



**ULAN COAL MINES PTY LIMITED
2023 MONITORING OF
CREEKS & TRIBUTARIES**

DOCUMENT NO. UCMP_L_03_24

Document Control

Document No:	UCMPL_03_24
Document Title:	2023 Monitoring of Creek and Tributaries
General Description:	Post mining monitoring along selected flow lines above Ulan West for erosion and ponding sites. Now includes Mona Creek above Ulan Underground.
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Date:	29 December 2023

Revisions

Rev No	Date	Description	By	Checked
1.0	29 December 2023	Original Draft	Stephen Bragg	Amanda Sales
2.0	27 March 2024	Final	Stephen Bragg	Amanda Sales

Cover Photo: UCFL4 – Site 18 (2023)

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Contents

1.0	INTRODUCTION	1
1.1	PURPOSE.....	1
1.2	SCOPE.....	3
1.3	SUMMARY OF APPROVED IMPACTS.....	5
1.4	MONITORING METHODOLOGY.....	6
1.5	LIMITATIONS.....	7
2.0	SITE LOCATIONS.....	9
2.1	MONITORING SITES	9
3.0	RESULTS.....	12
3.1	EPHEMERAL TRIBUTARY - FLOW LINE 4	12
3.2	ULAN CREEK TRIBUTARY - FLOW LINE 2	13
3.3	ULAN CREEK TRIBUTARY - FLOW LINE 3	14
3.4	BROKENBACK CREEK.....	15
3.5	MONA CREEK	16
4.0	DISCUSSIONS & RECOMMENDATIONS	17
5.0	REFERENCES	18

Tables

Table 1-1	Ulan West Longwall Extraction Progress	6
Table 1-2	Ulan Underground Longwall Extraction Progress.....	7
Table 2-1	Tributaries of Ulan Creek Monitoring Sites	9
Table 2-2	Brokenback Creek Monitoring Sites	10
Table 2-3	Mona Creek Monitoring Sites	11
Table 3-1	Summary of Monitoring Results for UCFL4.....	12
Table 3-2	Summary of Monitoring Results for UCFL2.....	14
Table 3-3	Summary of Monitoring Results for UCFL3.....	14
Table 3-4	Summary of Monitoring Results for BBC	15
Table 3-5	Summary of Monitoring Results for Mona Creek.....	16

Figures

Figure 1-1	Monitoring of Flow Lines Above Ulan West (2015-2022)	2
Figure 1-2	Monitoring of Flow Lines in 2023.....	4
Figure 1-3	Observed Subsidence Impacts	8

List of Appendices

Appendix A Inspection Results for UCFL4

Appendix B Inspection Results for UCFL2

Appendix C Inspection Results for UCFL3

Appendix D Inspection Results for BBC

Appendix E Inspection Results for Mona Creek

1.0 Introduction

Ulan Coal Mines Pty Limited (UCMPL) engaged Pacific Environmental Pty Ltd (PE) in 2023 to complete the annual monitoring of selected ephemeral creeks and tributaries (also referred as flow lines) as required by the *Ulan West Extraction Plan for LW1 – LW8* (UW Extraction Plan) and the recently amended *Ulan Underground Extraction Plan Longwalls LW30-LW32 and LWW6 – LWW8* (UUG Extraction Plan).

The intent of the *2023 Monitoring of Creek and Tributaries* (this Report) was to consolidate the annual monitoring requirements of selected flow lines within both the UW Extraction Plan and the recently amended UUG Extraction Plan.

In previous years PE has been engaged to monitor sections of undermined flow lines above the UW Mine, as required by the UW Extraction Plan and as directed by UCMPL (**Figure 1-1**). This flow line monitoring has included:

- Ulan Creek Flowline 4 (UCFL4);
 - Monitoring commenced in 2014* and continued in 2023 (**Section 3.1**).
- Ulan Creek Flowline 2 (UCFL2);
 - Monitoring commenced in 2015 and concluded in 2022 (**Section 3.2**).
- Brokenback Creek (BBC);
 - Monitoring commenced in 2018 and continued in 2023 (**Section 3.4**).

Notes: * Barnson Pty Ltd commenced the initial monitoring in 2014 (**Section 3.1**).

