



**DENDROBIUM AREA 3B
LONGWALL 18 END OF PANEL
LANDSCAPE REPORT
OCTOBER 2022**



EXECUTIVE SUMMARY

This report summarises the observed and measured subsidence effects on landscape features resulting from the extraction of Dendrobium Area 3B (DA3B) Longwall 18. Longwall 18 is the tenth panel extracted from DA3B. Extraction began on 2 December 2021 and was completed on 17 May 2022.

The Illawarra Metallurgical Coal Environmental Field Team (IMCEFT) conducts detailed monitoring and inspections of landscape features including swamps, watercourses, rock outcrops and other landscape features within the mining area of 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) (August 2020);
- Dendrobium Area 3B Swamp Impact, Monitoring, Management and Contingency Plan (SIMMCP) (October 2020 amendment); 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 24 surface impacts were identified by IMCEFT. All 24 surface impacts were observed on natural features. Water quality triggers were also recorded during Longwall 18 and will be addressed in detail in the specialist Surface Water and Shallow Groundwater Assessment of the final EoP Report.

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Abbreviations

AEMR – Annual Environmental Management Report

BCD - Biodiversity and Conservation Division

CMA – Corrective Management Action

DPE - Department of Planning and Environment

EoP – End of Panel

IMCEFT – Illawarra Metallurgical Coal Environmental Field Team

OEH - Office of Environment and Heritage (former agency)

RR – Resources regulator

SIMMCP – Swamp Impact, Monitoring, Management and Contingency Plan

SLMMP – Subsidence Landscape Monitoring and Management Plan

S32 – South32

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 18 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.

1.1 Surface Monitoring for Longwall 18

IMCEFT and 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). Landscape monitoring sites (SLMMP photo points) were monitored before, during and after the Longwall 18 extraction period (Table 1). Longwall 18 post-mining inspections were undertaken, and no impacts were observed.



Photo 1: A3b-SS20, baseline inspection. Taken on 5/12/2017.



Photo 2: A3b-SS20, post-mining inspection. Taken on 6/08/2022.

Table 1: Summary of SLMMP sites associated with Longwall 18.

Site Name	Easting	Northing	Impact Description
A3b-SS18	288812	6190998	No impacts observed
A3b-SS19	289020	6191108	No impacts observed
A3b-SS20	289245	6190585	No impacts observed
A3b-SS21	289633	6190858	No impacts observed
AT6-slmmp	289502	6190991	No impacts observed
AT7-slmmp	289222	6190861	No impacts observed
A3b_RailCorridor	289990	6190730	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. Specialist assessments of swamps, including comparison with reference swamps, will be included in the Terrestrial Ecology Assessment and Surface Water and Shallow Groundwater Assessment. These will be provided in the Longwall 18 EoP Summary Report.



Photo 3: Reference swamp site S87_S02. Taken on 21/06/2022.



Photo 4: Reference swamp site S22_S02. Taken on 21/06/2022.

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 DPE, 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. The SIMMCP and WIMMCP (and Environmental Management Strategy) were revised in accordance with the Area 3B SMP Approval dated 8 December 2020. Impacts to surface features observed during the extraction of Longwall 18 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 18.

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

Aspect	Management Plan	TARP Date Range
	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 – 11/08/2020
	Swamp Impact, Monitoring, Management and Contingency Plan (August 2020; <i>Addendum A- October 2020</i>)	28/10/2020 - 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 (February 2020)	14/02/2020 – 11/08/2020
	Watercourse Impact Monitoring, Management and Contingency Plan (August 2020)	12/08/2020 – 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 18, 24 new surface impacts were identified (Table 3 and Figure 2). These impacts are labelled as *DA3B_LW18_001* to *DA3B_LW18_024*. Water quality triggers were also recorded. These triggers will be addressed in the Longwall 18 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 18 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 18 were assessed against the relevant TARP (for landscape, swamp or watercourse) and assigned a trigger value (Level 1, Level 2, Level 3 or exceeding predictions where applicable). Trigger levels 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 associated with Longwall 18.

Site ID	Eastings	Northings	Impact Type	Feature Affected	Identification Date	Trigger Level	Description	Refer to Impact Report/s Dated
DA3B_LW18_001	288784	6191476	Rock Fracturing, Uplift and Fragmentation.	Rock Outcrop	14/12/2021	1	Rock fracturing to a rock outcrop to the south of Swamp 23.	15/12/2021
LA4_S1	288138	6192556	Water Quality Trigger	LA4	17/12/2021	1	Trigger for dissolved oxygen at LA4_S1.	22/12/2021
LA4_S1	288138	6192556	Water Quality Trigger	LA4	17/12/2021	Exceeding Prediction	Trigger for pH at LA4_S1.	22/12/2021
LA4_S1	288138	6192556	Water Quality Trigger	LA4	17/12/2021	Exceeding Prediction	Trigger for electrical conductivity at LA4_S1.	22/12/2021
DA3B_LW18_002	288976	6190704	Rock Fracturing	Rock Outcrop/ Steep Slope	31/01/2022	1	Rock fracturing and soil cracking to a rock outcrop/steep slope west of Fire Road 6A.	31/01/2022
DA3B_LW18_003	288940	6190704	Rock Fracturing, Uplift and Soil Cracking	Rock Outcrop	31/01/2022	2	Rock fracturing to a rock outcrop west of Fire Road 6A.	31/01/2022
DA3B_LW18_004	288864	288948	Rock Fracturing & Uplift	Rock Outcrop	9/02/2022	1	Rock fracturing to a rock outcrop west of Fire Road 6A.	9/02/2022
DA3B_LW18_005 (Update)	288816	6190861	Rockfall	Steep Slope/ Step	9/02/2022	2	Displacement between rock/soil and soil cracking at a steep slope west of Fire Road 6A.	9/02/2022 & 1/07/2022

Site ID	Eastings	Northings	Impact Type	Feature Affected	Identification Date	Trigger Level	Description	Refer to Impact Report/s Dated
DA3B_LW18_006	288948	6190672	Rockfall	Steep Slope/Step	15/02/2022	2	Soil cracking to bushland near an access track west of Fire Road 6A.	16/02/2022
DA3B_LW18_007	288950	6190822	Rock Fracturing	Rock Outcrop	8/06/2022	1	Rock fracturing to rock outcrop west of Fire Road 6A.	15/06/2022
DA3B_LW18_008	288822	6190753	Soil Cracking	Bushland	9/06/2022	2	Soil cracking near access track west of Fire Road 6A.	15/06/2022
DA3B_LW18_009	289595	6190657	Rock Displacement, Fracturing and Fragmentation	Rock Outcrop	9/06/2022	2	Rock fracturing, displacement and fragmentation in bushland near NDC1.	15/06/2022
DA3B_LW18_010	289751	6190685	Rockfall and Fragmentation	Cliffline	10/06/2022	1	Rockfall at 7m high cliffline, west of Fire Road 6A.	15/06/2022
DA3B_LW18_011	289776	6190685	Rockfall	Rock Outcrop	10/06/2022	1	Rockfall to 4m high rock outcrop, west of Fire Road 6A.	15/06/2022
DA3B_LW18_012	288802	6190825	Soil Cracking	Bushland	30/06/2022	2	Soil cracking near access track west of Fire Road 6A.	1/07/2022
DA3B_LW18_013	289038	6191123	Rock Fracturing and Fragmentation	Steep Slope/Step	16/08/2022	1	Rock fracturing and fragmentation to steep slope/step north of LA2.	19/08/2022
DA3B_LW18_014	288978	6191094	Rock Fracture	Steep Slope/Step	16/08/2022	2	Rock fracture to steep slope/step north of LA2.	19/08/2022

Site ID	Eastings	Northings	Impact Type	Feature Affected	Identification Date	Trigger Level	Description	Refer to Impact Report/s Dated
DA3B_LW18_015	288920	6191077	Rock Fracturing	Steep Slope/Step	16/08/2022	1	Rock fracturing to steep slope/step north of LA2.	19/08/2022
DA3B_LW18_016	288886	6191095	Rock Fracturing	Steep Slope/Step	16/08/2022	2	Rock fracturing to steep slope/step north of LA2.	19/08/2022
DA3B_LW18_017	288877	6191083	Rock Displacement and Rockfall	Steep Slope/Step	16/08/2022	1	Rock displacement and rockfall to steep slope/step north of LA2.	19/08/2022
DA3B_LW18_018	288841	6191078	Rock Fracturing and Rockfall	Steep Slope/Step	16/08/2022	1	Rock fracturing and rockfall to steep slope/step north of LA2.	19/08/2022
DA3B_LW18_019	288821	6191105	Rock Fracture	Steep Slope/Step	16/08/2022	1	Rock fracture to steep slope/step north of LA2.	19/08/2022
DA3B_LW18_020	288808	6191114	Rockfall	Step	16/08/2022	1	Rockfall to steep slope/step north of LA2.	19/08/2022
DA3B_LW18_021	288826	6191147	Rock Fracturing	Rock Outcrop	16/08/2022	2	Rock fracturing to rock outcrop north of LA2.	19/08/2022
DA3B_LW18_022	288932	6191153	Rockfall	Steep Slope/Step	16/08/2022	1	Rockfall to steep slope/step north of LA2.	19/08/2022
DA3B_LW18_023	288971	6191224	Soil Cracking	Bushland	16/08/2022	2	Soil cracking in bushland north LA2.	19/08/2022
DA3B_LW18_024	288499	6191616	Iron Staining	LA3	16/08/2022	1	Iron staining in tributary LA3.	19/08/2022
DA3B_LW17_041	290813	6190391	Rockfall and Iron Staining	Waterfall 54	2/08/2022	Exceeding Prediction	Rockfall to Waterfall 54.	8/08/2022

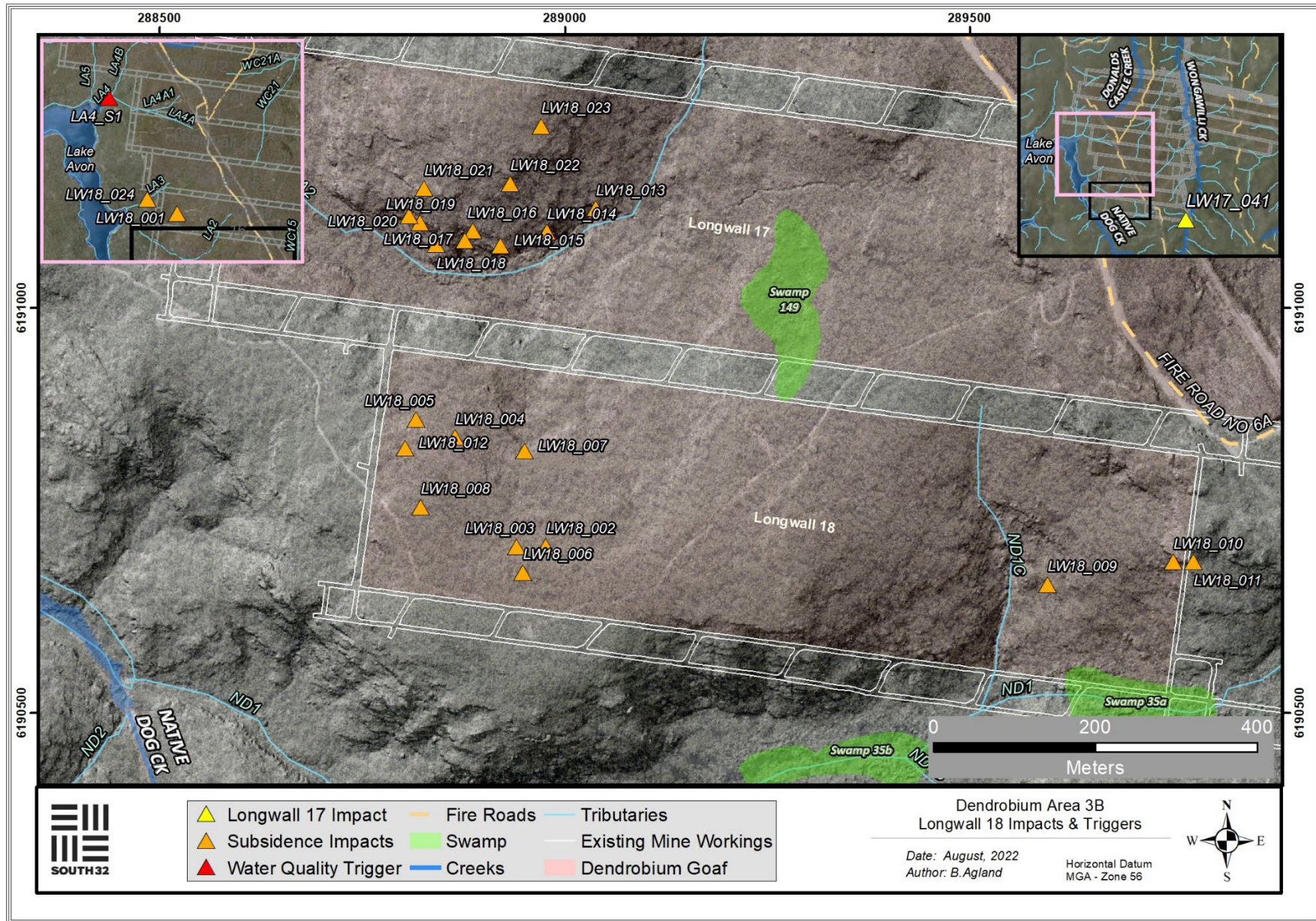


Figure 2: Map showing surface impacts and triggers recorded during Longwall 18 extraction.

