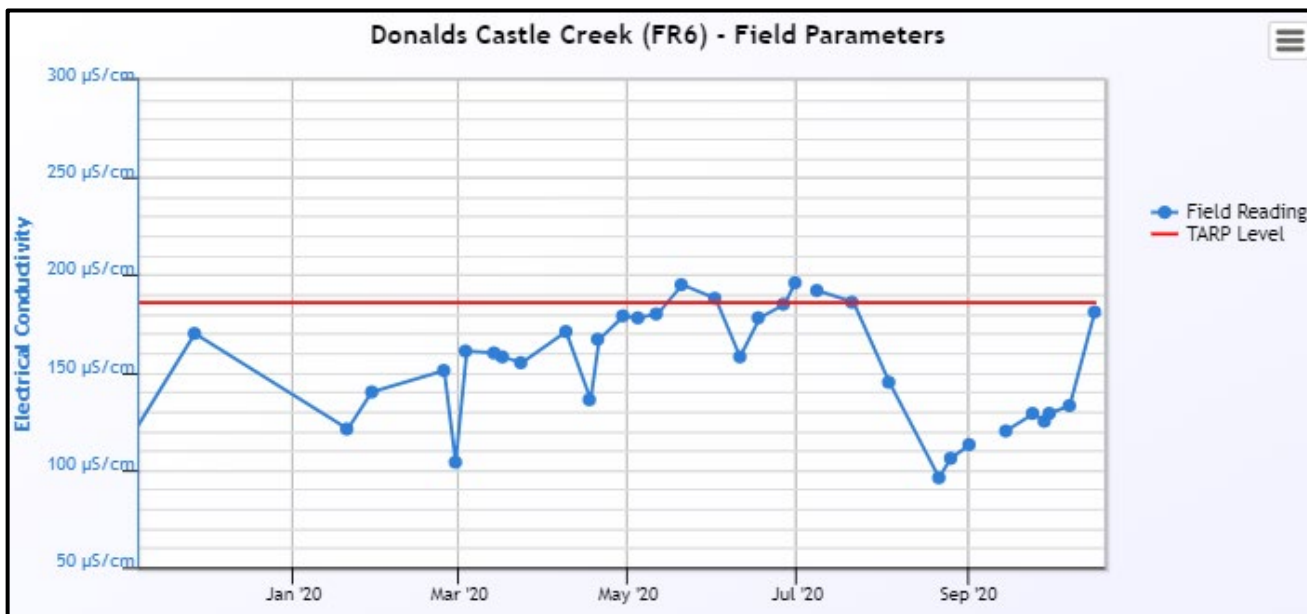


Figure 12: Electrical conductivity results recorded at *Donalds Castle Creek (FR6)* over the past 12 months.

8 IMPACTS TO BUILT FEATURES

A total of 24 surface impacts associated with built features were identified during the extraction of Longwall 16 (Table 3). These features include *Fire Road 6A (FR6A)*, *Fire Road 6P (FR6P)*, *railway corridor ballast* and some smaller unnamed access tracks.

8.1 Level 1 Surface Cracking

A total of 21 impacts (Table 3) to built features were reported as Level 1 in accordance with the Dendrobium Area 3B SMP (Table 8); specifically:

Level 1: 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.



Photo 99: DA3B_LW16_001, soil cracking on access track between Lake Avon and FR6A. Taken on 16/04/2020.



Photo 100: DA3B_LW16_001, soil cracking naturally remediated. Taken on 19/11/2020.



Photo 101: DA3B_LW16_002, soil cracking on access track between Lake Avon and FR6A. Taken on 16/04/2020.



Photo 102: DA3B_LW16_002, soil cracking naturally remediated. Taken on 19/11/2020.



Photo 103: DA3B_LW16_003, soil cracking and rock fracturing on access track between Lake Avon and FR6A. Taken on 22/04/2020.



Photo 104: DA3B_LW16_003, soil cracking and rock fracturing mostly naturally infilled. Taken on 19/11/2020.



Photo 105: DA3B_LW16_004, soil cracking on access track between Lake Avon and FR6A. Taken on 16/04/2020.



Photo 106: DA3B_LW16_004, soil cracking naturally remediated. Taken on 19/11/2020.



Photo 107: DA3B_LW16_006, soil cracking on access track between Lake Avon and FR6A. Taken on 22/04/2020.



Photo 108: DA3B_LW16_006, soil cracking naturally remediated. Taken on 19/11/2020.



Photo 109: DA3B_LW16_007, soil cracking on access track between Lake Avon and FR6A. Taken on 22/04/2020.



Photo 110: DA3B_LW16_007, soil cracking mostly naturally remediated. Taken on 19/11/2020.

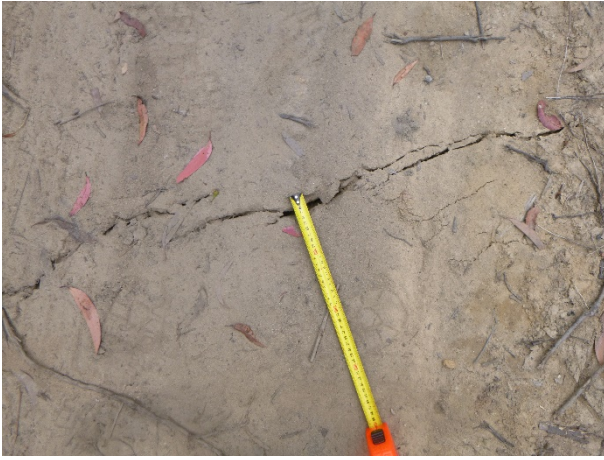


Photo 111: DA3B_LW16_008, soil cracking on access track between Lake Avon and FR6A. Taken on 27/04/2020.



Photo 112: DA3B_LW16_008, soil cracking naturally remediated. Taken on 19/11/2020.



Photo 113: DA3B_LW16_009, soil cracking on rehabilitated access track between Lake Avon and FR6A. Taken on 27/04/2020.



Photo 114: DA3B_LW16_009, soil cracking naturally remediated. Taken on 19/11/2020.



Photo 115: DA3B_LW16_014, soil cracking on access track between Lake Avon and FR6A. Taken on 12/05/2020.



Photo 116: DA3B_LW16_014, soil cracking naturally remediated. Taken on 19/11/2020.



Photo 117: DA3B_LW15_008 (Update), soil cracking and uplift on FR6A. Taken on 12/05/2020.



Photo 118: DA3B_LW15_008 (Update), soil cracking and uplift naturally remediated. Taken on 24/11/2020.



Photo 119: DA3B_LW16_020, soil cracking on FR6A. Taken on 30/06/2020.



Photo 120: DA3B_LW16_020, soil cracking naturally remediated. Taken on 19/11/2020.



Photo 121: DA3B_LW16_023, cracking across Fire Road 6A. Taken on 7/07/2020.



Photo 122: DA3B_LW16_023, cracking partly naturally remediated. Taken on 7/07/2020.



Photo 123: DA3B_LW16_027, soil cracking across Fire Road 6P. Taken on 21/08/2020.



Photo 124: DA3B_LW16_027, signs of natural remediation observed. Taken on 30/11/2020.



Photo 125: DA3B_LW16_033, section of soil cracking on access track parallel to WC15. Taken on 28/09/2020.



Photo 126: DA3B_LW16_033, soil cracking naturally remediated. Taken on 30/11/2020.

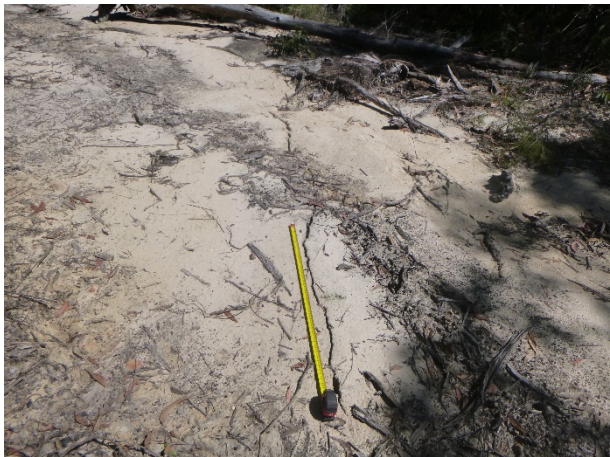


Photo 127: DA3B_LW16_034, looking at the length of soil cracking on access track parallel to WC15. Taken on 28/09/2020.



Photo 128: DA3B_LW16_034, soil cracking naturally remediated. Taken on 30/11/2020.

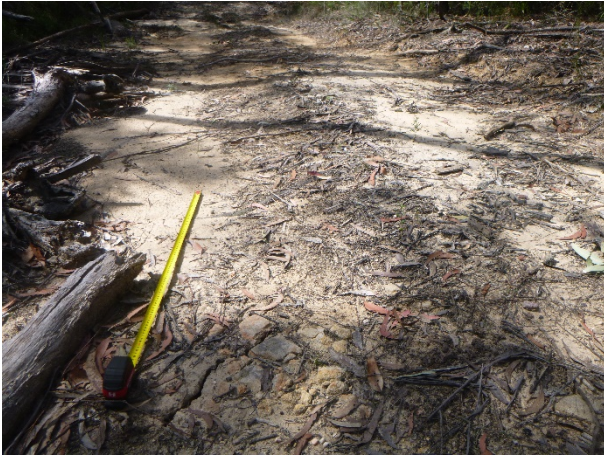


Photo 129: DA3B_LW16_037, overview of soil cracking at SLMMP site A75-SLMMP. Taken on 28/09/2020.



Photo 130: DA3B_LW16_037, small soil crack expected to naturally remediate. Taken on 28/09/2020.



Photo 131: DA3B_LW16_039, soil cracking to access track east of Swamp 14. Taken on 7/10/2020.



Photo 132: DA3B_LW16_039, soil cracking naturally remediated. Taken on 30/11/2020.



Photo 133: DA3B_LW16_040, soil cracking to access track east of Swamp 14. Taken on 7/10/2020.



Photo 134: DA3B_LW16_040, no change to soil cracking. Taken on 30/11/2020.



Photo 135: DA3B_LW16_041, soil cracking to access track east of Swamp 14. Taken on 7/10/2020.



Photo 136: DA3B_LW16_041, displacement of soil from rock outcrop on access track east of Swamp 14. Taken on 7/10/2020.



Photo 137: DA3B_LW16_041, soil cracking naturally remediated. Taken on 30/11/2020.

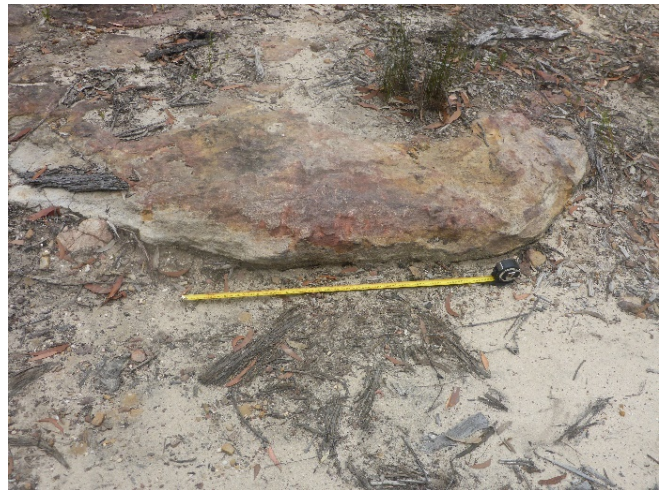


Photo 138: DA3B_LW16_041, soil displacement naturally remediated. Taken on 30/11/2020.



Photo 139: DA3B_LW16_042, soil cracking to access track east of Swamp 14. Taken on 7/10/2020.



Photo 140: DA3B_LW16_042, soil cracking naturally remediated. Taken on 30/11/2020.



Photo 141: DA3B_LW16_043, soil cracking to access track east of Swamp 14. Taken on 7/10/2020.



Photo 142: DA3B_LW16_043, soil cracking naturally remediated. Taken on 30/11/2020.

8.2 Level 2 Surface Cracking

Three impacts (Table 3) to built features were reported as Level 2 in accordance with the DA3B SMP (Table 8); specifically:

Level 2: Crack or fracture between 100mm and 300mm width.

Crack in the fire trail, which could result in significant erosion or impede vehicle access.

Crack or fracture between 10m and 50m length.



Photo 143: DA3B_LW16_005, soil cracking to access track between Lake Avon and FR6A. Taken on 22/04/2020.



Photo 144: DA3B_LW16_005, soil cracking remediated naturally. Taken on 19/11/2020.



Photo 145: DA3B_LW16_013, soil cracking to access track between Lake Avon and FR6A. Taken on 12/05/2020.



Photo 146: DA3B_LW16_013, soil cracking following a rainfall event. Taken on 28/05/2020.



Photo 147: DA3B_LW16_013, looking at the remediated access track. Taken on 11/06/2020.



Photo 148: DA3B_LW16_013, looking at soil cracking adjacent to access track. Taken on 19/11/2020.



Photo 149: DA3B_LW16_019, looking at length of soil cracking on FR6A. Taken on 23/06/2020.



Photo 150: DA3B_LW16_019, looking at depth of cracking on FR6A. Taken on 23/06/2020.



Photo 151: DA3B_LW16_019, remediated soil cracking on FR6A. Taken on 29/06/2020.



Photo 152: DA3B_LW16_019, looking at soil cracking adjacent to FR6A. Taken on 19/11/2020

8.3 Remediation

Following approval from WaterNSW, remediation was undertaken to surface cracking across *FR6A* and an access track between *Lake Avon* and *FR6A*. Some additional remediation was required following a large rainfall event. Minor soil cracks in other areas have, or are expected to continue to, infill through natural processes.

9 CURRENT AND FUTURE MONITORING

Monitoring undertaken during Longwall 16 and recommendations for future monitoring in Dendrobium Area 3B, particularly concerning Longwall 17, are outlined in Table 4. These recommendations are based on monitoring commitments in the Dendrobium Area 3B SMP, WIMMCP and SIMMCP and the proximity of sites to future longwalls.

The monthly post mining period of 2 years has lapsed for the below features:

- Tributaries WC16 and WC18- monitoring at these sites will be discontinued;
- Swamps 3, 4, 5 and 8- These will be monitored at a reduced frequency.

Table 4: Monitoring associated with Longwall 16 and recommendations for monitoring during extraction of Longwall 17.

ASPECT	MONITORING SITES ASSOCIATED WITH LONGWALL 16	MONITORING REQUENCY	RECOMMENDED FUTURE MONITORING FOR LONGWALL 17
Watercourses	Observational, Photo Point and Water Monitoring		
	<ul style="list-style-type: none"> • Donalds Castle Creek • Lake Avon • LA2 • LA3 • LA4A • Swamp 23 • Swamps 5, 10, 11, 13 and 14 • WC12 • WC15, WC16 and WC21 • Wongawilli Creek • WC6, WC7, WC8, WC9, ND1 • Swamp 35a/b • Native Dog Creek 	<p>Monthly 2 years pre and post mining, weekly when longwall is within 400m of monitoring site</p> <p>SLMMP Sites: pre and post mining, monthly when longwall is within 400m of monitoring site</p>	<ul style="list-style-type: none"> • Donalds Castle Creek • Lake Avon • LA2 • LA3 • LA4A • Swamp 23 • Swamps 10, 11, 13 and 14 • WC12 • WC15 and WC21 • Wongawilli Creek • WC6, WC7, WC8, WC9 • Swamp 35a/b • Native Dog Creek • ND1, ND1C
	Water Quality		
	<p>Wongawilli Creek</p> <ul style="list-style-type: none"> • WWU1 (Wongawilli Creek headwaters) • WWU4 (Wongawilli Creek upstream) • WC_Pool 49 (Wongawilli Creek adjacent to LW15) • WC_Pool 46 (Wongawilli Creek adjacent to LW12) • WWM2 (Wongawilli Creek adjacent to LW11) • WC_Pool 43b (Wongawilli Creek downstream of LW9) • Wongawilli Ck (FR6) (Wongawilli Creek downstream) • WC21_Pool 5 (Wongawilli Creek tributary downstream of mining) • WC21_Pool 30 (Wongawilli Creek tributaries over mining) 	<p>Monthly monitoring during and post mining for two years until required</p>	<p>Wongawilli Creek</p> <ul style="list-style-type: none"> • WWU1 (Wongawilli Creek headwaters) • WWU4 (Wongawilli Creek upstream) • WC_Pool 49 (Wongawilli Creek adjacent to LW15) • WC_Pool 46 (Wongawilli Creek adjacent to LW12) • WWM2 (Wongawilli Creek adjacent to LW11) • WC_Pool 43b (Wongawilli Creek downstream of LW9) • Wongawilli Ck (FR6) (Wongawilli Creek downstream) • WC21_Pool 5 (Wongawilli Creek tributary downstream of mining)