5 IMPACTS TO FIRST AND SECOND ORDER STREAMS

5.1 LA3

DA3B_LW18_024 (E 288499, N 6191616)

LA3 is a tributary of Lake Avon, that flows southward from DA3B mining operations (Figure 2). The upper reaches of the LA3 sub catchment were mined beneath by Longwall 15 and Longwall 16. During an inspection on 16 August 2022, iron staining was observed to originate at *LA3_Boulderfield 4a* and extend downstream to *LA3_Step 2* (Photo 5 to Photo 8). Iron staining was not observed upstream or downstream of these features (Photo 9 and Photo 10). No surface impacts have been observed on LA3 prior to this.

DA3B_LW18_024 is a Level 1 trigger as per the DA3B Watercourse Impact, Monitoring Management and Contingency Plan (Table 9), specifically:

- Observable increase in iron staining within the mining area.



Photo 5: *LA3_Boulderfield 4a* looking upstream at the origin of the iron staining. Taken 16/08/2022.



Photo 6: *LA3_Boulderfield 4a* looking downstream from the origin of the iron staining. Taken 16/08/2022.



Photo 7: *LA3_Pool 4*, looking downstream. Taken 15/08/2022.



Photo 8: *LA3_Step 2*, looking upstream. Taken 16/08/2022.



Photo 9: *LA3_Rockbar 4b*, looking downstream.
Taken 15/08/2022.



Photo 10: *LA3_Rockbar 2b*, looking downstream. Taken 16/08/2022.

5.2 Waterfall 54

DA3B_LW17_041 (E 290813, N 6190391)

DA3B_LW17_041 is located at *Waterfall 54*, a feature of Wongawilli Creek (Figure 1). The impact was identified on 2 August 2022 and consists of a rock fall. The rockfall site has an approximate length of 3m, depth of 1.5m and height of 1m (Photo 11). Rock debris is evident at the base of the waterfall (Photo 12). Analysis of photo records to determine the time when the fall occurred, indicates that the rockfall occurred between the 6 October 2021 and 28 October 2021. This period coincides with the extraction and finishing of Longwall 17 (Photo 13 and Photo 14). Visual inspections beneath Waterfall 54 during this period and during active subsidence were restricted due to safety concerns. During active subsidence inspections were conducted from a distance set back from the waterfall. The rockfall occurred behind densely vegetated area and was therefore not observed due to the vegetation and setback observation point.

An increase in iron staining was also observed at *Waterfall 54* (Photo 15), compared to observations recorded in the baseline period. No visual changes to water flow were identified (Photo 6). A specialist review was undertaken.

DA3B_LW17_041 is exceeding predictions as per the Wongawilli Creek Waterfall 54 Trigger Action Response Plan (TARP) (Table 1), specifically;

- Mining results in rock fall at WC-WF54 or its overhang



Photo 11: *DA3B_LW17_041*, showing site of rock fall. Taken 2/08/2022.



Photo 12: *DA3B_LW17_041*, showing a section of potential rock fall. Taken 2/08/2022.



Photo 13: *Waterfall 54* inspection. Taken 6/10/2021.

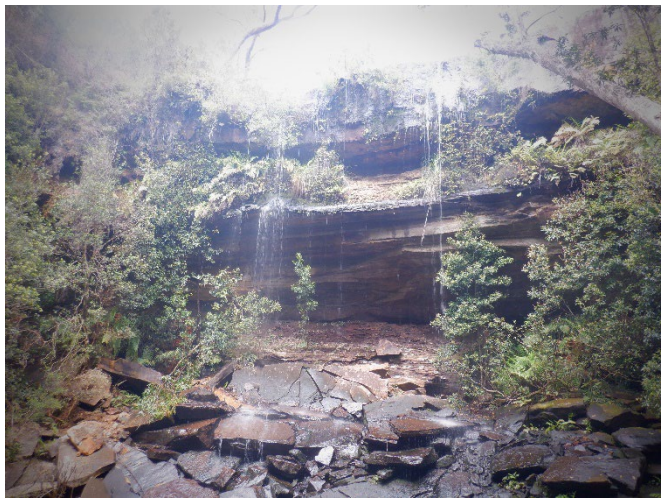


Photo 14: *Waterfall 54* inspection displaying visual change in rock debris (bottom left corner of image). Taken 28/10/2021.



Photo 15: *DA3B_LW17_041*, showing a section of iron staining. Taken 2/08/2022.

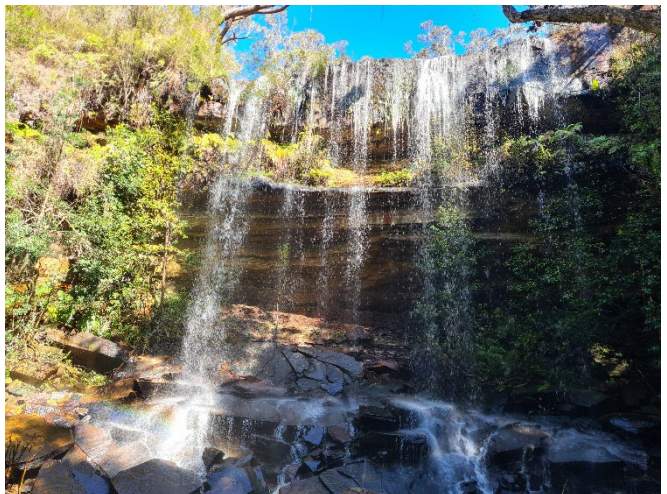


Photo 16: *DA3B_LW17_041*, showing overview of *Waterfall 54*. Taken 2/08/2022.

6 IMPACTS TO OTHER LANDSCAPE FEATURES

DA3B_LW18_001 (E 288784, N 6191476)

DA3B_LW18_001 is located on a rock outcrop to the south of Swamp 23 (Figure 2). The impact is comprised of rock fracturing. The fracturing has a continuous length of 4.70m, a width of up to 0.01m and a maximum measurable depth of 0.16m (Photo 17 and Photo 18). This impact likely occurred during the extraction of Longwall 16, therefore no follow up inspection was conducted following completion of Longwall 18.

DA3B_LW18_001 is a Level 1 trigger as per the Dendrobium Area 3B Landscape TARP (Table 9), specifically:

- Crack or fracture up to 10m in length;
- Crack or fracture up to 100mm width.



Photo 17: DA3B_LW18_001, showing a section of rock fracturing. Taken 14/12/2021.



Photo 18: DA3B_LW18_001, showing the width of the fracturing. Taken 14/12/2021.

DA3B_LW18_002 (E 288976, N 6190704)

DA3B_LW18_002 is located on a rock outcrop/ steep slope west of Fire Road 6A (Figure 2). The impact area consists of two rock fractures with associated soil cracking. The largest fracture has a maximum continuous length of 3.46m, a width of up to 0.025m and a maximum measurable depth of 0.68m (Photo 19 and Photo 20). The impact was re-inspected on 21 June 2022 and no changes were observed (Photo 21).

DA3B_LW18_002 is a Level 1 trigger as per the Dendrobium Area 3B Landscape TARP (Table 9), specifically:

- Crack or fracture up to 10m in length;
- Crack or fracture up to 100mm width.



Photo 19: *DA3B_LW18_002*, showing a section of rock fracturing. Taken 31/01/2022.



Photo 20: *DA3B_LW18_002*, showing the width of the fracturing. Taken 31/01/2022.



Photo 21: *DA3B_LW18_002*, showing a section of rock fracturing. Taken 21/06/2022.

DA3B_LW18_003 (E 288940, N 6190704)

DA3B_LW18_003 is located on a rock outcrop west of Fire Road 6A (Figure 2). The impact consists of a rock fracture. The rock fracture has a continuous length of 15.5m, a width of up to 0.08m and a maximum measurable depth of 1.1m (Photo 22 and Photo 23). The impact was re-inspected on 21 June 2022 and dislodgment and fragmentation of the original fracture was observed (Photo 24). Maximum recorded values remain unchanged from the first inspection.

DA3B_LW18_003 is a Level 2 trigger as per the Dendrobium Area 3B Landscape TARP (Table 9), specifically:

- Crack or fracture between 10m and 50m in length.



Photo 22: *DA3B_LW18_003*, showing a section of rock fracturing. Taken 31/01/2022.

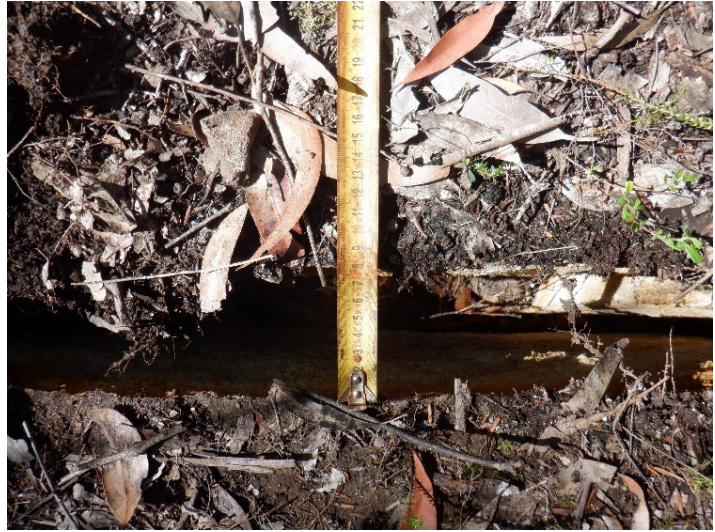


Photo 23: *DA3B_LW18_003*, showing the width of the fracturing. Taken 31/01/2022.



Photo 24: *DA3B_LW18_003*, showing the additional fragmentation and dislodgment. Taken 21/06/2022.

DA3B_LW18_004 (E 288864, N 6190839)

DA3B_LW18_004 is located on a rock outcrop west of Fire Road 6A (Figure 2). The impact is comprised of a rock fracture. The fracture has a maximum continuous length of 2.9m, a width of up to 0.02m and a maximum measurable depth of 0.45m (Photo 25 and Photo 26). The impact was re-inspected on 30 June 2022. The fracture now has a maximum continuous length of 3.4m, a width of up to 0.03m and maximum measurable depth of 0.9m (Photo 27).

DA3B_LW18_004 is a Level 1 trigger as per the Dendrobium Area 3B Landscape TARP (Table 9), specifically:

- Crack or fracture up to 10m in length;
- Crack or fracture up to 100mm width.



Photo 25: *DA3B_LW18_004*, showing the length of rock fracturing. Taken 9/02/2022.



Photo 26: *DA3B_LW18_004*, showing the width of the fracturing. Taken 9/02/2022.



Photo 27: *DA3B_LW18_004*, overview of the impact. Taken 30/06/2022.

DA3B_LW18_005 (E 288816, N 6190851)

DA3B_LW18_005 is located on a steep slope/ridgeline west of Fire Road 6A (Figure 2). The impact consists of displacement between soil and adjacent rock strata. The displacement has a discontinuous length of 5.5m, a continuous length of 1.9m, a width of up to 0.06m and a maximum measurable depth of 1.1m (Photo 28 and Photo 29). The impact was re-inspected on 30 June 2022 and additional soil cracking was observed. The soil cracking has a maximum continuous length of 16m, discontinuous length of 42.4m, maximum width of 0.09m and maximum measurable depth of 3.09m (Photo 30 and Photo 31).