	<ul style="list-style-type: none"> • WC21_Pool 53 (Wongawilli Creek tributary over mining) • WC12_Pool 1 (Wongawilli Creek tributary downstream of mining) • WC15_Pool 9 (Wongawilli Creek tributary downstream of mining) <p>Lake Avon</p> <ul style="list-style-type: none"> • LA_1, LA1, LA2_Pool 5, LA3_Pool 4 <p>Donalds Castle Creek</p> <ul style="list-style-type: none"> • Donalds Castle Ck (FR6) (Donalds Castle Creek lower) • DC_Pool 22 (Donalds Castle Creek downstream of mining) • DCL3 (Donalds Castle Creek further downstream site) <p>Reference Site</p> <ul style="list-style-type: none"> • LC5_S1 		<ul style="list-style-type: none"> • WC21_Pool 30 (Wongawilli Creek tributaries over mining) • WC21_Pool 53 (Wongawilli Creek tributary over mining) • WC12_Pool 1 (Wongawilli Creek tributary downstream of mining) • WC15_Pool 9 (Wongawilli Creek tributary downstream of mining) <p>Lake Avon and Tributaries</p> <ul style="list-style-type: none"> • LA_1, LA1, LA2_Pool 5, LA3_Pool 4 <p>Donalds Castle Creek</p> <ul style="list-style-type: none"> • Donalds Castle Ck (FR6) (Donalds Castle Creek lower) • DC_Pool 22 (Donalds Castle Creek downstream of mining) • DCL3 (Donalds Castle Creek further downstream site) <p>Native Dog Creek</p> <ul style="list-style-type: none"> • NDC_Pool 1 • ND1_Pool 2 • ND2_Pool 3 <p>Reference Site</p> <ul style="list-style-type: none"> • LC5_S1 • NDC1
Swamps	Observational, Photo Point and Water Monitoring		
	<ul style="list-style-type: none"> • Swamps 5, 10, 11, 13, 14 and 23, 35a/b 	Pre and post mining for two years, monthly when longwall is within 400m of monitoring site	<ul style="list-style-type: none"> • Swamps 10, 11, 13, 14 and 23, 35a/b
	Shallow Groundwater Level		
	<ul style="list-style-type: none"> • Swamp 05: 05_01, 05_02, 05_03, 05_03i, 05_03ii, 05_03iii, 05_04, 05_05, 05_06 • Swamp 10: 10_01 • Swamp 11: S11-H1, S11-H2, S11-H3 • Swamp 13: 13_01 • Swamp 14: 14_01, 14_02 • Swamp 23: 23_01, 23_02 <p>Reference Sites</p> <ul style="list-style-type: none"> • Swamp 2: 02_S01 • Swamp 7: 07_S05, 07_S06 • Swamp 15A: S15a_S01, S15a_Piezo, S15a_S04, S15a_S06 • Swamp 22: 22_01, 22_02 • Swamp 25: S25_S01 • Swamp 33: S33_S01, S33_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 	<p>For open hole sites:</p> <ul style="list-style-type: none"> • Monthly monitoring pre, during and post mining for two years to be removed annually • Reference sites 6 monthly <p>For instrumented sites:</p> <ul style="list-style-type: none"> • Automatic groundwater level monitoring, during and post mining (4 hour interval or similar) • Monitoring post mining for five years to be reviewed annually 	<ul style="list-style-type: none"> • Swamp 05: 05_01, 05_04, • Swamp 10: 10_01 • Swamp 11: S11-H1, S11-H2, S11-H3 • Swamp 13: 13_01 • Swamp 14: 14_01, 14_02 • Swamp 23: 23_01, 23_02 • Swamp 35a: 35a_01 • Swamp 35b: 35b_01 <p>Reference Sites</p> <ul style="list-style-type: none"> • Swamp 2: 02_S01 • Swamp 7: 07_S05, 07_S06 • Swamp 15A: S15a_S01, S15a_Piezo, S15a_S04, S15a_S06 • Swamp 22: 22_01, 22_02 • Swamp 25: S25_S01 • Swamp 33: S33_S01, S33_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
	Soil Moisture		
	<ul style="list-style-type: none"> • Swamp 05: S05_S01, S05_S02, S05_S03, S05_S03i, S05_S03ii, S05_S03iii, S05_S04, S05_S05, S05_S08 • Swamp 11: S11_S01, S11_S02, S11_S05 • Swamp 13: S13_S01, S13_S02, S13_S03 • Swamp 14: 14_01, 14_02 	<ul style="list-style-type: none"> • 6 monthly baseline and reference site monitoring • Weekly monitoring when longwall is within 400m of swamp • 6 monthly monitoring for 2 years post mining 	<ul style="list-style-type: none"> • 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_02 • Swamp 35a: 35a_01 • Swamp 35b: 35b_01

	<ul style="list-style-type: none"> Swamp 23: 23_01, 23_02 Reference Sites: <ul style="list-style-type: none"> 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 		Reference Sites: <ul style="list-style-type: none"> 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: S33_S01, S33_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
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Landscape	Targeted Sites		
	Cliffs No targeted cliff lines associated with Longwall 16 Fire Trails Fire Road 6A (across active mining area) Fire Road 6N Fire Road 6P	<ul style="list-style-type: none"> Monthly monitoring during any subsidence period Monitoring to continue 6 monthly for 2 years following the completion of mining 	Cliffs <ul style="list-style-type: none"> DA3-CF25 DA3-CF26 DA3-CF41 DA3-CF42 DA3-CF43 Fire Trails Fire Road 6A (across active mining area) Fire Road 6N Fire Road 6P
	All mapped cliff, steep slopes, watercourse, swamps and fire trail sites in subsidence area General observation of active mining areas	<ul style="list-style-type: none"> Weekly monitoring when longwall extraction is within 400m of feature 	Continue monitoring of all mapped cliffs, steep slopes, watercourse, swamps and fire trail sites in subsidence area Continue general observation of active mining areas

10 PREDICTED AND OBSERVED IMPACTS

The below table provides a summary of the predicted and observed impacts for Longwall 16 (Table 5).

Table 5: Dendrobium Area 3B Impacts, TARPs & Performance Measures – Longwall 16 End of Panel Report.

Performance Measure	Potential Impacts	Exceeding Prediction	TARP Trigger Level	Observed Impacts/Triggers	Additional Comments
Watercourses					
<p><u>Wongawilli Creek & Donalds Castle Creek</u></p> <p><i>Dendrobium Area 3B SMP Approval:</i></p> <p>Minor environmental consequences including:</p> <ul style="list-style-type: none"> • <i>minor</i> fracturing, gas release and iron staining; and • <i>minor</i> impacts on water flows, water levels and water quality. <p><i>Dendrobium Modified Development Consent:</i></p> <ul style="list-style-type: none"> • Operations shall not cause subsidence impacts at Wongawilli Creek other than “minor 	<p>Minor environmental consequences including: minor fracturing, gas release and iron staining; and minor impacts on water flows, water levels and water quality</p>	<p><u>Observational</u></p> <ul style="list-style-type: none"> • Fracturing within Wongawilli Creek and/or Donalds Castle Creek resulting in diversion of flow such that >10% of the pools (in Wongawilli Creek or Donalds Castle Creek) have water levels lower than baseline period • Measured surface water flow reduction in Wongawilli Creek and/or Donalds Castle 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 	<p><u>Observational</u></p> <p>Level 1</p> <ul style="list-style-type: none"> • 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 	<p>No Level 1 impacts observed</p>	

Performance Measure	Potential Impacts	Exceeding Prediction	TARP Trigger Level	Observed Impacts/Triggers	Additional Comments
<p>impacts” (such as minor fracturing, gas release, iron staining and minor impacts on water flows, water levels and water quality);</p> <ul style="list-style-type: none"> • Operations will not result in reduction (other than negligible reduction) in the quality or quantity of surface water or groundwater inflows to Lake Cordeaux or Lake Avon or surface water inflow to the Cordeaux River at its confluence with Wongawilli Creek. 		<p>attributed to natural variation</p> <ul style="list-style-type: none"> • 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 WONGAWILLI CK (FR6) • Iron staining and associated increases in dissolved iron resulting from the mining is observed in water at the Donalds Castle Creek downstream monitoring site Donalds Castle Ck (FR6) 	<p>Level 2</p> <ul style="list-style-type: none"> • 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 • 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 	No Level 2 impacts observed	
			<p>Level 3</p> <ul style="list-style-type: none"> • 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 	<p>Donalds Castle Creek (FR6)- Three exceedances of the +3 standard deviation level from the baseline mean for electrical conductivity. <i>(Further discussed in Surface and Shallow Groundwater Assessment)</i></p>	See impact report dated: -26/05/2020 -4/06/2020 -2/07/2020

Performance Measure	Potential Impacts	Exceeding Prediction	TARP Trigger Level	Observed Impacts/Triggers	Additional Comments
			<ul style="list-style-type: none"> • Gas release results in vegetation dieback, mortality or loss of aquatic habitat • Observable increase in iron staining within the mining area continues more than 600m from the longwall 		
		<u>Pool Water Level</u> Fracturing resulting in diversion of flow such that >10% of the pools have water levels lower than baseline period	<u>Pool Water Level</u> Level 1 <ul style="list-style-type: none"> • Fracturing not resulting in diversion of flow 	No Level 1 impacts observed	
			Level 2 <ul style="list-style-type: none"> • Fracturing resulting in diversion of flow 	No Level 2 impacts observed	
			Level 3 <ul style="list-style-type: none"> • Fracturing resulting in diversion of flow such that <10% of the pools have water levels lower than baseline period 	No Level 3 impacts observed	

Performance Measure	Potential Impacts	Exceeding Prediction	TARP Trigger Level	Observed Impacts/Triggers	Additional Comments
	<p>Drainage lines</p> <ul style="list-style-type: none"> • Changes in the natural gradient and stream alignment • Changes in the levels of ponding, flooding and scouring of the banks • Surface fracturing • Surface water diversion • Induction of ferruginous springs <p><i>N.B. Not linked specifically to a performance measure</i></p>	<ul style="list-style-type: none"> • 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 Wongawilli CK (FR6) • Iron staining and associated increases in dissolved iron resulting from the mining is observed in water at the Donalds Castle Creek downstream monitoring 	<p>Level 1</p> <ul style="list-style-type: none"> • 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 • One exceedance of the ± 3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean during the monitoring period 	<ul style="list-style-type: none"> • Impact DA3B_LW16_038 – Iron staining present at LA2_Pool34 • LA4_S1- water quality trigger for DO. 	<p>See impact report dated: - 30/09/2020</p> <p>See impact report dated: - 5/08/2020</p>

Performance Measure	Potential Impacts	Exceeding Prediction	TARP Trigger Level	Observed Impacts/Triggers	Additional Comments
		<p>site Donalds Castle Ck (FR6)</p> <ul style="list-style-type: none"> • Mining results in two consecutive exceedances of the ± 3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean during the monitoring period 	<p>Level 2</p> <ul style="list-style-type: none"> • 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 • 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 • Two exceedances of the ± 3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean during the monitoring period 	<ul style="list-style-type: none"> • Impact DA3B_LW16_028 – Rock fracture to rockbar/step above <i>WC15_Pool34</i> • Impact DA3B_LW14_017 (Update) – Additional rock fracturing and displacement on tributary <i>WC15</i> • Impact DA3B_LW14_019 (Update) – Additional rock fracturing, uplift and displacement near tributary <i>WC15</i> • LA4_S1- water quality triggers for pH and EC. 	<p>See impact report dated: - 1/09/2020</p> <p>See impact report dated: - 14/09/2020</p> <p>See impact report dated: - 14/09/2020</p> <p>See impact report dated: - 5/08/2020 - 14/09/2020</p>

Performance Measure	Potential Impacts	<i>Exceeding Prediction</i>	TARP Trigger Level	Observed Impacts/Triggers	Additional Comments
			<p>Level 3</p> <ul style="list-style-type: none"> • 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 • Observable increase in iron staining within the mining area continues more than 600m from the longwall • Three exceedances of the ± 3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean during the monitoring period 	No Level 3 impacts observed	

Performance Measure	Potential Impacts	<i>Exceeding</i> Prediction	TARP Trigger Level	Observed Impacts/Triggers	Additional Comments

SWAMPS

	<p>Falls in surface or near-surface groundwater levels in swamps.</p> <p><i>N.B. not linked specifically to a performance measure and would not be considered a breach if predictions were exceeded.</i></p>		<p>Level 1 Groundwater level lower than baseline level at any monitoring site within a swamp (in comparison to reference swamps); and/or Rate of groundwater level reduction exceeds rate of groundwater level reduction during baseline period at any monitoring site (measured as average mm/day during the recession curve).</p>	No Level 1 impacts observed	
			<p>Level 2 Groundwater level lower than baseline level at 50% of monitoring sites (within 400m of mining) within a swamp (in comparison to reference swamps); and/or Rate of groundwater level reduction exceeds rate of groundwater level reduction during baseline period at a 50% of monitoring sites (within 400m of mining) within the swamp.</p>	<p>• Swamp 11 (11_H2) – Groundwater level lower than baseline level at 50% of monitoring sites (within 400m of mining) within a swamp (in comparison to reference swamps).</p>	See impact report dated: - 18/05/2020

			<p>Level 3 Groundwater level lower than baseline level at >80% of monitoring sites (within 400m of mining) within a swamp (in comparison to reference swamps); and/or Rate of groundwater level reduction exceeds rate of groundwater level reduction during baseline period at >80% of monitoring sites (within 400m of mining) within the swamp.</p>	<p>• Swamp 14 (14_01) – Rate of groundwater level reduction exceeds rate of groundwater level reduction during baseline period at >80% of monitoring sites (within 400 m of mining) within the swamp.</p> <p>• Swamp 23 (23_02) – Rate of groundwater level reduction exceeds rate of groundwater level reduction during baseline period at >80% of monitoring sites (within 400 m of mining) within the swamp.</p>	<p>See impact report dated: - 14/09/2020 - 16/11/2020</p> <p>See impact report dated: - 30/04/2020</p>
	<p>Falls in soil moisture levels in swamps.</p> <p><i>N.B. Not linked specifically to a performance measure and would not be considered a breach if predictions were exceeded.</i></p>		<p>Level 1 Soil moisture level lower than baseline level at any monitoring sites (within 400m of mining) within a swamp (in comparison to reference swamps).</p>	No Level 1 impacts observed	
			<p>Level 2 Soil moisture level lower than baseline level at 50% of monitoring sites (within 400m of mining) within a swamp (in comparison to reference swamps)</p>	No Level 2 impacts observed	
			<p>Level 3 Soil moisture level lower than baseline level at >80% of monitoring sites (within 400m of mining) within a swamp (in comparison to reference swamps).</p>	No Level 3 impacts observed	

LANDSCAPE					
	<p>The cliffs located in the SMP Area are all located outside the extents of the proposed longwalls, at minimum distances of 30m to 460m at the closest points. It is possible therefore that some small isolated rockfalls could occur along the cliffs as a result of the extraction of the proposed longwalls. It is not expected however, that, any large scale cliff instabilities would occur</p>		<p>Level 1</p> <ul style="list-style-type: none"> • Rockfall 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 	<ul style="list-style-type: none"> • Impact DA3B_LW16_001 – Soil cracking on access track between <i>Lake Avon</i> and <i>FR6A</i>. • Impact DA3B_LW16_002 – Soil cracking on access track between <i>Lake Avon</i> and <i>FR6A</i>. • Impact DA3B_LW16_003 – Soil cracking on access track between <i>Lake Avon</i> and <i>FR6A</i>. • Impact DA3B_LW16_004 – Rock fracturing and soil cracking on access track between <i>Lake Avon</i> and <i>FR6A</i>. • Impact DA3B_LW16_006 – Soil cracking on access 	<p>See impact report dated: - 17/04/2020</p> <p>See impact report dated: - 17/04/2020</p> <p>See impact report dated: - 17/04/2020 - 22/04/2020</p> <p>See impact report dated: - 17/04/2020</p> <p>See impact report dated: - 22/04/2020</p>