DA3B_LW18_005 is a Level 2 trigger as per the Dendrobium Area 3B Landscape TARP (Table 9), specifically:

- Crack or fracture between 10m and 50m in length.



Photo 28: DA3B_LW18_005, showing a section of displacement. Taken 9/02/2022.

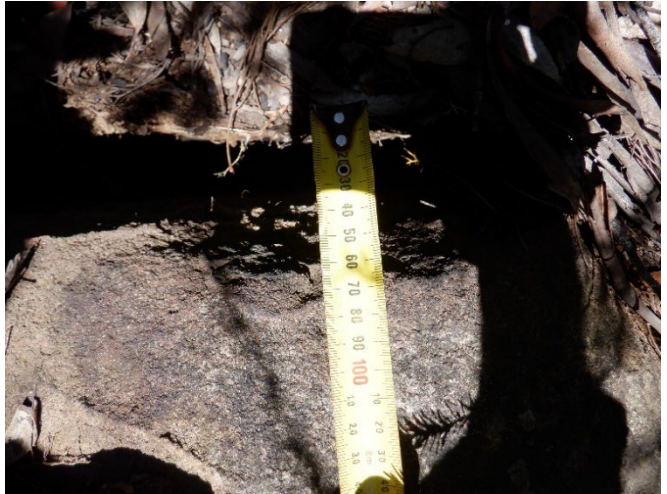


Photo 29: DA3B_LW18_005, showing the width of the displacement. Taken 9/02/2022.



Photo 30: DA3B_LW18_005, showing a section of soil cracking. Taken 30/06/2022.



Photo 31: DA3B_LW18_005, showing the depth of soil cracking. Taken 30/06/2022.

DA3B_LW18_006 (E 288948, N 6190672)

DA3B_LW18_006 is located near an access track west of Fire Road 6A (Figure 2). The impact is comprised of soil cracking. The soil cracking has a continuous length of 15m, a width of up to 0.15m and a maximum measurable depth of 0.60m (Photo 32 and Photo 33). The impact was re-inspected on 21 June 2022 and no changes were observed (Photo 34).

DA3B_LW18_006 is a Level 2 trigger as per the Dendrobium Area 3B Landscape TARP (Table 9), specifically:

- Crack or fracture between 10m and 50m in length;
- Crack or fracture between 100mm and 300mm width.



Photo 32: *DA3B_LW18_006*, showing a section of soil cracking. Taken 15/02/2022.



Photo 33: *DA3B_LW18_006*, showing the width of soil cracking. Taken 15/02/2022.



Photo 34: *DA3B_LW18_006*, showing a section of soil cracking. Taken 21/06/2022.

DA3B_LW18_007 (E 288950, N 6190822)

DA3B_LW18_007 is located in bushland west of Fire Road 6A (Figure 2). The impact is comprised of rock fracturing. The rock fracturing has a continuous maximum length of 2.03m, a width of up to 0.02m and a maximum measurable depth of 0.50m (Photo 35 and Photo 36).

DA3B_LW18_007 is a Level 1 trigger as per the Dendrobium Area 3B Landscape TARP (Table 9), specifically:

- Crack or fracture up to 100mm width;
- Crack or fracture up to 10m length.



Photo 35: *DA3B_LW18_007*, showing a section of rock fracturing. Taken 8/06/2022.



Photo 36: *DA3B_LW18_007*, showing the width of rock fracturing. Taken 8/06/2022.

DA3B_LW18_008 (E 288822, N 6190753)

DA3B_LW18_008 is located near an access track west of Fire Road 6A (Figure 2). The impact is comprised of soil cracking. The soil cracking has a continuous length of 15.52m, a maximum width of 0.28m and a maximum measurable depth of 2.8m (Photo 37 and Photo 38).

DA3B_LW18_008 is a Level 2 trigger as per the Dendrobium Area 3B Landscape TARP (Table 9), specifically:

- Crack or fracture between 100 and 300mm width;
- Crack or fracture between 10 and 50m length.



Photo 37: *DA3B_LW18_008*, showing a section of soil cracking. Taken 9/06/2022.



Photo 38: *DA3B_LW18_008*, showing the depth of soil cracking. Taken 9/06/2022.

DA3B_LW18_009 (E 289595, N 6190657)

DA3B_LW18_009 is located in bushland near ND1C (Figure 2). The impact is comprised of rock displacement, fracturing and fragmentation. The rock displacement has a maximum continuous length of 0.9m, a maximum width of 0.2m and a maximum measurable depth of 1.0m (Photo 39 and Photo 40). The rock fracture has a maximum continuous length of 4.2m, a maximum width of 0.02m and a maximum measurable depth of 0.22m (Photo 41 and Photo 42).

DA3B_LW18_009 is a Level 2 trigger as per the Dendrobium Area 3B Landscape TARP (Table 9), specifically:

- Crack or fracture between 100 and 300mm width.



Photo 39: DA3B_LW18_009, showing a section of rock displacement. Taken 9/06/2022.



Photo 40: DA3B_LW18_009, showing the width of rock displacement. Taken 9/06/2022.



Photo 41: DA3B_LW18_009, showing width of rock fracturing. Taken 9/06/2022.



Photo 42: DA3B_LW18_009, showing a section of rock fragmentation. Taken 9/06/2022.

DA3B_LW18_010 (E 289751, N 6190685)

DA3B_LW18_010 is located at the base of a 7m high steep slope, west of Fire Road 6A (Figure 2). The impact is comprised of rockfall and fragmentation. The rockfall site has an approximate length of 1.6m, width of 1.0m and depth of 0.6m (values have been estimated due to safety concerns getting closer) (Photo 43 and Photo 44).

DA3B_LW18_010 is a Level 1 trigger as per the Dendrobium Area 3B Landscape TARP (Table 9), specifically:

- Rockfall from a cliff (steep slope) which is left mostly intact (<10% length), resulting in insignificant ground disturbance.



Photo 43: *DA3B_LW18_010*, showing rock fall and fragmentation. Taken 10/06/2022.

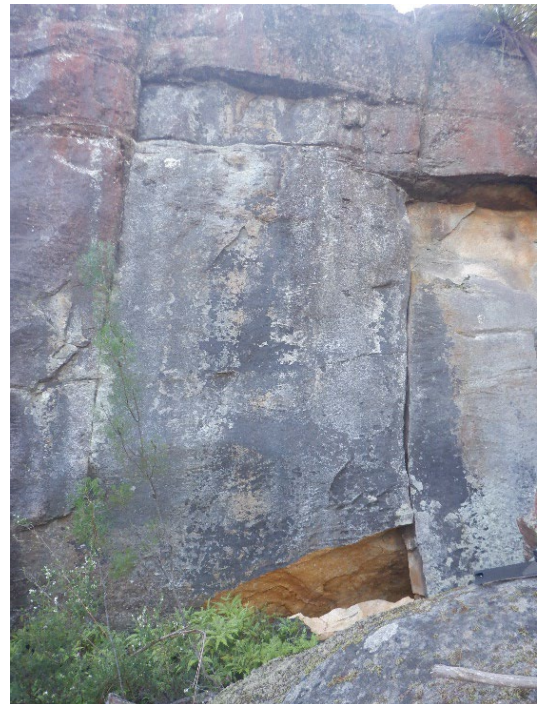


Photo 44: *DA3B_LW18_010*, showing rock fall and fragmentation site. Taken 10/06/2022.

DA3B_LW18_011 (E 289776, N 6190685)

DA3B_LW18_011 is located on a 4m high rock outcrop, west of Fire Road 6A (Figure 2). The impact is comprised of a rockfall. The rockfall has an approximate length of 1.0m, width of 0.6m and depth of 0.2m (values have been estimated due to safety concerns) (Photo 45).

DA3B_LW18_011 is a Level 1 trigger as per the Dendrobium Area 3B Landscape TARP (Table 9), specifically:

- Rockfall from a cliff (step/outcrop) which is left mostly intact (<10% length), resulting in insignificant ground disturbance.



Photo 45: *DA3B_LW18_011*, showing rock fall. Taken 10/06/2022.

DA3B_LW18_012 (E 288802, N 6190825)

DA3B_LW18_012 is located in bushland west of Fire Road 6A (Figure 2). The impact is comprised of two soil cracks running in parallel, with discontinuous lengths of 26m and 9.5m. The soil cracking has a maximum continuous length of 10.8m, a width of up to 0.06m and a maximum measurable depth of 3.70m (Photo 46 and Photo 47). Visible rock fracturing can be seen in lower sections of the soil cracking (Photo 48).

DA3B_LW18_012 is a Level 2 trigger as per the Dendrobium Area 3B Landscape TARP (Table 9) specifically:

- Crack or fracture between 10 and 50m length.



Photo 46: *DA3B_LW18_012*, showing a section of soil cracking. Taken 30/06/2022.



Photo 47: *DA3B_LW18_012*, showing depth of soil cracking. Taken 30/06/2022.



Photo 48: *DA3B_LW18_012*, showing exposed rock within the cracking. Taken 30/06/2022.

DA3B_LW18_013 (E 289038, N 6191123)

DA3B_LW18_013 is located on a steep slope/step on the northern slope of LA2 valley (Figure 2). The impact was mined beneath by Longwall 17. The impact is comprised of a rock fracture and fragmentation (Photo 49 and Photo 50). The rock fracture has a maximum length of 1.1m, a maximum measurable depth of 0.5m and a maximum width of 0.015m. The rock fragmentation has an approximate volume of 0.015m³ (0.14m x 0.2m x 0.55m).

DA3B_LW18_013 is a Level 1 trigger as per the DA3B Landscape TARP (Table 9), specifically:

- Crack or fracture up to 10m length
- Crack or fracture up to 100mm width



Photo 49: *DA3B_LW18_013*, showing overview of rock fracture. Taken 16/08/2022.



Photo 50: *DA3B_LW18_013*, showing rock fragmentation. Taken 16/08/2022.

DA3B_LW18_014 (E 288978, N 6191094)

DA3B_LW18_014 is located on a steep slope/step on the northern slope of LA2 valley (Figure 2). The impact was mined beneath by Longwall 17. The impact is comprised of multiple rock fractures and a rockfall (Photo 51 to Photo 54). The rock fracture has a maximum length of 1.4m, a maximum width of 0.19m and a maximum measurable depth of 2m.

DA3B_LW18_014 is a Level 2 trigger as per the DA3B Landscape TARP (Table 9), specifically:

- Crack or fracture between 100 and 300mm width



Photo 51: *DA3B_LW18_014*, showing overview of site. Taken 16/08/2022.



Photo 52: *DA3B_LW18_014*, maximum width of fracture. Taken 16/08/2022



Photo 53: *DA3B_LW18_014*, showing section of rock fracturing. Taken 16/08/2022.



Photo 54: *DA3B_LW18_014*, showing rockfall debris. Taken 16/08/2022.

DA3B_LW18_015 (E 288920, N 6191077)

DA3B_LW18_015 is located on a steep slope/step on the northern slope of LA2 valley (Figure 2). The impact site was mined beneath by Longwall 17. The impact is comprised of a vertical rock fracture at the base of a steep slope/step (Photo 55 and Photo 56). The rock fracture has a maximum length of 0.45m, a maximum measurable depth of 0.25m and a maximum width of 0.02m.

DA3B_LW18_015 is a Level 1 trigger as per the DA3B Landscape TARP (Table 9), specifically:

- Crack or fracture up to 10m length
- Crack or fracture up to 100mm width



Photo 55: *DA3B_LW18_015*, showing overview of rock fracture. Taken 16/08/2022.



Photo 56: *DA3B_LW18_015*, showing width of rock fracture. Taken 16/08/2022.

DA3B_LW18_016 (E 288886, N 6191095)

DA3B_LW18_016 is located on a steep slope/step on the northern slope of LA2 valley (Figure 2). The impact was mined beneath by Longwall 17. The impact is comprised of multiple rock fractures in an area of 15m² (Photo 57 and Photo 58). The rock fracturing has a maximum length of 2.9m, a maximum width of 0.11m and a maximum measurable depth of 0.94m.

DA3B_LW18_014 is a Level 2 trigger as per the DA3B Landscape TARP (Table 9), specifically:

- Crack or fracture between 100 and 300mm width



Photo 57: *DA3B_LW18_016*, showing largest rock fracture. Taken 16/08/2022.