	<p>based on previous experience.</p> <p>Impacts to steep slopes due to mining induced subsidence are most likely to occur in the form of surface cracks. Experience indicates that the likelihood of large-scale down-slope movements is extremely low due to the high depth of cover within the SMP Area.</p> <p>If tension cracks do develop it is possible that soil erosion may occur if the cracks are left untreated. Some remediation may therefore be required.</p>		<ul style="list-style-type: none"> • Erosion in a localised area which would be expected to naturally stabilise without CMA and within the period of monitoring 	<p>track between <i>Lake Avon</i> and <i>FR6A</i>.</p> <ul style="list-style-type: none"> • Impact DA3B_LW16_007 – Soil cracking on access track between <i>Lake Avon</i> and <i>FR6A</i>. • Impact DA3B_LW16_008 – Soil cracking on access track between <i>Lake Avon</i> and <i>FR6A</i>. • Impact DA3B_LW16_009 – Soil cracking on access track between <i>Lake Avon</i> and <i>FR6A</i>. • Impact DA3B_LW16_011 – Small rock fall at steep slope/steep between <i>Lake Avon</i> and <i>FR6A</i>. • Impact DA3B_LW16_012 – Rock fracturing at steep slope/step between <i>FR6P</i> and <i>Swamp 14</i>. • Impact DA3B_LW16_014 – Soil cracking on access track between <i>Lake Avon</i> and <i>FR6A</i>. • Impact DA3B_LW16_015 – Rock fracturing at steep slope/step between <i>Lake Avon</i> and <i>FR6A</i>. • Impact DA3B_LW16_016 – Rock fracturing and rockfall at a steep 	<p>See impact report dated: - 22/04/2020</p> <p>See impact report dated: - 30/04/2020</p> <p>See impact report dated: - 30/04/2020</p> <p>See impact report dated: - 30/04/2020</p> <p>See impact report dated: - 30/04/2020</p> <p>See impact report dated: - 18/05/2020</p> <p>See impact report dated: - 18/05/2020</p> <p>See impact report dated: - 18/05/2020</p>
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				<p>slope/step between <i>Lake Avon</i> and <i>FR6A</i>.</p> <ul style="list-style-type: none"> • Impact DA3B_LW16_017 – Rock fracturing to outcrop between <i>Swamp 23</i> and <i>LA2</i>. • Impact DA3B_LW16_018 – Rock fracturing to SLMMP site <i>A3B-SS16</i>. • Impact DA3B_LW16_020 – Soil cracking across <i>FR6A</i>. • Impact DA3B_LW16_024 – Rock fracturing and soil cracking to rehabilitated access track between <i>Swamp 14</i> and <i>FR6A</i>. • Impact DA3B_LW16_025 – Rock fracturing to steep slope between <i>Swamp 14</i> and <i>FR6A</i>. • Impact DA3B_LW16_026 (Update) – Rock fracturing to step slope between <i>Swamp 14</i> and <i>FR6P</i>. • Impact DA3B_LW16_027 – Soil cracking to <i>FR6P</i>. • Impact DA3B_LW16_029 – Rockfall to step on western slope of <i>WC15</i> valley • Impact DA3B_LW16_030 – Localised erosion on tributary <i>WC15</i>. 	<p>See impact report dated: - 19/06/2020</p> <p>See impact report dated: - 19/06/2020</p> <p>See impact report dated: - 2/07/2020</p> <p>See impact report dated: - 10/08/2020</p> <p>See impact report dated: - 10/08/2020</p> <p>See impact report dated: - 10/08/2020 - 27/08/2020</p> <p>See impact report dated: - 27/08/2020</p> <p>See impact report dated: - 1/09/2020</p> <p>See impact report dated: - 1/09/2020 - 14/09/2020</p> <p>See impact report dated: - 30/09/2020</p>
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				<ul style="list-style-type: none"> • Impact DA3B_LW16_031 – Rock fracturing on cliff line to the north-west of <i>WC15</i>. • Impact DA3B_LW16_032 – Soil cracking to the north-west of <i>WC15</i>. • Impact DA3B_LW16_033 – Soil cracking on an access track parallel to <i>WC15</i>. • Impact DA3B_LW16_034 – Soil cracking on an access track parallel to <i>WC15</i>. • Impact DA3B_LW16_035 – Soil cracking and displacement near SLMMP site <i>A3B-SS17</i>. <p>Impact DA3B_LW16_036 – Rock fracturing to a cline line at SLMMP site <i>A3B-SS17</i>.</p> <ul style="list-style-type: none"> • Impact DA3B_LW16_037 – Soil cracking on an access track parallel to <i>WC15</i>. • Impact DA3B_LW16_038 – Iron staining present at <i>LA2_Pool34</i>. • Impact DA3B_LW16_039 – Soil cracking to access track, east of <i>Swamp 14</i>. 	<p>See impact report dated: - 30/09/2020</p> <p>See impact report dated: - 30/09/2020</p> <p>See impact report dated: - 30/09/2020</p> <p>See impact report dated: - 30/09/2020</p> <p>See impact report dated: - 30/09/2020</p> <p>See impact report dated: - 30/09/2020</p> <p>See impact report dated: - 30/09/2020</p> <p>See impact report dated: - 12/10/2020</p> <p>See impact report dated: - 12/10/2020</p> <p>See impact report dated: - 12/10/2020</p>
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				<ul style="list-style-type: none"> • Impact DA3B_LW16_040 – Soil cracking to access track, east of <i>Swamp 14</i>. • Impact DA3B_LW16_041 – Soil cracking to access track, east of <i>Swamp 14</i>. • Impact DA3B_LW16_042 – Soil cracking to access track, east of <i>Swamp 14</i>. • Impact DA3B_LW16_043 – Soil cracking to access track, east of <i>Swamp 14</i>. • Impact DA3B_LW16_045 – Rock fracturing to a steep slope east of <i>Swamp 14</i>. • Impact DA3B_LW16_046 – Rock fracturing to a steep slope/ step east of <i>Swamp 14</i>. • Impact DA3B_LW16_047 – Rock fracturing to a steep slope east of <i>Swamp 14</i>. • Impact DA3B_LW16_048 – Rock fracture to rock outcrop west of <i>Swamp 14</i>. • Impact DA3B_LW16_050 – Rock fracture to steep slope west of <i>Swamp 14</i>. • Impact DA3B_LW16_052 – Soil cracking in bushland to the west of <i>Swamp 14</i>. • Impact DA3B_LW15_002 – Rock fracturing and rockfall at step adjacent to <i>Swamp 23</i>. 	<p>See impact report dated: - 12/10/2020</p> <p>See impact report dated: - 12/10/2020</p> <p>See impact report dated: - 16/11/2020</p> <p>See impact report dated: - 27/11/2020</p> <p>See impact report dated: - 2/12/2020</p> <p>See impact report dated: - 2/12/2020</p> <p>See impact report dated: - 2/12/2020</p> <p>See impact report dated: - 2/12/2020</p> <p>See impact report dated: - 18/05/2020</p> <p>See impact report dated: - 18/05/2020</p>
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				<ul style="list-style-type: none"> • Impact DA3B_LW15_008 – Soil cracking and uplift across <i>FR6A</i>. 	
			<p>Level 2</p> <ul style="list-style-type: none"> • Rockfall 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, 	<ul style="list-style-type: none"> • Impact DA3B_LW16_005 – Soil cracking on access track between <i>Lake Avon</i> and <i>FR6A</i>. • Impact DA3B_LW16_010 – Rock fracturing to rock outcrop between <i>Lake Avon</i> and <i>FR6A</i>. • Impact DA3B_LW16_013 – Soil cracking on access track between <i>Lake Avon</i> and <i>FR6A</i>. • Impact DA3B_LW16_019 – Soil cracking across <i>FR6A</i> (now remediated). • Impact DA3B_LW16_021 – Rock fracturing to step with small rockfall. • Impact DA3B_LW16_028 – Rock fracture to rockbar/step above <i>WC15_Pool/34</i>. • Impact DA3B_LW16_044 – Soil cracking, rock fracturing and displacement on steep slope east of <i>Swamp 14</i>. • Impact DA3B_LW16_049 – Rock fracturing and 	<p>See impact report dated: - 22/04/2020</p> <p>See impact report dated: - 30/04/2020</p> <p>See impact report dated: - 18/05/2020 - 29/05/2020 - 19/06/2020</p> <p>See impact report dated: - 24/06/2020 - 30/06/2020</p> <p>See impact report dated: - 2/07/2020</p> <p>See impact report dated: - 1/09/2020</p> <p>See impact report dated: - 16/11/2020</p> <p>See impact report dated:</p>

			<p>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</p>	<p>fragmentation to steep slope west of <i>Swamp 14</i>.</p> <ul style="list-style-type: none"> • Impact DA3B_LW16_051 – Rock fracturing and soil cracking to rock outcrop and bushland west of <i>Swamp 14</i>. 	<p>- 2/12/2020</p> <p>See impact report dated: - 2/12/2020</p>
			<p>Level 3</p> <ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Impact DA3B_LW16_022 – Rock fracturing to cut-through of railway corridor. 	<p>See impact report dated: - 10/07/2020 - 10/08/2020</p>

11 APPENDIX A – TRIGGER ACTION RESPONSE PLANS

Table 6: Dendrobium Swamp Impacts, Triggers and Response.

Performance Measures	Potential Impacts	Performance Triggers	Management Strategies	Offsets	Other Actions
Negligible erosion of the surface of the swamp	Gully erosion or similar	<p><u>Level 1:</u> The increase in length of erosion within a swamp (compared to its pre-mining length) is 2% of the swamp length or area; and/or</p> <p>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.</p> <p><u>Level 2:</u> The increase in length of erosion within a swamp (compared to its pre-mining length) is 3% of the swamp length or area; and/or</p> <p>Soil surface crack that causes erosion that is likely to stabilise within the monitoring period without intervention; and/or</p> <p>Gully knickpoint forms or an existing gully knickpoint becomes active.</p> <p><u>Level 3:</u> The increase in length of erosion within a swamp (compared to its pre-mining length) is 4% of the swamp length or area; and/or</p> <p>Soil surface crack that causes erosion that is unlikely to stabilise within the monitoring period without intervention.</p> <p><u>Exceeding Prediction</u></p> <p>Mining results in the total length of erosion within a swamp (compared to its pre-mining length) to increase >5% of the length or area of the swamp compared to any increase in total erosion length in a reference</p>	<p>a) upfront mine planning</p> <p>b) erosion monitoring (i.e. ALS, observation)</p> <p>c) coir logs</p> <p>d) knickpoint control</p> <p>e) water spreading</p> <p>f) weeding</p> <p>g) fire management</p> <p>h) reporting</p> <p>i) investigation and review</p> <p>j) update future predictions</p>	<p>Offset required immediately, if no remediation considered practicable.</p> <p>Offset required 2 years following remediation, if it is ineffective.</p> <p>This period can be extended to 5 years, with the agreement of the Secretary.</p>	

		swamp (ie increase in length or area of erosion in an impact swamp less any increase in length or area in erosion in a reference swamp is >5%).			
<p>Minor changes in the size of the swamps</p> <p>Minor changes in the ecosystem functionality of the swamps</p> <p>No significant change to the composition or distribution of species within the swamps</p>	<p>Swamp vegetation changes:</p> <ul style="list-style-type: none"> - Swamp size - Species richness, distribution, composition and diversity - Vegetation sub-communities 	<p>Swamp Size</p> <p><u>Level 1:</u> A trending decline in the extent of an upland swamp (combined area of groundwater dependent communities) for two consecutive monitoring periods, greater than observed in the Control Group, and exceeding the standard error (SE) of the Control Group.</p> <p><u>Level 2:</u> A trending decline in the extent of an upland swamp (combined area of groundwater dependent communities) for three consecutive monitoring periods, greater than observed in the Control Group, and exceeding the SE of the Control Group.</p> <p><u>Level 3:</u> A trending decline in the extent of an upland swamp (combined area of groundwater dependent communities) for four consecutive monitoring periods, greater than observed in the Control Group, and exceeding the SE of the Control Group.</p> <p><u>Exceeding Prediction:</u> Mining results in a trending decline in the extent of an upland swamp (combined area of groundwater dependent communities) for five consecutive monitoring periods, greater than observed in the Control Group, and exceeding the SE of the Control Group.</p> <p>Ecosystem Functionality</p> <p><u>Level 1:</u> A trending decline in the extent of any individual groundwater dependent community within a swamp for two consecutive monitoring periods, greater than observed in the Control Group, and exceeding the SE of the Control Group.</p>	<ul style="list-style-type: none"> a) upfront mine planning b) vegetation monitoring c) water spreading d) seeding/planting e) weeding f) fauna monitoring g) fire management h) grouting of controlling of controlling rockbars and bedrock base and/or use of other remediation techniques i) reporting j) investigation and review k) update future predictions 	<p>Offset required immediately, if no remediation considered practicable.</p> <p>Offset required 5 years following remediation, if it is ineffective.</p> <p>This period can be extended to 10 years, with the agreement of the Secretary.</p>	<p>Monitoring period for swamp size is related to capture of Lidar data at the end of each longwall ~ 1 year</p> <p>Triggers for groundwater decline result in increased intensity and frequency of vegetation monitoring</p>