Photo 58: *DA3B_LW18_016*, showing maximum width of rock fracturing. Taken 16/08/2022

DA3B_LW18_017 (E 288877, N 6191083)

DA3B_LW18_017 is located on a steep slope/step on the northern slope of LA2 valley (Figure 2). The impact was mined beneath by Longwall 17. The impact is comprised of a rockfall, rock displacement and rock fracturing (Photo 59 and Photo 60). The dislodged rock has a volume of approximately 0.13m³ (1.1m x 0.16m x 0.75m). Minor rock fracturing is present.

DA3B_LW18_017 is a Level 1 trigger as per the DA3B Landscape (Table 9), specifically:

- Rockfall from a cliff which is left mostly intact (<10% length), resulting in insignificant ground disturbance
- Crack or fracture up to 100mm width
- Crack or fracture up to 10m length



Photo 59: DA3B_LW18_017, showing rock displacement. Taken 16/08/2022.



Photo 60: DA3B_LW18_017, showing rockfall. Taken 16/08/2022.

DA3B_LW18_018 (E 288841, N 6191078)

DA3B_LW18_018 is located on a steep slope/step on the northern slope of LA2 valley (Figure 2). The impact was mined beneath by Longwall 17. The impact is comprised of multiple rock fractures and rockfalls in an area of 20m x 5m (Photo 61 to Photo 64). The rock fracturing has an estimated maximum length of 3.5m and an estimated maximum width of 0.08m. The largest rockfall has an estimated volume of 0.26m³ (1.5m x 0.7m x 0.25m). Measurements were estimated due to safety concerns.

DA3B_LW18_018 is a Level 1 trigger as per the DA3B Landscape TARP (Table 9), specifically:

- Crack or fracture up to 10m in length
- Crack or fracture up to 100mm width
- Rockfall from a cliff which is left mostly intact (<10% length), resulting in insignificant ground disturbance



Photo 61: *DA3B_LW18_018*, showing section of rockfall and rock fracturing. Taken 16/08/2022.



Photo 62: *DA3B_LW18_018*, showing section of rockfall. Taken 16/08/2022.



Photo 63: *DA3B_LW18_018*, showing section of rock fracturing. Taken 16/08/2022.



Photo 64: *DA3B_LW18_018*, showing section of rock fracturing. Taken 16/08/2022.

DA3B_LW18_019 (E 288821, N 6191105)

DA3B_LW18_019 is located on a steep slope/step on the northern slope of LA2 valley (Figure 2). The impact was mined beneath by Longwall 17. The impact is comprised of a vertical rock fracture (Photo 65 and Photo 66). The fracture has a maximum length of 3.6m (discontinuous length 5m), a maximum measurable depth of 0.6m and a maximum width of 0.03m.

DA3B_LW18_019 is a Level 1 trigger as per the DA3B Landscape TARP (Table 9), specifically:

- Crack or fracture up to 10m in length
- Crack or fracture up to 100mm width



Photo 65: *DA3B_LW18_019*, showing overview of rock fracture. Taken 16/08/2022.

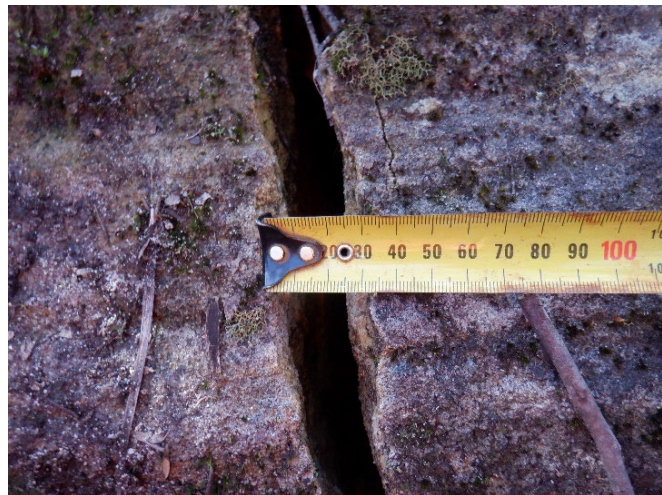


Photo 66: *DA3B_LW18_019*, showing maximum width of rock fracture. Taken 16/08/2022.

DA3B_LW18_020 (E 288808, N 6191114)

DA3B_LW18_020 is located on a step on the northern slope of LA2 valley (Figure 2). The impact site was mined beneath by Longwall 17. The impact is comprised of a rockfall from a small overhang on a step (Photo 67 and Photo 68). The rockfall is 7.3m in length, 3.9m in width and 0.9m in depth, having an approximate volume of 25.6m³. The debris area is 7.3m by 3.9m.

DA3B_LW18_020 is a Level 1 trigger as per the DA3B Landscape (Table 9), specifically:

- Rockfall from a cliff which is left mostly intact (<10% length), resulting in insignificant ground disturbance



Photo 67: *DA3B_LW18_020*, showing overview of impact. Taken 16/08/2022.



Photo 68: *DA3B_LW18_020*, showing rockfall closer up. Taken 16/08/2022.

DA3B_LW18_021 (E 288826, N 6191147)

DA3B_LW18_021 is located on a rock outcrop north of the LA2 valley (Figure 2). The impact was mined beneath by Longwall 17. The impact is comprised of multiple rock fractures in an area of 15m x 10m (Photo 69 to Photo 72). The rock fracturing has a maximum length of 10m, a maximum width of 0.13m and a maximum measurable depth of 0.94m.

DA3B_LW18_021 is a Level 2 trigger as per the DA3B Landscape TARP (Table 9), specifically:

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



Photo 69: *DA3B_LW18_021*, showing section of rock fracturing. Taken 16/08/2022.



Photo 70: *DA3B_LW18_021*, showing maximum width of rock fracturing. Taken 16/08/2022.



Photo 71: *DA3B_LW18_021*, showing overview of largest fracture. Taken 16/08/2022.



Photo 72: *DA3B_LW18_021*, showing section of rock fracturing. Taken 16/08/2022.

DA3B_LW18_022 (E 288932, N 6191153)

DA3B_LW18_022 is located on a steep slope/step on the northern slope of LA2 valley (Figure 2). The impact site was mined beneath by Longwall 17. The impact is comprised of a rockfall from a steep slope/step (Photo 73 and Photo 74). The rockfall was 2.6m in length, 1.3m in width and 1.2m in depth, having a volume of approximately 4m³.

DA3B_LW18_022 is a Level 1 trigger as per the DA3B Landscape (Table 9), specifically:

- Rockfall from a cliff which is left mostly intact (<10% length), resulting in insignificant ground disturbance



Photo 73: *DA3B_LW18_022*, showing overview of impact. Taken 16/08/2022.



Photo 74: *DA3B_LW18_022*, showing section of rockfall/debris. Taken 16/08/2022.

DA3B_LW18_023 (E 288971, N 6191224)

DA3B_LW18_023 is in bushland north of the LA2 valley (Figure 2). The impact was mined beneath by Longwall 17 and consists of soil cracking (Photo 75 to Photo 77). The cracking has a maximum width of 0.25m, a maximum continuous length of 26m and maximum measurable depth of 2m. Flagging tape is in place as a safety precaution.

DA3B_LW18_023 is a Level 2 trigger as per the DA3B Landscape TARP (Table 9), specifically:

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



Photo 75: DA3B_LW18_023, showing section of soil cracking. Taken 16/08/2022.



Photo 76: DA3B_LW18_023, showing maximum width of soil cracking. Taken 16/08/2022.



Photo 77: DA3B_LW18_023, showing overview of soil cracking. Taken 16/08/2022.

7 TARP TRIGGERS

7.1 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. Water quality parameters are recorded at LA4_S1, with results reaching the TARP level for pH, Dissolved Oxygen (DO) and Electrical Conductivity (EC) as shown in Table 4. During an inspection on 17 December 2021, surface flow was observed entering the site but no flow was observed exiting the site (Photo 78 and Photo 79). Water quality results for pH and EC were recorded as a Level 3 Trigger during the extraction of Longwall 17; reported on 9 June 2021 and 6 July 2021, respectively. A specialist review was undertaken in response. Water quality results for DO were recorded as a Level 1 Trigger during the extraction of Longwall 16; reported on 5 August 2020.

Table 4: Water quality results and associated TARP levels for LA4_S1, on Lake Avon tributary LA4.

Site	Water Quality Parameter	Result on 18/11/2021	Result on 17/12/2021	TARP Level
LA4_S1	pH (pH Units)	4.11	4.01	Below 4.9
	DO (%)	86.4	67.6	Below 69.5
	EC (µS/cm)	172	160	Above 129.8

*Red indicates TARP has been reached. Blue indicates TARP has not been reached.

These observations constitute a Level 1 trigger and Exceeding Predictions triggers as per the DA3B Watercourse Impact, Monitoring Management and Contingency Plan (Table 8) specifically:

- One exceedance of the ± 3 standard deviation level (negative for pH and DO, positive for EC) from the baseline mean within six months:
 - DO 69.5 %
- Mining results in two consecutive exceedances or three exceedances 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 µS/cm



Photo 78: LA4_S1, looking upstream. Taken on 17/12/2021.



Photo 79: LA4_S1, looking downstream. Taken on 17/12/2021.

8 IMPACTS TO BUILT FEATURES

No impacts were observed on built features during the extraction of Longwall 18.

9 CURRENT AND FUTURE MONITORING

Monitoring undertaken during Longwall 18 and recommendations for future monitoring in Dendrobium Area 3A, particularly concerning Longwall 19, are outlined in Table 5. These recommendations are based on monitoring commitments in the Dendrobium Area 3B/3A 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: WC21* and LA4A. These will be monitored at a reduced frequency.

* A rehabilitation plan is underway at WC21 and monitoring will continue in accordance with this.

Table 5: Monitoring sites associated with Longwall 18 and monitoring proposed for Longwall 19 in DA3A.

Aspect	Monitoring Sites Associated with Longwall 18	Monitoring Frequency	Recommended Future Monitoring for Longwall 19
Watercourses	Observational, photo point and water monitoring <ul style="list-style-type: none"> • Donalds Castle Creek • Lake Avon • LA2 • LA3 • Swamp 23 • Swamps 13 and 14 • WC12, WC15 and WC21 • Wongawilli Creek • WC6, WC7, WC8, WC9 • Swamp 35a/b • Swamp 149, 150, 151 • Native Dog Creek • ND1, ND1C 	<p>Monthly 2 years pre and post mining, weekly when longwall is within 400m of monitoring site.</p> <p>Reference sites 6 monthly.</p> <p>SLMMP Sites: pre and post mining, monthly when longwall is within 400m of monitoring site.</p>	<p>Longwall 19 Monitoring</p> <ul style="list-style-type: none"> • Wongawilli Creek • Sandy Creek • SC10 • SC10B • SC10C • WC13 • WC13A • WC14 • WC15 • WC17 • WC17B <p>Dendrobium Area 3B (post-mining for 2 years)</p> <ul style="list-style-type: none"> • LA2 • LA3 • ND1 • ND1A • ND1B • ND1C • ND2 • WC12 • WC15 • WC7

Aspect	Monitoring Sites Associated with Longwall 18	Monitoring Frequency	Recommended Future Monitoring for Longwall 19
	<p>Water Quality</p> <p>Wongawilli Creek</p> <ul style="list-style-type: none"> • WWU1 (Wongawilli Creek headwaters) • WWU4 (Wongawilli Creek upstream) • WC_Pool 104 (Wongawilli Creek adjacent to LW17) • WC_Pool 87 (Wongawilli Creek adjacent to LW15) • WC_Pool 69 (Wongawilli Creek adjacent to LW12) • WWM2 (Wongawilli Creek adjacent to LW11) • WC_Pool 49 (Wongawilli Creek downstream of LW9) • WC_FR6 (Wongawilli Creek downstream) • WC21_Pool 5 (Wongawilli Creek tributary downstream of mining) • WC21_Pool 30 (Wongawilli Creek tributaries overmining) • WC21_Pool 53 (Wongawilli Creek tributary overmining) • 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"> • DCC_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 • CR36_S1 	<p>Monthly monitoring pre, during and post mining for two years.</p>	<p>Longwall 19 Monitoring</p> <ul style="list-style-type: none"> • Wongawilli Creek (WC_Channel 14, WC_Pool 53, WC_Pool 55, WC_Pool 69, WC_Pool 72b, WC_Pool 72A) • Sandy Creek (SCK_Rockbar 5, Sandy Creek Arm) • SC10 (SC10_Pool 1, SC10_Rockbar 3, SC10_Pool 4, SC10_Pool 10b, SC10_Pool 11, SC10_Pool 14, SC10_Pool 15, SC10_Pool 21, SC10_Pool 23, SC10_Pool 26a, SC10_Pool 29. • SC10C (SC10C_Pool 1, SC10C_Pool 3, SC10C_Pool 5, SC10C_Pool 8, SC10C_Pool 11a) • WC13 (WC13_Pool 1, WC13_Pool 3) • WC14 (WC14_Pool 3, WC14_Pool 16) • WC15 (WC15_Pool 2, WC15_Pool 9) • WC17 (WC17_Pool 0, WC17_Pool 4, WC17_Pool 10, WC17_Pool 12) <p>Dendrobium Area 3B (post-mining for 2 years)</p> <ul style="list-style-type: none"> • Lake Avon (LA_1, LA1) • LA2 (LA2_Pool 5, LA2_Pool 24, LA2_Pool 25, LA2_Pool 34) • LA3 (LA3_RB4B, LA3_Pool 4) • ND1 (ND1_Pool 2, ND1_Pool 23) • Native Dog Creek (NDC_Pool 1, NDC_Pool 6, NDC_Pool 7, NDC_Pool 15) • ND2 (ND2_Pool 3) • WC12 (WC12_Pool 1, WC12_Pool 12, WC12_Rockbar 18) • WC15 (WC15_Pool 28, WC15_Channel 32A, WC15_Pool 34) • Wongawilli Creek (WC_Pool 87, WC_Pool 104) • WC7 (WC7_Pool 1, WC7_Pool 9, WC7_Pool 14) <p>Reference Site</p> <ul style="list-style-type: none"> • LC5_S1 • CR36_S1 • NDC1

Aspect	Monitoring Sites Associated with Longwall 18	Monitoring Frequency	Recommended Future Monitoring for Longwall 19
Swamps	Observational, Photo Point and Water Monitoring		
	<ul style="list-style-type: none"> Swamps 13, 14, 23, 35a/b, 149, 150, 151 	<p>Pre and post mining for 2 years, monthly when longwall is within 400 m of monitoring site.</p> <p>Weekly inspection and pool water levels when longwall is within 400 m of monitoring site.</p> <p>Reference sites 6-monthly.</p>	<ul style="list-style-type: none"> Swamps 12, 15a, 15b, 34, 95, 146, 148
Shallow Groundwater Level			
	<ul style="list-style-type: none"> Swamp 13: 13_01 Swamp 14: 14_01, 14_02 Swamp 23: 23_01, 23_02 Swamp 35a: 35a_01 Swamp 35b: 35b_01 Swamp 149: 149_01 Swamp 150: 150_01 Swamp 151: 151_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 	<p>For open hole sites:</p> <ul style="list-style-type: none"> Monthly monitoring pre, during and post mining for two years to be reviewed annually Reference sites 6 monthly <p>For instrumented sites:</p> <ul style="list-style-type: none"> Automatic groundwater level monitoring pre, during and post mining (1-hour interval or similar) Monitoring post mining for five years to be reviewed annually 	<p>Longwall 19 Monitoring</p> <ul style="list-style-type: none"> Swamp 12: 12_01, 12_03, 12_04 Swamp 15A: 15a_03, 15a_04, 15a_07, 15a_12, 15a_15, 15a_18, 15a_19 Swamp 15b: 15b_H1, 15b_H2, 15b_H3, 15b_39 Swamp 34: 34_01 Swamp 95: 95_01 Swamp 146: 146_01 Swamp 148: 148_01 <p>Dendrobium Area 3B (post-mining for 2 years)</p> <ul style="list-style-type: none"> Swamp 14: 14_01, 14_02 Swamp 23: 23_02 Swamp 35a: 35a_01 Swamp 35b: 35b_01 Swamp 150: 150_01 Swamp 151: 151_01 <p>Reference Sites</p> <ul style="list-style-type: none"> Swamp 2: 02_S01 Swamp 7: 07_S05, 07_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 13: S13_S01, S13_S02, S13_S03 Swamp 14: 14_01, 14_02 Swamp 23: 23_02 Swamp 35a: 35a_01 	<p>For manually measured sites:</p> <ul style="list-style-type: none"> Monthly monitoring for 2 years baseline and post mining and 6-monthly reference sites Weekly monitoring when longwall is within 400 m of 	<p>Longwall 19 Monitoring</p> <ul style="list-style-type: none"> Swamp 12: 12_01, 12_03, 12_04 Swamp 15A: 15a_03, 15a_04, 15a_07, 15a_12, 15a_15, 15a_18, 15a_19

Aspect	Monitoring Sites Associated with Longwall 18	Monitoring Frequency	Recommended Future Monitoring for Longwall 19
	<ul style="list-style-type: none"> • Swamp 35b: 35b_01 • Swamp 149: 149_01 • Swamp 150: 150_01 <p>Reference Sites:</p> <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 	<p>monitoring site</p> <p>For instrumented sites:</p> <ul style="list-style-type: none"> • Automatic soil moisture monitoring pre, during and post • Monitoring post mining for five years to be reviewed annually 	<ul style="list-style-type: none"> • Swamp 15b: 15b_H1, 15b_H2, 15b_H3, 15b_39 • Swamp 34: 34_01 • Swamp 95: 95_01 • Swamp 146: 146_01 • Swamp 148: 148_01 <p>Dendrobium Area 3B (post-mining 2 years)</p> <ul style="list-style-type: none"> • Swamp 13: 13_03 • Swamp 14: 14_01, 14_02 • Swamp 23: 23_02 • Swamp 35a: 35a_01 • Swamp 35b: 35b_01 • Swamp 149: 149_01 • Swamp 150: 150_01 • Swamp 151: 151_01 <p>Reference Sites:</p> <ul style="list-style-type: none"> • Swamp 2: S02_S01 • Swamp 7: S07_S05, S07_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
Landscape	Targeted Sites		
	<p>Cliffs</p> <ul style="list-style-type: none"> • No Clifflines <p>Fire Trails</p> <ul style="list-style-type: none"> • Fire Road 6A (across active mining area) • Fire Road 6N • Fire Road 6P • Fire Road 6Q Fire Road 6P 	<p>Monthly monitoring during any subsidence period. Monitoring to continue 6 monthly for 2 years following the completion of mining.</p>	<p>Cliffs</p> <ul style="list-style-type: none"> • DA3-CF7 • DA3-CF8 • DA3-CF15 • DA3-CF16 • DA3-CF17 • DA3-CF18 <p>Fire Trails</p> <ul style="list-style-type: none"> • Fire Road 6F (across active mining area)
Inspection of Active Mining Area – Landscape Features, Vegetation, Watercourses			
	<p>Continue monitoring of all mapped cliff, steep slope, watercourse, swamp and firetrail sites in subsidence area.</p> <p>Continue general observation of active mining areas.</p>	<p>Weekly monitoring when longwall extraction is within 400m of feature.</p>	<p>Continue monitoring of all mapped cliff, steep slope, watercourse, swamp and fire trail sites in subsidence area.</p> <p>Continue general observation of active mining areas.</p>

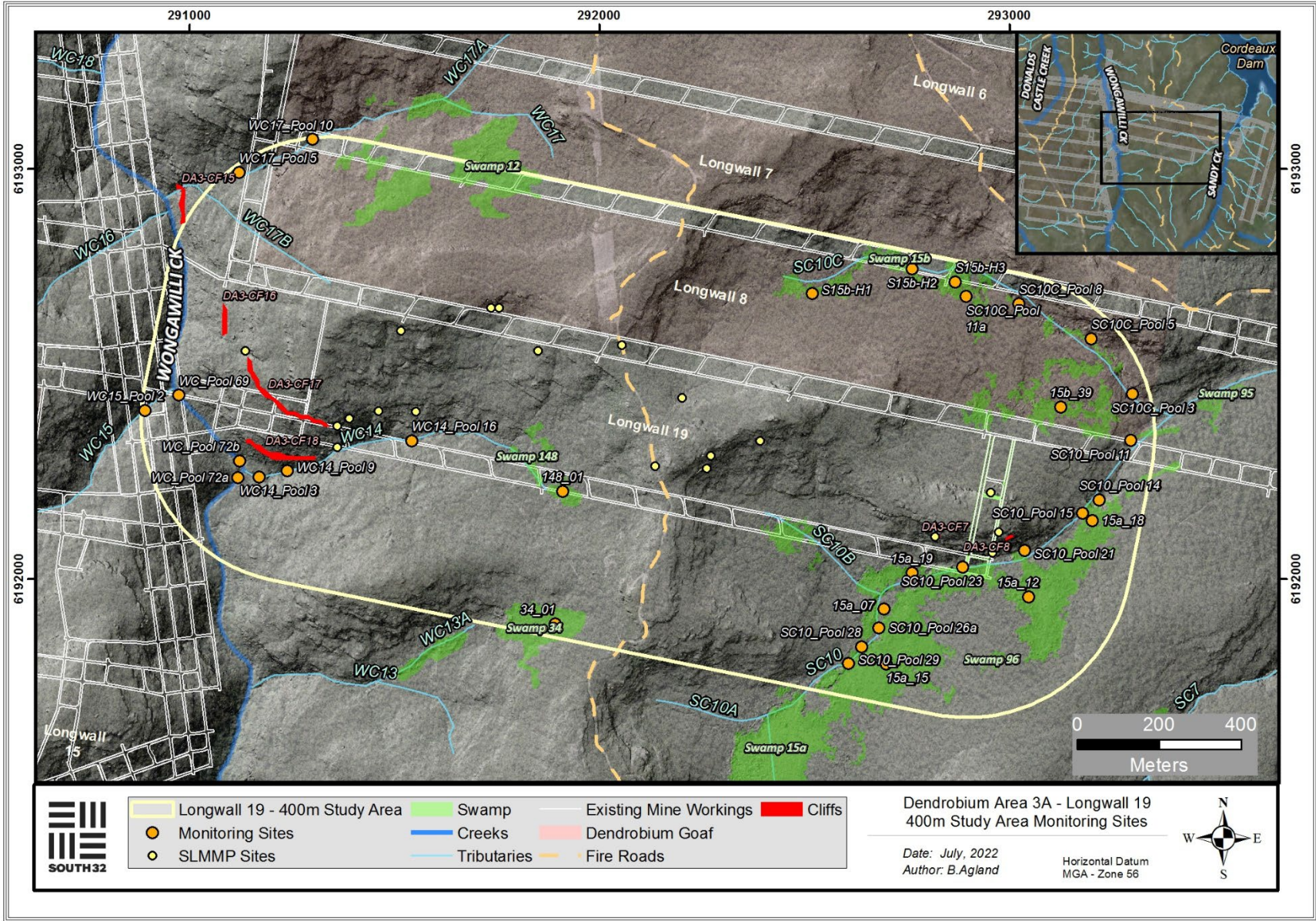


Figure 3: Monitoring sites relevant to Longwall 19.

10 PREDICTED AND OBSERVED IMPACTS

The below table provides a summary of the predicted and observed impacts for Longwall 18 (Table 6).

Table 6: Dendrobium Area 3B Impacts, TARPs and Performance measures for Longwall 18.