		<p><u>Level 2:</u> A trending decline in the extent of any groundwater dependent community within a swamp for three consecutive monitoring periods, greater than observed in the Control Group, and exceeding the SE of the Control Group.</p> <p><u>Level 3:</u> A trending decline in the extent of any groundwater dependent community within a swamp for four consecutive monitoring periods, greater than observed in the Control Group, and exceeding the SE of the Control Group.</p> <p><u>Exceeding Prediction:</u> Mining results in a trending decline in the extent of a groundwater dependent community within a swamp for five consecutive monitoring periods, greater than observed in the Control Group, and exceeding the SE of the Control Group.</p> <p>Species Composition and Distribution</p> <p><u>Level 1:</u> A 2% (or otherwise statistically significant) decline in species richness or diversity during a period of stability or increase in species richness/diversity in reference swamps for two consecutive years; and/or</p> <p><u>Level 2:</u> A 5% (or otherwise statistically significant) decline in species richness or diversity during a period of stability or increase in species richness/diversity in reference swamps for three consecutive years.</p> <p><u>Level 3:</u> An 8% (or otherwise statistically significant) decline in species richness or diversity during a period of stability or increase in species richness/diversity in reference swamps for four consecutive years.</p> <p><u>Exceeding Prediction:</u></p>			
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		Mining results in a >10% (or otherwise statistically significant) decline in species richness or diversity during a period of stability or increase in species richness/diversity in reference swamps for five consecutive years.			
Maintenance or restoration of the structural integrity of the bedrock base of any significant permanent pool or controlling rockbar within the swamps	Subsidence impacts (i.e. cracking) on bedrock base or controlling rockbar	<p><u>Level 1:</u> Fracturing observed in the bedrock base of any significant permanent pool which results in observable loss of surface water of 10% compared to baseline for the pool (in addition to any decrease in reference pools).</p> <p><u>Level 2:</u> Fracturing observed in the bedrock base of any significant permanent pool which results in observable loss of surface water of 20% compared to baseline for the pool (in addition to any decrease in reference pools).</p> <p><u>Level 3:</u> Fracturing observed in the bedrock base of any significant permanent pool which results in observable loss of surface water of 20% compared to baseline for the pool for >20% of the time over a period of 1 year (in addition to any decrease in reference pools).</p> <p><u>Exceeding Prediction</u> 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 >20% lower than baseline for >20% of the time over a period of 1 year.</p>	<ul style="list-style-type: none"> a) upfront mine planning b) subsidence monitoring c) surface water monitoring d) groundwater monitoring e) grouting of controlling of controlling rockbars and bedrock base and/or use of other remediation techniques f) CMAs g) reporting h) investigation and review i) update future predictions 	<p>Offset required immediately, if no remediation considered practicable.</p> <p>Offset required 2 years following remediation, if it is ineffective.</p> <p>This period can be extended to 5 years, with the agreement of the Secretary.</p>	
Minor changes in the ecosystem	Falls in surface or near-surface groundwater levels in swamps	<u>Level 1:</u> Groundwater level lower than baseline level at any monitoring site within a swamp (in comparison to reference swamps); and/or	<ul style="list-style-type: none"> a) upfront mine planning b) groundwater monitoring 		Triggers for groundwater decline result in increased intensity and

functionality of the swamps	<i>N.B. Not linked specifically to a PM and would not be considered a breach if predictions were exceeded.</i>	<p>Rate of groundwater level reduction exceeds rate of groundwater level reduction during baseline period at any monitoring site (measured as average mm/day during the recession curve).</p> <p><u>Level 2:</u> Groundwater level lower than baseline level at 50% of monitoring sites (within 400m of mining) within a swamp (in comparison to reference swamps); and/or</p> <p>Rate of groundwater level reduction exceeds rate of groundwater level reduction during baseline period at a 50% of monitoring sites (within 400m of mining) within the swamp.</p> <p><u>Level 3:</u> Groundwater level lower than baseline level at >80% of monitoring sites (within 400m of mining) within a swamp (in comparison to reference swamps); and/or</p> <p>Rate of groundwater level reduction exceeds rate of groundwater level reduction during baseline period at >80% of monitoring sites (within 400m of mining) within the swamp.</p>	<ul style="list-style-type: none"> c) implementation of swamp research program d) weeding e) fire management f) reporting g) update future predictions 		frequency of vegetation monitoring and/or further investigations of subsidence impacts on bedrock base and rockbars
Minor changes in the ecosystem functionality of the swamps	<p>Falls in soil moisture levels in swamps</p> <p><i>N.B. Not linked specifically to a PM and would not be considered a breach if predictions were exceeded.</i></p>	<p><u>Level 1:</u> Soil moisture level lower than baseline level at any monitoring sites (within 400m of mining) within a swamp (in comparison to reference swamps).</p> <p><u>Level 2:</u> Soil moisture level lower than baseline level at 50% of monitoring sites (within 400m of mining) within a swamp (in comparison to reference swamps).</p> <p><u>Level 3:</u> Soil moisture level lower than baseline level at >80% of monitoring sites (within 400m of mining) within a swamp (in comparison to reference swamps).</p>	<ul style="list-style-type: none"> a) upfront mine planning b) soil moisture monitoring c) water spreading d) weeding e) fire management f) reporting g) update future predictions 		Triggers of soil moisture decline result in increased intensity and frequency of vegetation monitoring and/or further investigations of subsidence impacts on bedrock base and rockbars.

Table 7: Dendrobium Watercourse Impacts, Triggers and Response.

Monitoring	Trigger	Action
OBSERVATIONAL, PHOTO POINT AND WATER MONITORING		
<p>Native Dog, Wongawilli and Donalds Castle Creeks, WC21, WC15, LA4, DC13, LA5, ND1, WC6, WC7, WC8, WC9, WC12, WC16 and WC18</p> <p>General observation of streams in active mining areas when longwall is within 400m</p>	<p>Level 1 *</p> <ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> Continue monitoring program Submit an Impact Report to OEH, DoPE, T&I, Water NSW and other relevant resource managers Report in the End of Panel Report Summarise actions and monitoring in AEMR
<p>Relevant Performance Measure(s):</p> <ul style="list-style-type: none"> Wongawilli Creek - minor environmental consequences Donalds Castle Creek - minor environmental consequences Waterfall WC-WF54 – negligible environmental consequences 	<p>Level 2 *</p> <ul style="list-style-type: none"> 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 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 	<ul style="list-style-type: none"> <i>Actions as stated for Level 1</i> Review monitoring frequency Notify relevant technical specialists and seek advice on any CMA required Implement agreed CMAs as approved (subject to stakeholder feedback)
	<p>Level 3 *</p> <ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> <i>Actions as stated for Level 2</i> Site visit with OEH, DoPE, T&I, Water NSW 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, DoPE, T&I, Water NSW and other stakeholders

Monitoring	Trigger	Action
	<ul style="list-style-type: none"> Gas release results in vegetation dieback, mortality or loss of aquatic habitat Observable increase in iron staining within the mining area continues more than 600m from the longwall 	<ul style="list-style-type: none"> Completion of works following approvals and at a time agreed between BHPBIC, DoPE, T&I and Water NSW (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
	<p>Exceeding Prediction</p> <ul style="list-style-type: none"> 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 WONGAWILLI CK (FR6) Iron staining and associated increases in dissolved iron resulting from the mining is observed in water at the Donalds Castle Creek downstream monitoring site Donalds Castle Ck (FR6) Rockfall at WC-WF54 or its overhang Impacts on the structural integrity of WC-WF54, its overhang or its pool 	<ul style="list-style-type: none"> <i>Actions as stated for Level 3</i> 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		
<p>Wongawilli Creek</p> <p>Wongawilli Ck (FR6)</p> <p>Baseline means:</p> <ul style="list-style-type: none"> pH 5.98 EC 98.8 uS/cm DO 89.5% 	<p>Level 1 *</p> <ul style="list-style-type: none"> One exceedance of the ± 3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean during the monitoring period: <ul style="list-style-type: none"> pH 4.45 EC 154.1 uS/cm DO 50.5% 	<ul style="list-style-type: none"> Continue monitoring program Submit an Impact Report to OEH, DoPE, T&I, Water NSW and other relevant resource managers Report in the End of Panel Report Summarise actions and monitoring in AEMR
<p>Relevant Performance Measure(s):</p>	<p>Level 2 *</p> <ul style="list-style-type: none"> Two exceedances of the ± 3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean during the monitoring period: 	<ul style="list-style-type: none"> <i>Actions as stated for Level 1</i> Review monitoring frequency Notify relevant technical specialists and seek advice on any CMA required