Performance Measure	Potential Impacts	Exceeding Prediction	TARP Trigger Level	Observed Impacts/Triggers	Additional Comments
Watercourses					
<p>Wongawilli Creek & Donalds Castle Creek</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) 	<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 	<p>No Level 2 impacts observed</p>	
		<ul style="list-style-type: none"> • 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 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>No Level 3 impacts observed</p>	

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><u>Drainage lines</u></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"> • LA4_S1 <ul style="list-style-type: none"> - One exceedance of the ± 3 standard deviation level for DO from the baseline mean within six months • DA3B_LW18_024 <ul style="list-style-type: none"> - Iron staining present at LA3 	<p>- See impact report dated: 22/12/2021</p> <p>- See impact report dated: 19/08/2022</p>

Performance Measure	Potential Impacts	<i>Exceeding Prediction</i>	TARP Trigger Level	Observed Impacts/Triggers	Additional Comments
		site Donalds Castle Ck (FR6) • 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	Level 2 • Crack or fracture between 100 and 300mm width at its widest point or any fracture which results in observable loss of surface water or erosion • 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	No Level 2 impacts observed	

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 Prediction</i>	TARP Trigger Level	Observed Impacts/Triggers	Additional Comments
			<i>Exceeding Prediction</i>	<ul style="list-style-type: none"> • LA4_S1 <ul style="list-style-type: none"> - Mining results in two consecutive exceedances of the ± 3 standard deviation level for electrical conductivity (EC) from the baseline mean. • LA4_S1 <ul style="list-style-type: none"> - Mining results in two consecutive exceedances of the ± 3 standard deviation level for pH from the baseline mean. 	<p>- See impact report dated: 22/12/2021.</p> <p>- See impact report dated: 22/12/2021.</p>

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>	<p>No Level 1 impacts observed</p>	
			<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>No Level 2 impacts observed</p>	

			<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>	No Level 3 impacts observed	
	<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 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>		<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"> • DA3b_LW18_001 - Rock fracturing to rock outcrop. • DA3b_LW18_002 - Rock fracturing and soil cracking to a rock outcrop/steep slope. • DA3b_LW18_004 - Rock fracturing to a rock outcrop. • DA3b_LW18_007 - Rock fracturing to a rock outcrop. • DA3b_LW18_010 - Rockfall and fragmentation at cliffline. • DA3b_LW18_011 - Rockfall at a rock outcrop. • DA3b_LW18_013 - Rock fracturing and fragmentation to steep slope/step • DA3b_LW18_015 - Rock fracture to steep slope/step • DA3b_LW18_017 - Rock displacement and rockfall to steep slope/step • DA3b_LW18_018 - Rock fracturing and rockfall to steep slope/step 	<ul style="list-style-type: none"> - See impact report dated: 15/12/2021. - See impact report dated: 31/01/2022. - See impact report dated: 9/02/2022. - See impact report dated: 15/06/2022. - See impact report dated: 15/06/2022. - See impact report dated: 15/06/2022. - See impact report dated: 19/08/2022. - See impact report dated: 19/08/2022. - See impact report dated: 19/08/2022. - See impact report dated: 19/08/2022.
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			<ul style="list-style-type: none"> • DA3b_LW18_019 - Rock fracture to steep slope/step • DA3b_LW18_020 - Rockfall steep slope/step • DA3b_LW18_022 - Rockfall to steep slope/step 	<ul style="list-style-type: none"> - See impact report dated: 19/08/2022. - See impact report dated: 19/08/2022. - See impact report dated: 19/08/2022.
		<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 	<ul style="list-style-type: none"> • DA3b_LW18_003 - Rock fracturing to a rock outcrop. • DA3b_LW18_005 - Displacement between rock and soil at a steep slope. • DA3b_LW18_006 - Soil cracking in bushland. • DA3b_LW18_008 - Soil cracking in bushland. • DA3b_LW18_009 - Rock fracturing, displacement and fragmentation to a rock outcrop. • DA3b_LW18_012 - Soil Cracking in bushland. • DA3b_LW18_014 - Rock fracture to steep slope/step • DA3b_LW18_016 - Rock fracturing to steep slope/step 	<ul style="list-style-type: none"> - See impact report dated: 31/01/2022. - See impact report dated: 9/02/2022. 1/07/2022 - See impact report dated: 16/02/2022. - See impact report dated: 15/06/2022. - See impact report dated: 15/06/2022. - See impact report dated: 1/07/2022. - See impact report dated: 19/08/2022. - See impact report dated: 19/08/2022.

			<ul style="list-style-type: none"> • 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"> • DA3b_LW18_021 - Rock fracturing to rock outcrop • DA3b_LW18_023 - Soil cracking in bushland 	<p>- See impact report dated: 19/08/2022.</p> <p>- See impact report dated: 19/08/2022.</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 	No Level 3 impacts observed	

11 APPENDIX A – TRIGGER ACTION RESPONSE PLANS

Table 7: Dendrobium Swamp Impacts, Triggers and Response Plan.

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>Exceeding Prediction 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 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>	<ul style="list-style-type: none"> a) upfront mine planning b) erosion monitoring (i.e. ALS, observation) c) coir logs d) knickpoint control e) water spreading f) weeding g) fire management h) reporting i) investigation and review j) 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>	

Performance Measures	Potential Impacts	Performance Triggers	Management Strategies	Offsets	Other Actions
<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>Exceeding Prediction: 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> <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>a) upfront mine planning</p> <p>b) vegetation monitoring</p> <p>c) water spreading</p> <p>d) seeding/planting</p> <p>e) weeding</p> <p>f) fauna monitoring</p> <p>g) fire management</p> <p>h) grouting of controlling of rockbars and bedrock base and/or use of other remediation techniques</p> <p>i) reporting</p> <p>j) investigation and review</p> <p>k) update future predictions</p>	<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>

Performance Measures	Potential Impacts	Performance Triggers	Management Strategies	Offsets	Other Actions
		<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>Exceeding Prediction: 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>Exceeding Prediction: 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.</p>			

Performance Measures	Potential Impacts	Performance Triggers	Management Strategies	Offsets	Other Actions
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>Exceeding Prediction Structural integrity of the bedrock base of any significant permanent pool or controlling rockbar cannot be restored, i.e. pool water level within the swamp after CMAs continues to be >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 functionality of the swamps	<p>Falls in surface or near-surface groundwater levels in swamps</p> <p>N.B. Not linked specifically to a PM and would not be considered a breach if predictions</p>	<p><u>Level 1:</u> Groundwater level lower than baseline level at any monitoring site 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 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</p>	<ul style="list-style-type: none"> a) upfront mine planning b) groundwater monitoring c) implementation of swamp research program d) weeding e) fire management f) reporting g) update future predictions 		Triggers for groundwater decline result in increased intensity and frequency of vegetation monitoring and/or further investigations of subsidence impacts on bedrock base and rockbars

Performance Measures	Potential Impacts	Performance Triggers	Management Strategies	Offsets	Other Actions
	were exceeded.	<p>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>			
Minor changes in the ecosystem functionality of the swamps	<p>Falls in soil moisture levels in swamps</p> <p>N.B. Not linked specifically to a PM and would not be considered a breach if predictions were exceeded.</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 8: Dendrobium Watercourse Impacts, Triggers and Response Plan.

Monitoring	Trigger	Action
OBSERVATIONAL, PHOTO POINT AND WATER MONITORING		
<p>Wongawilli Creek, Donalds Castle Creek and WC-WF54</p> <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>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 • Observation that a pool on a subject creek has ceased to flow 	<ul style="list-style-type: none"> • Continue monitoring program • Submit an Impact Report to BCD, DPE, RR, WaterNSW • Report in the End of Panel Report • Summarise actions and monitoring in AEMR
	<p>Level 2 *</p> <ul style="list-style-type: none"> • Observation that a single pool on a subject creek is dry in consecutive monitoring events • Observation that two or more pools on a subject creek are dry in a single monitoring event • Observation that the subject creek has ceased to flow in consecutive monitoring event 	<ul style="list-style-type: none"> • <i>Actions as stated for Level 1</i> • Carry out Water Flow Assessment Method D • Review monitoring frequency • Submit letter report to DPE, RR and WaterNSW and seek advice on any CMA required. • Implement agreed CMAs as approved (subject to agency feedback)
	<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 • Submit letter report to DPE, RR and WaterNSW and seek advice on any CMA required. • Implement agreed CMAs as approved (subject to agency feedback)

Monitoring	Trigger	Action
	<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 surfacewater • 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 	<ul style="list-style-type: none"> • <i>Actions as stated for Level 2</i> • Offer site visit with BCD, DPE, RR, WaterNSW • 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 BCD, DPE, RR, WaterNSW • Completion of works following approvals and at a time agreed between S32, DPE, RR 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
	<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 Creek (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) • Rock fall at WC-WF54 or its overhang <p>Impacts on the structural integrity of WC-WF54, its overhang or its pool</p>	<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>Native Dog Creek, ND1, ND2, WC15, WC12, WC7, LA1 and LA2</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 noobservable 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 <p>Observable increase in iron staining within the mining area</p>	<ul style="list-style-type: none"> Continue monitoring program Submit an Impact Report to BCD, DPE, RR, Water NSW Report in the End of Panel Report Summarise actions and monitoring in AEMR
	<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 surfacewater or erosion Crack or fracture between 10 and 50m length Soil surface crack that causes erosion that is likely to stabilisewithin 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 Submit letter report to DPE, RR and WaterNSW and seek advice on any CMA required. Implement agreed CMAs as approved (subject to agency 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 surfacewater Soil surface crack that causes erosion that is unlikely to stabilisewithin the monitoring period without intervention Gas release results in vegetation dieback, mortality or loss ofaquatic habitat 	<ul style="list-style-type: none"> <i>Actions as stated for Level 2</i> Offer site visit with BCD, DPE, RR, WaterNSW 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 isappropriate to do so in consultation with BCD, DPE, RR, WaterNSW Completion of works following approvals and at a time agreed between S32, DPE, RR and WaterNSW (i.e. may be after mining induced movements and impacts are complete), including

Monitoring	Trigger	Action
	<ul style="list-style-type: none"> Observable increase in iron staining within the mining area continues more than 600m from the longwall 	<ul style="list-style-type: none"> monitoring and reporting on success Review relevant TARP and Management Plan in consultation with keyagencies
Water Quality		
<p>Wongawilli Creek Wongawilli Ck (FR6) Baseline means:</p> <ul style="list-style-type: none"> pH 5.98 EC 98.8 uS/cm DO 89.5% <p>Relevant Performance Measure(s): Wongawilli Creek - minor environmental consequences</p>	<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 BCD, DPE, RR, WaterNSW Report in the End of Panel Report Summarise actions and monitoring in AEMR
<p>Level 2 *</p> <ul style="list-style-type: none"> Two non-consecutive exceedances of the ± 3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean within six months: <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 1</i> Review monitoring frequency Submit letter report to BCD, DPE, RR and WaterNSW and seek advice on any CMA required. Implement agreed CMAs as approved (subject to agency 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 within six months: <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> Offer site visit with BCD, DPE, RR, WaterNSW Implement additional monitoring or increase frequency if required Review relevant TARP and Management Plan in consultation with keyagencies Develop site CMA (subject to agency feedback). This may include: <ul style="list-style-type: none"> Limestone emplacement to raise pH where it is appropriate to do so Completion of works following approvals and at a time agreed between S32, DPE, RR and WaterNSW (i.e. may be after mining induced movements and impacts are complete), including monitoring and reporting on success 	

Monitoring	Trigger	Action
	<p>Exceeding Prediction</p> <ul style="list-style-type: none"> Mining results in two consecutive exceedances or three exceedances of the ± 3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean within six months: <ul style="list-style-type: none"> pH 4.45 EC 154.1 uS/cm DO 50.5% 	<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 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) Baseline means: pH 5.41 EC 116.0 uS/cm DO 85.6%</p> <p>Relevant Performance Measure(s): Donalds Castle Creek - minor environmental consequences</p>	<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 within six months: <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 BCD, DPE, RR, WaterNSW Report in the End of Panel Report Summarise actions and monitoring in AEMR
	<ul style="list-style-type: none"> Two non-consecutive exceedances of the ± 3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean within six months: <ul style="list-style-type: none"> pH 3.60 EC 185.8 uS/cm DO 40.1% 	<ul style="list-style-type: none"> Actions as stated for Level 1 Review monitoring frequency Submit letter report to DPE, RR and WaterNSW and seek advice on any CMA required. Implement agreed CMAs as approved (subject to agency 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 within six months: <ul style="list-style-type: none"> pH 3.60 EC 185.8 uS/cm DO 40.1% 	<ul style="list-style-type: none"> Actions as stated for Level 2 Offer site visit with BCD, DPE, RR, WaterNSW Implement additional monitoring or increase frequency if required Review relevant TARP and Management Plan in consultation with key agencies 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 agency feedback). This may

Monitoring	Trigger	Action
		include: <ul style="list-style-type: none"> - Limestone emplacement to raise pH where it is appropriate to do so • Completion of works following approvals and at a time agreed between S32, DPE, RR and WaterNSW (i.e. may be after mining induced movements and impacts are complete), including monitoring and reporting on success
	Exceeding Prediction <ul style="list-style-type: none"> • Mining results in two consecutive exceedances or three exceedances of the ± 3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean within six months: <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
Lake Avon Lake Avon tributary (LA4_S1) baseline means: pH 5.38 EC 90.8 uS/cm DO 89.9%	Level 1 * <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 within six months: <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 BCD, DPE, RR, WaterNSW • Report in the End of Panel Report • Summarise actions and monitoring in AEMR