Monitoring	Trigger	Action
<ul style="list-style-type: none"> Wongawilli Creek - minor environmental consequences 	<ul style="list-style-type: none"> pH 4.45 EC 154.1 uS/cm DO 50.5% 	<ul style="list-style-type: none"> Implement agreed CMAs as approved (subject to stakeholder feedback)
	<p>Level 3 *</p> <ul style="list-style-type: none"> Three exceedances of the ± 3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean during the monitoring period: <ul style="list-style-type: none"> pH 4.45 EC 154.1 uS/cm DO 50.5% 	<ul style="list-style-type: none"> <i>Actions as stated for Level 2</i> Site visit with OEH, DoPE, T&I, Water NSW 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: <ul style="list-style-type: none"> 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, DoPE, T&I and Water NSW (i.e. may be after mining induced movements and impacts are complete), including monitoring and reporting on success
	<p>Exceeding Prediction</p> <ul style="list-style-type: none"> Mining results in two consecutive exceedances of the ± 3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean during the monitoring period: <ul style="list-style-type: none"> pH 4.45 EC 154.1 uS/cm DO 50.5% 	<ul style="list-style-type: none"> <i>Actions as stated for Level 3</i> 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
<p>Donalds Castle Creek</p> <p>Donalds Castle Ck (FR6)</p> <p>Baseline means:</p> <ul style="list-style-type: none"> pH 5.41 EC 116.0 uS/cm DO 85.6% 	<p>Level 1 *</p> <ul style="list-style-type: none"> One exceedance of the ± 3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean during the monitoring period: <ul style="list-style-type: none"> pH 3.60 EC 185.8 uS/cm DO 40.1% 	<ul style="list-style-type: none"> Continue monitoring program Submit an Impact Report to OEH, DoPE, T&I, Water NSW and other relevant resource managers Report in the End of Panel Report Summarise actions and monitoring in AEMR
	<p>Level 2 *</p>	<ul style="list-style-type: none"> <i>Actions as stated for Level 1</i>

Monitoring	Trigger	Action
<p>Relevant Performance Measure(s):</p> <ul style="list-style-type: none"> • Donalds Castle Creek - minor environmental consequences 	<ul style="list-style-type: none"> • Two exceedances of the ± 3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean during the monitoring period: <ul style="list-style-type: none"> – pH 3.60 – EC 185.8 uS/cm – DO 40.1% 	<ul style="list-style-type: none"> • Review monitoring frequency • Notify relevant technical specialists and seek advice on any CMA required • Implement agreed CMAs as approved (subject to stakeholder feedback)
	<p>Level 3 *</p> <ul style="list-style-type: none"> • Three exceedances of the ± 3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean during the monitoring period: <ul style="list-style-type: none"> – pH 3.60 – EC 185.8 uS/cm – DO 40.1% 	<ul style="list-style-type: none"> • <i>Actions as stated for Level 2</i> • Site visit with OEHL, DoPE, T&I, Water NSW 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: <ul style="list-style-type: none"> – pH, EC, major cations, major anions, Total Fe, Mn & Al – Filterable suite of metals • Develop site CMA (subject to stakeholder feedback). This may include: <ul style="list-style-type: none"> – 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, DoPE, T&I and Water NSW (i.e. may be after mining induced movements and impacts are complete), including monitoring and reporting on success
	<p>Exceeding Prediction</p> <ul style="list-style-type: none"> • Mining results in two consecutive exceedances of the ± 3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean during the monitoring period: <ul style="list-style-type: none"> – pH 3.60 – EC 185.8 uS/cm – DO 40.1% 	<ul style="list-style-type: none"> • <i>Actions as stated for Level 3</i> • 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
<p>Lake Avon</p> <p>Lake Avon tributary (LA4_S1)</p> <p>Baseline means:</p> <ul style="list-style-type: none"> • pH 5.38 • EC 90.8 uS/cm • DO 89.9% <p>(24 months of baseline data available - to be updated with additional baseline data)</p> <p>Relevant Performance Measure(s):</p> <ul style="list-style-type: none"> • Lake Avon - negligible reduction in the quality of surface water inflows to Lake Avon 	<p>Level 1 *</p> <ul style="list-style-type: none"> • One exceedance of the ± 3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean during the monitoring period: <ul style="list-style-type: none"> - pH 4.90 - EC 129.8 uS/cm - DO 69.5% 	<ul style="list-style-type: none"> • Continue monitoring program • Submit an Impact Report to OEH, DoPE, T&I, Water NSW and other relevant resource managers • Report in the End of Panel Report • Summarise actions and monitoring in AEMR
	<p>Level 2 *</p> <ul style="list-style-type: none"> • Two exceedances of the ± 3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean during the monitoring period: <ul style="list-style-type: none"> - pH 4.90 - EC 129.8 uS/cm - DO 69.5% 	<ul style="list-style-type: none"> • <i>Actions as stated for Level 1</i> • Review monitoring frequency • Notify relevant technical specialists and seek advice on any CMA required • Implement agreed CMAs as approved (subject to stakeholder feedback)
	<p>Level 3 *</p> <ul style="list-style-type: none"> • Three exceedances of the ± 3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean during the monitoring period: <ul style="list-style-type: none"> - pH 4.90 - EC 129.8 uS/cm - DO 69.5% 	<ul style="list-style-type: none"> • <i>Actions as stated for Level 2</i> • Site visit with OEH, DoPE, T&I, Water NSW 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: <ul style="list-style-type: none"> - pH, EC, major cations, major anions, Total Fe, Mn & Al - Filterable suite of metals • Develop site CMA (subject to stakeholder feedback). This may include: <ul style="list-style-type: none"> - 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, DoPE, T&I and Water NSW (i.e. may be after mining induced movements and impacts are complete), including monitoring and reporting on success
	<p>Exceeding Prediction</p>	<ul style="list-style-type: none"> • <i>Actions as stated for Level 3</i> • Investigate reasons for the exceedance

Monitoring	Trigger	Action
	<ul style="list-style-type: none"> Mining results in two consecutive 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: <ul style="list-style-type: none"> pH 4.90 EC 129.8 uS/cm DO 69.5% 	<ul style="list-style-type: none"> 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		
<p>Mapped pools in the mining area:</p> <ul style="list-style-type: none"> Wongawilli Creek Donalds Castle Creek <p>Relevant Performance Measure(s):</p> <ul style="list-style-type: none"> Wongawilli Creek - minor environmental consequences Donalds Castle Creek - minor environmental consequences 	<p>Level 1 *</p> <ul style="list-style-type: none"> Fracturing not resulting in diversion of flow 	<ul style="list-style-type: none"> Continue monitoring program Submit an Impact Report to OEH, DoPE, T&I, Water NSW and other relevant resource managers Report in the End of Panel Report Summarise actions and monitoring in AEMR
	<p>Level 2 *</p> <ul style="list-style-type: none"> Fracturing resulting in diversion of flow 	<ul style="list-style-type: none"> <i>Actions as stated for Level 1</i> Review monitoring frequency Notify relevant technical specialists and seek advice on any CMA required Implement agreed CMAs as approved (subject to stakeholder feedback)
	<p>Level 3 *</p> <ul style="list-style-type: none"> Fracturing resulting in diversion of flow such that <10% of the pools have water levels lower than baseline period 	<ul style="list-style-type: none"> <i>Actions as stated for Level 2</i> Site visit with OEH, DoPE, T&I, Water NSW 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, DoPE, T&I, Water NSW and other stakeholders Completion of works following approvals and at a time agreed between BHPBIC, DoPE, T&I and Water NSW (i.e. may be after mining induced movements and impacts are complete), including monitoring and reporting on success
	<p>Exceeding Prediction</p> <ul style="list-style-type: none"> Fracturing resulting in diversion of flow such that >10% of the pools have water levels lower than baseline period 	<ul style="list-style-type: none"> <i>Actions as stated for Level 3</i> Investigate reasons for the exceedance Update future predictions based on the outcomes of the investigation