Monitoring	Trigger	Action
<p>Relevant Performance Measure(s): Avon Dam - negligible reduction in the quality of surface water inflows to Avon Dam</p>	<p>Level 2 *</p> <ul style="list-style-type: none"> • Two non-consecutive exceedances of the ± 3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean within six months: <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 • Submit letter report to DPE, RR and WaterNSW and seek advice on any CMA required. • Implement agreed CMAs as approved (subject to agency 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 within six months: <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> • Offer site visit with BCD, DPE, RR, WaterNSW • Implement additional monitoring or increase frequency if required • Review relevant TARP and Management Plan in consultation with key agencies • 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 agency 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 S32, DPE, RR and WaterNSW (i.e. may be after mining induced movements and impacts are complete), including monitoring and reporting on success

Monitoring	Trigger	Action
	<p>Exceeding Prediction</p> <ul style="list-style-type: none"> Mining results in two consecutive exceedances or three exceedances of the ± 3 standard deviation level (positive for EC, negative for pH and DO) from the baseline mean within six months: <ul style="list-style-type: none"> pH 4.90 EC 129.8 uS/cm DO 69.5% 	<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 <p>Provide residual environmental offset for any mining impact where CMAs are unsuccessful as required by Condition 14 Schedule 3 of the Development Consent</p>
POOL WATER LEVEL		
<p>Wongawilli Creek and Donalds Castle Creek</p> <p>Relevant Performance Measure(s): Wongawilli Creek - minor environmental consequences Donalds Castle Creek - minor environmental consequences</p>	<p>Level 1 *</p> <p>Single pool on a subject creek is observed as dry</p>	<ul style="list-style-type: none"> Continue monitoring program Carry out Water Flow Assessment Method D. Submit letter report to DPE, RR, Water NSW Report in the End of Panel Report Summarise actions and monitoring in AEMR
	<p>Level 2 *</p> <ul style="list-style-type: none"> Single pool on a subject creek is observed as dry in consecutive monitoring events <p>Two or more pools on a subject creek as observed as dry in a single monitoring period</p>	<ul style="list-style-type: none"> Actions as stated for Level 1 Review monitoring frequency Submit letter report to DPE, RR and WaterNSW and seek advice on any CMA required. Implement agreed CMAs as approved (subject to agency feedback)
	<p>Level 3 *</p> <p>Fracturing resulting in diversion of flow such that <10% of the pools have water levels lower than baseline period</p>	<ul style="list-style-type: none"> Actions as stated for Level 2 Offer site visit with BCD, DPE, RR, WaterNSW Implement additional monitoring or increase frequency if required Review relevant TARP and Management Plan in consultation with key agencies 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, DPE, RR, WaterNSW Completion of works following approvals and at a time agreed between S32, DPE, RR and WaterNSW (i.e. may be after mining)

Monitoring	Trigger	Action
		<p>induced movements and impacts are complete), including monitoring and reporting on success</p>
	<p>Exceeding Prediction Fracturing resulting in diversion of flow such that >10% of the pools have water levels lower than baseline period</p>	<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>• Waterfall WC-WF54 Relevant Performance Measure(s): Waterfall WC-WF54 – negligible environmental consequences</p>	<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 <p>Fracturing in Wongawilli Creek which results in observable flow diversion from the lip of the waterfall</p>	<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
SURFACE WATER FLOW		
<p>Wongawilli Creek and Donalds Castle Creek Avon Dam 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 • Avon Dam - negligible reduction in the quantity of surface water inflows to Avon Dam¹ • 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:</p> <ul style="list-style-type: none"> • <u>Wongawilli Creek - WWU</u> (Wongawilli Creek upstream); • <u>O'Hares Creek at 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> <p>Hydrological changes are assessed by comparing pre- and post-mining</p>	<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) 	<ul style="list-style-type: none"> • Continue monitoring program. • Submit an Impact Report to BCD, DPE, RR, WaterNSW. • Report in the End of Panel Report. • Summarise actions and monitoring in AEMR.
	<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. 	<ul style="list-style-type: none"> • <i>Actions as stated for Level 1</i> • Review monitoring frequency. • D) → carry out Water Flow Assessment Method D. • Submit letter report to DPE, RR and WaterNSW and seek advice on any CMA required. • Implement agreed CMAs as approved (subject to agency feedback).
	<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"> • <i>Actions as stated for Level 2</i> • Offer site visit with BCD, DPE, RR, 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 inappropriate to do so in consultation with BCD, DPE, RR, WaterNSW. • Completion of works following approvals and at a time agreed between S32, DPE, RR 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.

Monitoring	Trigger	Action
<p>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>Exceeding Prediction</p> <p>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"> • <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>Tributaries of Wongawilli Creek and Donalds Castle Creek and other affected watercourses not subject to performance measures</p> <p>Surface water flow Reference sites:</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> <p>Hydrological changes are assessed by comparing pre- and post-mining observed</p>	<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) 	<ul style="list-style-type: none"> • Continue monitoring program. • Submit an Impact Report to BCD, DPE, RR, WaterNSW. • Report in the End of Panel Report. • Summarise actions and monitoring in AEMR.
	<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"> • <i>Actions as stated for Level 1</i> • Review monitoring frequency. • Submit letter report to DPE, RR and WaterNSW and seek advice on any CMA required. • Implement agreed CMAs as approved (subject to agency feedback).

Monitoring	Trigger	Action
<p>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, DPE, RR, 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, DPE, RR, WaterNSW. • Completion of works following approvals and at a time agreed between S32, DPE, RR 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.
AQUATIC ECOLOGY		
<p>Pool water level, interconnectivity between pools and loss of connectivity, noticeable alteration of habitat</p> <ul style="list-style-type: none"> • Wongawilli Creek catchment – 8 sites • Donalds Castle Creek catchment – 1 site 	<p>Level 1 *</p> <p>Reduction in aquatic habitat for 1 year</p>	<ul style="list-style-type: none"> • Continue monitoring program. • Submit an Impact Report to BCD, DPE, RR, WaterNSW. • Report in the End of Panel Report. • Summarise actions and monitoring in AEMR.
	<p>Level 2 *</p> <p>Reduction in aquatic habitat for 2 years following the active subsidence period</p>	<ul style="list-style-type: none"> • <i>Actions as stated for Level 1</i> • Review monitoring frequency • Submit letter report to DPE, RR and WaterNSW and seek advice on any CMA required. • Implement agreed CMAs as approved (subject to agency feedback)

Monitoring	Trigger	Action
	<p>Level 3 * Reduction in aquatic habitat for >2 years following the active subsidence period</p>	<ul style="list-style-type: none"> • <i>Actions as stated for Level 2</i> • Offer site visit with BCD, DPE, RR, WaterNSW. • Implement additional monitoring or increase frequency if required • Review relevant TARP and Management Plan in consultation with key agencies • 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, DPE, RR, WaterNSW. • Completion of works following approvals and at a time agreed between S32, DPE, RR and WaterNSW (i.e. may be after mining induced movements and impacts are complete), including monitoring and reporting on success.
TERRESTRIAL FAUNA – THREATENED FROG SPECIES		
<p>Pool water level, interconnectivity between pools and loss of connectivity, noticeable alteration of habitat</p> <ul style="list-style-type: none"> • Wongawilli Creek catchment – 2 sites • Donalds Castle Creek catchment – 2 sites • Avon Dam tributary – 1 site • Native Dog tributary – 1 site 	<p>Level 1 * Reduction in habitat for 1 year</p>	<ul style="list-style-type: none"> • Continue monitoring program. • Submit an Impact Report to BCD, DPE, RR, WaterNSW. • Report in the End of Panel Report. • Summarise actions and monitoring in AEMR.
	<p>Level 2 * Reduction in habitat for 2 years following the active subsidence period</p>	<ul style="list-style-type: none"> • <i>Actions as stated for Level 1</i> • Review monitoring frequency • Submit letter report to DPE, RR and WaterNSW and seek advice on any CMA required. • Implement agreed CMAs as approved (subject to agency feedback)

Monitoring	Trigger	Action
	<p>Level 3 * Reduction in habitat for > 2 years following the active subsidence period</p>	<ul style="list-style-type: none"> • <i>Actions as stated for Level 2</i> • Offer site visit with BCD, DPE, RR, WaterNSW. • Implement additional monitoring or increase frequency if required • Review relevant TARP and Management Plan in consultation with key agencies • 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, DPE, RR, WaterNSW. • Completion of works following approvals and at a time agreed between S32, DPE, RR and WaterNSW (i.e. may be after mining induced movements and impacts are complete), including monitoring and reporting on success.

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].

² Flow reduction as determined from measured at flow gauging station WWL_A.

Table 9: Dendrobium Landscape Impacts, Triggers and Response Plan.

Monitoring	Trigger	Action
LANDSCAPE FEATURES		
<p>AREA 2</p> <p>Cliffs</p> <ul style="list-style-type: none"> • A2-CL1 (above LW4) <p>Steep Slopes</p> <ul style="list-style-type: none"> • A2-SL1 and A2-SL2 (above LWs 4 & 5) <p>Watercourses</p> <ul style="list-style-type: none"> • A2-WC10 and A2-WC11 (above LW3) • A2-WC13 & A2-WC16 (above LWs 4 & 5) <p>Swamp</p> <ul style="list-style-type: none"> • A2-SW1 (above LWs 4 & 5) <p>4WD Track</p> <ul style="list-style-type: none"> • A2-FT1 (above LWs 4 & 5) <p>Crinanite Surface Extent</p> <ul style="list-style-type: none"> • A2-CN1 & A2-CN2 (above LWs 3 & 4) 	<p>Level 1 *</p> <ul style="list-style-type: none"> • Rock fall from a cliff which is left mostly intact (<10%length), resulting in insignificant ground disturbance • Surface movement or rock displacement with negligible soilsurface exposed • Crack at the surface, which should not result in anysignificant erosion or further ground movement • Crack in a fire trail which should not result in erosion orimpede 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 ofmonitoring 	<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>AREA 3A</p> <p>Cliffs</p> <p>All mapped cliff sites in subsidence area (Refer toDendrobium Area 3A SMP Figures 19.3 for location of sites)</p> <p>Steep Slopes</p> <p>All mapped steep slopes in subsidence area Referto Dendrobium Area 3A SMP Figures 19.3 for location of sites</p> <p>Watercourses/ Swamps</p> <p>All mapped watercourse and swamps insubsidence area Refer to Dendrobium Area 3A SMP Figure 19.3</p> <p>Fire Trails</p> <p>All mapped fire trails in subsidence area</p>	<p>Level 2 *</p> <ul style="list-style-type: none"> • Rock fall or overhang collapse at a cliff site, where characteristics of the cliff have changed, and there has beensignificant ground disturbance • Surface movement or rock displacement that has exposedsignificant areas of soil • A crack at the surface, which could result in significanterosion or movement at the surface • A crack at the surface with potential risk to safety and/orfauna entrapment • A crack in the fire trail, which could result in significanterosion 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. 	<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 environmentaland 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>Refer to Dendrobium Area 3A SMP Figure 19.3</p> <p>AREA 3B Cliffs</p> <p>All mapped cliff sites in subsidence area Refer to Dendrobium Area 3B SMP Figures 18.1 for location of sites</p>	<p>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>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"> • <i>Actions as stated for Level 2</i> • Immediately notify DPE, DPIM, WaterNSW, 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>
<p>Sandy Creek Waterfall</p>	<p>Exceeding Prediction</p> <ul style="list-style-type: none"> • Rock fall at Sandy Creek Waterfall or from its overhang • Structural integrity of the waterfall, its overhang and its pool are impacted • More than negligible cracking within 30 m of the waterfall • More than negligible diversion of water from the lip of the waterfall 	<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

Monitoring	Trigger	Action
TERRESTRIAL FLORA AND FAUNA		
<p>A number of sites located across and around Areas 2, and 3A. Refer Dendrobium Area 3A SMP Figure 21.1, 21.2 and 21.3</p> <p>General observation of active mining areas</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
	<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 Statistically significant difference between Before After Control Impact sites as a result of mining 	<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
	<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 BCD, DPE, RR, WaterNSW, 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 DPE and RR 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.