Monitoring	Trigger	Action
		<ul style="list-style-type: none"> • Provide residual environmental offset for any mining impact where CMAs are unsuccessful as required by Condition 14 Schedule 3 of the Development Consent
<p>Waterfall WC-WF54</p> <p>Relevant Performance Measure(s):</p> <ul style="list-style-type: none"> • Waterfall WC-WF54 – negligible environmental consequences 	<p>Exceeding Prediction</p> <ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • <i>Actions as stated for Level 3</i> • 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
SURFACE WATER FLOW		
<p>Wongawilli Creek and Donalds Castle Creek Lake Avon and Cordeaux River</p> <p>Relevant Performance Measure(s):</p> <ul style="list-style-type: none"> • Wongawilli Creek - minor environmental consequences • Donalds Castle Creek - minor environmental consequences • Lake Avon - negligible reduction in the quantity of surface water inflows to Lake Avon¹ • Cordeaux River - negligible reduction in the quantity of surface water inflow to the Cordeaux River at its confluence with Wongawilli Creek² <p>Surface water flow Reference sites (as in Table 1.1):</p> <ul style="list-style-type: none"> • <u>Wongawilli Creek - WWU</u> (Wongawilli Creek upstream); • <u>O'Hares Creek at Wedderburn (213200)</u>; 	<p>Level 1</p> <ul style="list-style-type: none"> • A) Lower flow than expected (additional 10-15% of days where Q% lower than Reference Q%) • B) 5-10% increase in cease-to-flow frequency beyond natural) • C) Reduction in Q50 (10-15% beyond natural) <p>Level 2</p> <ul style="list-style-type: none"> • A) Lower flow than expected (additional 15-20% of days where Q% lower than Reference Q%). • B) 10-20% increase in cease-to-flow frequency (beyond natural) • C) 15-20% reduction in Q50 (beyond natural) • D) Observation that the subject Creek has ceased to flow at spatially consecutive monitoring sites. <p>Level 3</p> <ul style="list-style-type: none"> • A) Lower flow than expected (additional >20% of days where Q% lower than Reference Q%) • B) >20% increase in cease-to-flow frequency (beyond natural) • C) >20% reduction in Q50 (beyond natural) 	<ul style="list-style-type: none"> • Continue monitoring program. • Submit an Impact Report to BCD, DPIE, DRG, WaterNSW. • Report in the End of Panel Report. • Summarise actions and monitoring in AEMR. <p><i>Actions as stated for Level 1</i></p> <ul style="list-style-type: none"> • Review monitoring frequency. • D) → carry out Water Flow Assessment Method D. • Submit letter report to DPIE, DRG and WaterNSW and seek advice on any CMA required. • Implement agreed CMAs as approved (subject to agency feedback). <p><i>Actions as stated for Level 2</i></p> <ul style="list-style-type: none"> • Offer site visit with BCD, DPIE, DRG, WaterNSW. • Implement additional monitoring or increase frequency if required. • Develop site CMA (subject to agency feedback). This may include: grouting of rockbar and bedrock base of any significant pool where it is appropriate to do so in consultation with BCD, DPIE, DRG, WaterNSW.

<ul style="list-style-type: none"> • (other such sites, if necessary, include Woronora River 2132101 and Bomaderry Creek 215016) <p>NB. This section of the TARP contains four Water Flow Assessment Methods, labelled A, B, C and D, which are specified in detail in Watershed HydroGeo (2019).</p> <p>Hydrological changes are assessed by comparing pre- and post-mining observed flows from impact or assessment sites to flow data from the reference sites.</p> <p><i>Natural variability ('NV') will be defined as the 'average' change at the selected reference sites. Triggers may occur when the apparent impact at a site (NV + x% change) could be less than maximum observed variability at one of the reference sites.</i></p>	<div style="background-color: #FF8C00; height: 20px; width: 100%;"></div> <div style="background-color: #FF0000; height: 300px; width: 100%;"></div> <p>Exceeding Prediction Measured surface water flow reduction, based on Assessment Methods C, D, to be compared against predictions made in contemporary groundwater modelling conducted to the satisfaction of the Secretary to assess whether effects that cannot be explained by natural variability "exceed prediction".</p>	<ul style="list-style-type: none"> • Completion of works following approvals and at a time agreed between S32, DPIE, DRG and WaterNSW (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 agencies. <hr/> <p><i>Actions as stated for Level 3</i></p> <ul style="list-style-type: none"> • 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.
<p>Tributaries of Wongawilli Creek and Donalds Castle Creek and other affected watercourses not subject to performance measures</p> <p>Surface water flow Reference sites (as in Table 1.1):</p> <ul style="list-style-type: none"> • <u>Wongawilli Creek - WWU</u> (Wongawilli Creek upstream); • <u>O'Hares Creek and Wedderburn (213200)</u>; • (other such sites, if necessary, include Woronora River 2132101 and Bomaderry Creek 215016) <p>NB. This section of the TARP contains four Water Flow Assessment Methods, labelled A, B, C and D, which are specified in detail in Watershed HydroGeo (2019).</p>	<div style="background-color: #FFFF00; height: 150px; width: 100%;"></div> <div style="background-color: #FFD700; height: 150px; width: 100%;"></div> <p>Level 1</p> <ul style="list-style-type: none"> • A) Lower flow than expected (additional 10-20% of days where Q% lower than Reference Q%) • B) 5-10% increase in cease-to-flow frequency (beyond natural) • C) 10-20% reduction in Q50 (beyond natural) <p>Level 2</p> <ul style="list-style-type: none"> • A) Lower flow than expected (additional 20-30% of days where Q% lower than Reference Q%) • B) 10-20% increase in cease-to-flow frequency (beyond natural) • C) 20-30% reduction in Q50 (beyond natural) 	<ul style="list-style-type: none"> • Continue monitoring program. • Submit an Impact Report to BCD, DPIE, DRG, WaterNSW. • Report in the End of Panel Report. • Summarise actions and monitoring in AEMR. <hr/> <p><i>Actions as stated for Level 1</i></p> <ul style="list-style-type: none"> • Review monitoring frequency. • Submit letter report to DPIE, DRG and WaterNSW and seek advice on any CMA required. • Implement agreed CMAs as approved (subject to agency feedback).

<p>Hydrological changes are assessed by comparing pre- and post-mining observed flows from impact or assessment sites to flow data from the reference sites.</p> <p><i>Natural variability ('NV') will be defined as the 'average' change at the selected reference sites. Triggers may occur when the apparent impact at a site (NV + x% change) could be less than maximum observed variability at one of the reference sites.</i></p>	<p>Level 3</p> <ul style="list-style-type: none"> • A) Lower flow than expected (additional >30% of days where Q% lower than Reference Q%) • B) >20% increase in cease-to-flow frequency (beyond natural) • C) >30% reduction in Q50 (beyond natural) 	<ul style="list-style-type: none"> • <i>Actions as stated for Level 2</i> • Offer site visit with BCD, DPIE, DRG, WaterNSW. • Implement additional monitoring or increase frequency if required • Develop site CMA (subject to agency feedback). This may include: grouting of rockbar and bedrock base of any significant pool where it is appropriate to do so in consultation with BCD, DPIE, DRG, WaterNSW. • Completion of works following approvals and at a time agreed between S32, DPIE, DRG and WaterNSW (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 agencies.
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¹ Surface water inflows calculation = [Impacts at gauged catchments (LA1 + LA2 + LA3 + LA4 + LA6+ NDT1 + ND2) + estimated impacts at ungauged but undermined catchments (e.g. LA5)] / [total inflow to LA].

¹ Flow reduction as determined from measured at flow gauging station WWL_A.

Table 8: Dendrobium Landscape Impacts, Triggers and Response.

Monitoring	Trigger	Action
LANDSCAPE FEATURES		
<p>DENDROBIUM AREA 3B Cliffs All mapped cliff sites in subsidence area Refer to <i>Dendrobium Area 3B SMP</i> Figures 18.1 for location of sites</p>	<p>Level 1 *</p> <ul style="list-style-type: none"> • Rockfall 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 	<ul style="list-style-type: none"> • Continue monitoring program • Report impacts to key stakeholders • Summarise impacts and Report in the End of Panel Report and AEMR
	<p>Level 2 *</p> <ul style="list-style-type: none"> • Rockfall 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 	<ul style="list-style-type: none"> • <i>Actions as stated for Level 1</i> • 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 <p><i>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</i></p>

Monitoring	Trigger	Action
	<p>Level 3 *</p> <ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> 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 <p><i>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</i></p>
Sandy Creek Waterfall	<p>Exceeding Prediction</p> <ul style="list-style-type: none"> Rockfall 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 30m of the waterfall More than negligible diversion of water from the lip of the waterfall 	<ul style="list-style-type: none"> 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		
<p>A number of sites located across and around Areas 2, 3A and 3B Refer <i>Dendrobium</i> Area 3A SMP Figure 21.1, 21.2 and 21.3 and <i>Dendrobium</i> Area 3B Figure 20.1 for location of sites</p>	<p>Level 1 *</p> <ul style="list-style-type: none"> Vegetation impacted by mining (by rockfalls, soil slippage, gas emissions) that is likely to naturally regenerate within the monitoring period 	<ul style="list-style-type: none"> Continue monitoring program Report impacts to key stakeholders Summarise impacts and Report in the End of Panel Report and AEMR
General observation of active mining areas	<p>Level 2 *</p> <ul style="list-style-type: none"> Vegetation impacted by mining (by rockfalls, soil slippage, gas emissions) that is unlikely to naturally regenerate within the monitoring period 	<ul style="list-style-type: none"> 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
	<ul style="list-style-type: none"> • Statistically significant difference between Before After Control Impact sites as a result of mining <p>Level 3 *</p> <ul style="list-style-type: none"> • Vegetation impacted by mining that is not responding to CMAs 	<ul style="list-style-type: none"> • 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

* These may be revised in consultation with DoPI and DPI and other key stakeholders following analysis of natural variability within the pre-mining baseline data. These TARPs relate to Dendrobium Area 3B and impacts resulting from mining in Areas 1, 2 and 3A were managed under previous TARPs.