12 APPENDIX B – CORRECTIVE MANAGEMENT ACTIONS

Site/ Impact ID	Trigger Level	Identification Date	Exceeding predictions ?	Corrective management actions completed	Corrective management actions yet to be implemented
<i>DA3B_LW17_041</i>	Exceeding Prediction	2/08/2022	Yes	<ul style="list-style-type: none"> Continue monitoring program. Impact Report submitted to Department of Planning and Environment (DPE), Biodiversity and Conservation Division (BCD), Resources Regulator (RR) and WaterNSW. Impacts and Reports summarised in the EOP Report. Review Monitoring Frequency. Submit letter report to DPE, BCD and WaterNSW and seek advice on any CMA required. Offer site visit with BCD, DPE, Resources Regulator and WaterNSW. Investigate reasons for the exceedance. Specialist report completed by MSEC (2022b) 	<ul style="list-style-type: none"> Summarise impacts and Report in FY23 Annual Review (AR). Develop site CMA. Implement agreed CMA's as approved (subject to agency feedback). Review relevant TARP and Management Plan in consultation with key agencies. Provide residual environmental offset for any mining impact where CMAs are unsuccessful as required by Condition 14 Schedule 3 of the Development Consent. Update future predictions based on the outcomes of the investigation.
<i>DA3B_LW18_001</i>	1	14/12/2021	No	<ul style="list-style-type: none"> Continue monitoring program. Impact Report submitted to DPE, BCD, RR and WaterNSW. Impacts and Reports summarised in the EOP Report and AR. 	
<i>DA3B_LW18_002</i>	1	31/01/2022	No	<ul style="list-style-type: none"> Continue monitoring program. Impact Report submitted to DPE, BCD, RR and WaterNSW. Impacts and Reports summarised in the EOP Report and AR. 	

Site/ Impact ID	Trigger Level	Identification Date	Exceeding predictions ?	Corrective management actions completed	Corrective management actions yet to be implemented
DA3B_LW18_003	2	31/01/2022	No	<ul style="list-style-type: none"> Continue monitoring program. Impact Report submitted to DPE, BCD, RR and WaterNSW. Impacts and Reports summarised in the EOP Report and AR. Monitoring frequency reviewed. Safety signage and barricades not appropriate for this impact as its located in remote bushland. Reviewed by a technical specialist in the Longwall 18 EOP Subsidence Monitoring Review (MSEC, 2022). No additional CMA's recommended. 	
DA3B_LW18_004	1	9/02/2022	No	<ul style="list-style-type: none"> Continue monitoring program. Impact Report submitted to DPE, BCD, RR and WaterNSW. Impacts and Reports summarised in the EOP Report and AR. 	
DA3B_LW18_005	2	9/02/2022	No	<ul style="list-style-type: none"> Continue monitoring program. Impact Report submitted to DPE, BCD, RR and WaterNSW. Impacts and Reports summarised in the EOP Report and AR. Monitoring frequency reviewed. Safety signage and barricades not appropriate for this impact as its located in remote bushland. Reviewed by a technical specialist in the Longwall 18 EOP Subsidence Monitoring Review (MSEC, 2022). No additional CMA's recommended. 	

Site/ Impact ID	Trigger Level	Identification Date	Exceeding predictions ?	Corrective management actions completed	Corrective management actions yet to be implemented
DA3B_LW18_006	2	15/02/2022	No	<ul style="list-style-type: none"> • Continue monitoring program. • Impact Report submitted to DPE, BCD, RR and WaterNSW. • Impacts and Reports summarised in the EOP Report and AR. • Monitoring frequency reviewed. • Safety signage and barricades not appropriate for this impact as its located in remote bushland. • Reviewed by a technical specialist in the Longwall 18 EOP Subsidence Monitoring Review (MSEC, 2022). No additional CMA's recommended. 	
DA3B_LW18_007	1	8/06/2022	No	<ul style="list-style-type: none"> • Continue monitoring program. • Impact Report submitted to DPE, BCD, RR and WaterNSW. • Impacts and Reports summarised in the EOP Report and AR. 	
DA3B_LW18_008	2	9/06/2022	No	<ul style="list-style-type: none"> • Continue monitoring program. • Impact Report submitted to DPE, BCD, RR and WaterNSW. • Impacts and Reports summarised in the EOP Report and AR. • Monitoring frequency reviewed. • Safety signage and barricades not appropriate for this impact as its located in remote bushland. • Reviewed by a technical specialist in the Longwall 18 EOP Subsidence Monitoring Review (MSEC, 2022). No additional CMA's recommended. 	

Site/ Impact ID	Trigger Level	Identification Date	Exceeding predictions ?	Corrective management actions completed	Corrective management actions yet to be implemented
DA3B_LW18_009	2	9/06/2022	No	<ul style="list-style-type: none"> Continue monitoring program. Impact Report submitted to DPE, BCD, RR and WaterNSW. Impacts and Reports summarised in the EOP Report and AR. Monitoring frequency reviewed. Safety signage and barricades not appropriate for this impact as its located in remote bushland. Reviewed by a technical specialist in the Longwall 18 EOP Subsidence Monitoring Review (MSEC, 2022). No additional CMA's recommended. 	
DA3B_LW18_010	1	10/06/2022	No	<ul style="list-style-type: none"> Continue monitoring program. Impact Report submitted to DPE, BCD, RR and WaterNSW. Impacts and Reports summarised in the EOP Report and AR. 	
DA3B_LW18_011	1	10/06/2022	No	<ul style="list-style-type: none"> Continue monitoring program. Impact Report submitted to DPE, BCD, RR and WaterNSW. Impacts and Reports summarised in the EOP Report and AR. 	
DA3B_LW18_012	2	30/06/2022	No	<ul style="list-style-type: none"> Continue monitoring program. Impact Report submitted to DPE, BCD, RR and WaterNSW. Impacts and Reports summarised in the EOP Report and AR. Monitoring frequency reviewed. Safety signage and barricades not appropriate for this impact as its located in remote bushland. Reviewed by a technical specialist in the Longwall 18 EOP Subsidence Monitoring Review (MSEC, 2022). No additional CMA's recommended. 	

Site/ Impact ID	Trigger Level	Identification Date	Exceeding predictions ?	Corrective management actions completed	Corrective management actions yet to be implemented
DA3B_LW18_013	1	16/08/2022	No	<ul style="list-style-type: none"> Continue monitoring program. Impact Report submitted to DPE, BCD, RR and WaterNSW. Impacts and Reports summarised in the EOP Report. 	<ul style="list-style-type: none"> Summarise impacts and Report in FY23 AR.
DA3B_LW18_014	2	16/08/2022	No	<ul style="list-style-type: none"> Continue monitoring program. Impact Report submitted to DPE, BCD, RR and WaterNSW. Impacts and Reports summarised in the EOP Report. Monitoring frequency reviewed. Safety signage and barricades not appropriate for this impact as its located in remote bushland. Reviewed by a technical specialist in the Longwall 18 EOP Subsidence Monitoring Review (MSEC, 2022). No additional CMA's recommended. 	<ul style="list-style-type: none"> Summarise impacts and Report in FY23 AR.
DA3B_LW18_015	1	16/08/2022	No	<ul style="list-style-type: none"> Continue monitoring program. Impact Report submitted to DPE, BCD, RR and WaterNSW. Impacts and Reports summarised in the EOP Report. 	<ul style="list-style-type: none"> Summarise impacts and Report in FY23 AR.
DA3B_LW18_016	2	16/08/2022	No	<ul style="list-style-type: none"> Continue monitoring program. Impact Report submitted to DPE, BCD, RR and WaterNSW. Impacts and Reports summarised in the EOP Report. Monitoring frequency reviewed. Safety signage and barricades not appropriate for this impact as its located in remote bushland. Reviewed by a technical specialist in the Longwall 18 EOP Subsidence Monitoring Review (MSEC, 2022). No additional CMA's recommended. 	<ul style="list-style-type: none"> Summarise impacts and Report in FY23 AR.

Site/ Impact ID	Trigger Level	Identification Date	Exceeding predictions ?	Corrective management actions completed	Corrective management actions yet to be implemented
DA3B_LW18_017	1	16/08/2022	No	<ul style="list-style-type: none"> Continue monitoring program. Impact Report submitted to DPE, BCD, RR and WaterNSW. Impacts and Reports summarised in the EOP Report. 	<ul style="list-style-type: none"> Summarise impacts and Report in FY23 AR.
DA3B_LW18_018	1	16/08/2022	No	<ul style="list-style-type: none"> Continue monitoring program. Impact Report submitted to DPE, BCD, RR and WaterNSW. Impacts and Reports summarised in the EOP Report. 	<ul style="list-style-type: none"> Summarise impacts and Report in FY23 AR.
DA3B_LW18_019	1	16/08/2022	No	<ul style="list-style-type: none"> Continue monitoring program. Impact Report submitted to DPE, BCD, RR and WaterNSW. Impacts and Reports summarised in the EOP Report. 	<ul style="list-style-type: none"> Summarise impacts and Report in FY23 AR.
DA3B_LW18_020	1	16/08/2022	No	<ul style="list-style-type: none"> Continue monitoring program. Impact Report submitted to DPE, BCD, RR and WaterNSW. Impacts and Reports summarised in the EOP Report. 	<ul style="list-style-type: none"> Summarise impacts and Report in FY23 AR.
DA3B_LW18_021	2	16/08/2022	No	<ul style="list-style-type: none"> Continue monitoring program. Impact Report submitted to DPE, BCD, RR and WaterNSW. Impacts and Reports summarised in the EOP Report. Monitoring frequency reviewed. Safety signage and barricades not appropriate for this impact as its located in remote bushland. Reviewed by a technical specialist in the Longwall 18 EOP Subsidence Monitoring Review (MSEC, 2022). No additional CMA's recommended. 	<ul style="list-style-type: none"> Summarise impacts and Report in FY23 AR.

Site/ Impact ID	Trigger Level	Identification Date	Exceeding predictions ?	Corrective management actions completed	Corrective management actions yet to be implemented
DA3B_LW18_022	1	16/08/2022	No	<ul style="list-style-type: none"> Continue monitoring program. Impact Report submitted to DPE, BCD, RR and WaterNSW. Impacts and Reports summarised in the EOP Report. 	<ul style="list-style-type: none"> Summarise impacts and Report in FY23 AR.
DA3B_LW18_023	2	16/08/2022	No	<ul style="list-style-type: none"> Continue monitoring program. Impact Report submitted to DPE, BCD, RR and WaterNSW. Impacts and Reports summarised in the EOP Report. Monitoring frequency reviewed. Safety signage and barricade implemented. Reviewed by a technical specialist in the Longwall 18 EOP Subsidence Monitoring Review (MSEC, 2022). No additional CMA's recommended. 	<ul style="list-style-type: none"> Summarise impacts and Report in FY23 AR.
DA3B_LW18_024	1	16/08/2022	No	<ul style="list-style-type: none"> Continue monitoring program. Impact Report submitted to DPE, BCD, RR and WaterNSW. Reported in the EOP Report. 	

Site/ Impact ID	Trigger Level	Identification Date	Exceeding predictions ?	Corrective management actions completed	Corrective management actions yet to be implemented
LA4_S1	Exceeding Prediction	17/12/2021	Yes	<ul style="list-style-type: none"> Continue monitoring program. Impact Report submitted to DPE, BCD, RR and WaterNSW. Reported in the EOP Report and AR. Specialist report completed (HGEO 2022). Monthly monitoring has continued as recommended. No changes to monitoring frequency required. Offer site visit with BCD, DPE, RR and WaterNSW Laboratory samples collected as per SMP. No additional sampling recommended. Reasons for the exceedance addressed in the specialist report (HGEO 2022). No changes to TARP and Management plan recommended (HGEO 2022). DPIE requested IMC to consult with WaterNSW regarding any further CMA's (DPIE, 2022). Ravi Sundaram advised, via email, "<i>WaterNSW is satisfied with the assessment provided and has no comments on the report</i>" (email dated 25/1/2022) DPE provided no additional CMA's Future predictions to use all available data 	

References:

DPIE (2022). Dendrobium Mine (DA60-03-2001). Level 4 Trigger – Water Quality at LA4_S1. January 2021.

HGEO (2022). Dendrobium Mine Impacts at DA3B LA4: Technical Advice Update. January 2021.

MSEC (2022). Dendrobium – Area 3B – Longwall 18. End of Panel Subsidence Monitoring review report for Dendrobium Longwall 18. August 2022.

MSEC (2022b). Illawarra Metallurgical Coal: Dendrobium Area 3B. Review of the measured ground movements for Waterfall 54 due to the mining of LW18. August 2022.