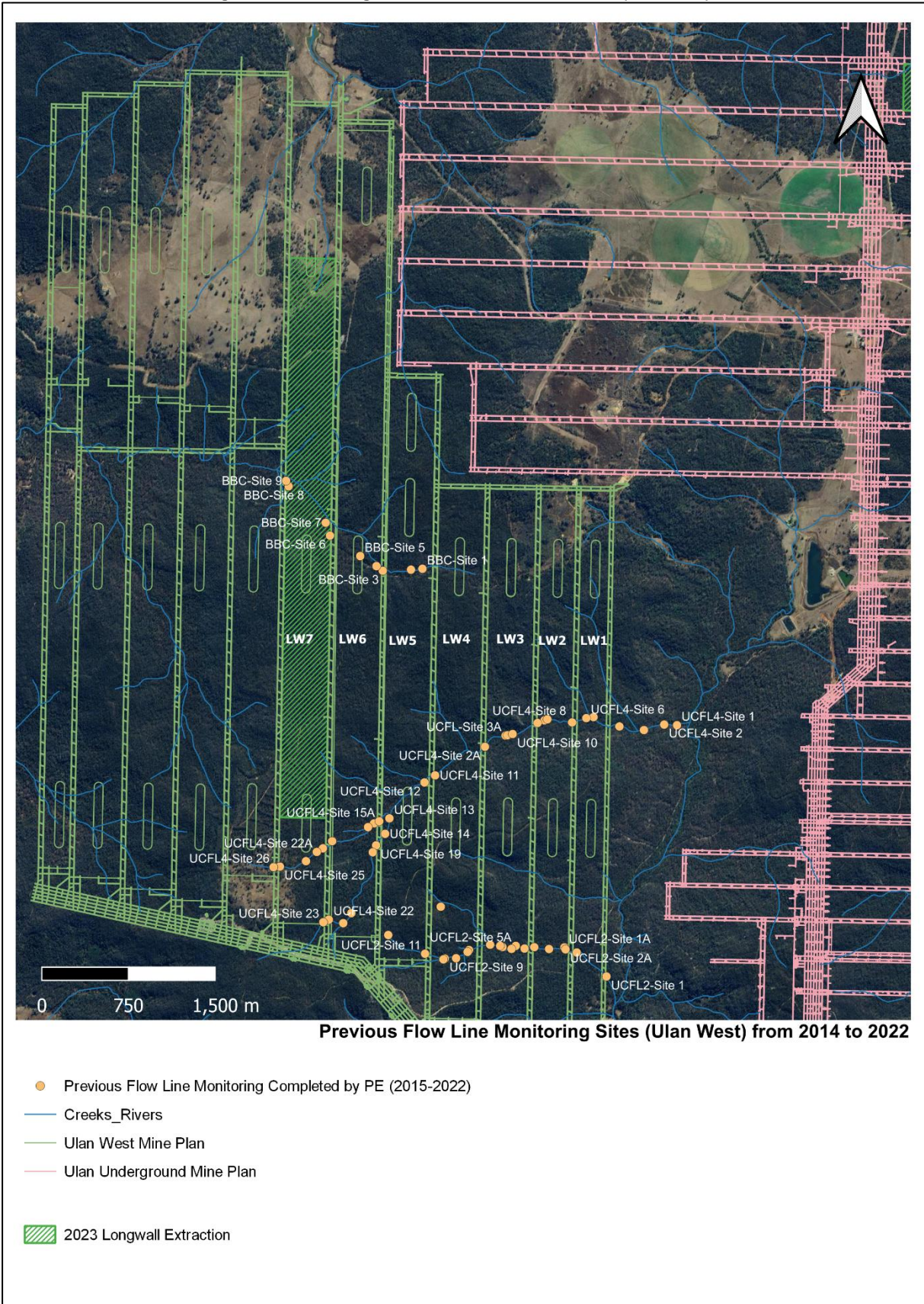
The monitoring results within this Report are from site inspections completed by PE on the 27 October and between the 27 - 28 November 2023 (**Figure 1-2**) and **Section 1.2**. PE understands monitoring of additional flow lines are undertaken by UCMPL during monthly pre and post mining inspections of longwalls as required by each Extraction Plan. The results of these inspections are not contained in this Report.

1.1 Purpose

The purpose of the pre and post mining monitoring of ephemeral tributaries and creeks above the Ulan West Underground Mine (UW Mine) and the Ulan Underground Mine (UUG Mine) is to identify the presence of predicted subsidence impacts (**Section 1.3**) including surface cracking and erosion, surface ponding or out of channel flows and distinguish between natural erosion and erosion induced from mine subsidence, as required by the UW Extraction Plan and UUG Extraction Plan. Monitoring is to continue along the impacted flow line for a period of two years post mining.

The results of this flow line monitoring will be interpreted by UCMPL's subsidence engineer to validate subsidence predictions made in either the UW Extraction Plan, UUG Extraction Plan and the *Ulan Coal - Continued Operations Environmental Assessment 2009* (Project EA) (**Section 1.3**).

Figure 1-1 Monitoring of Flow Lines Above Ulan West (2015-2022)

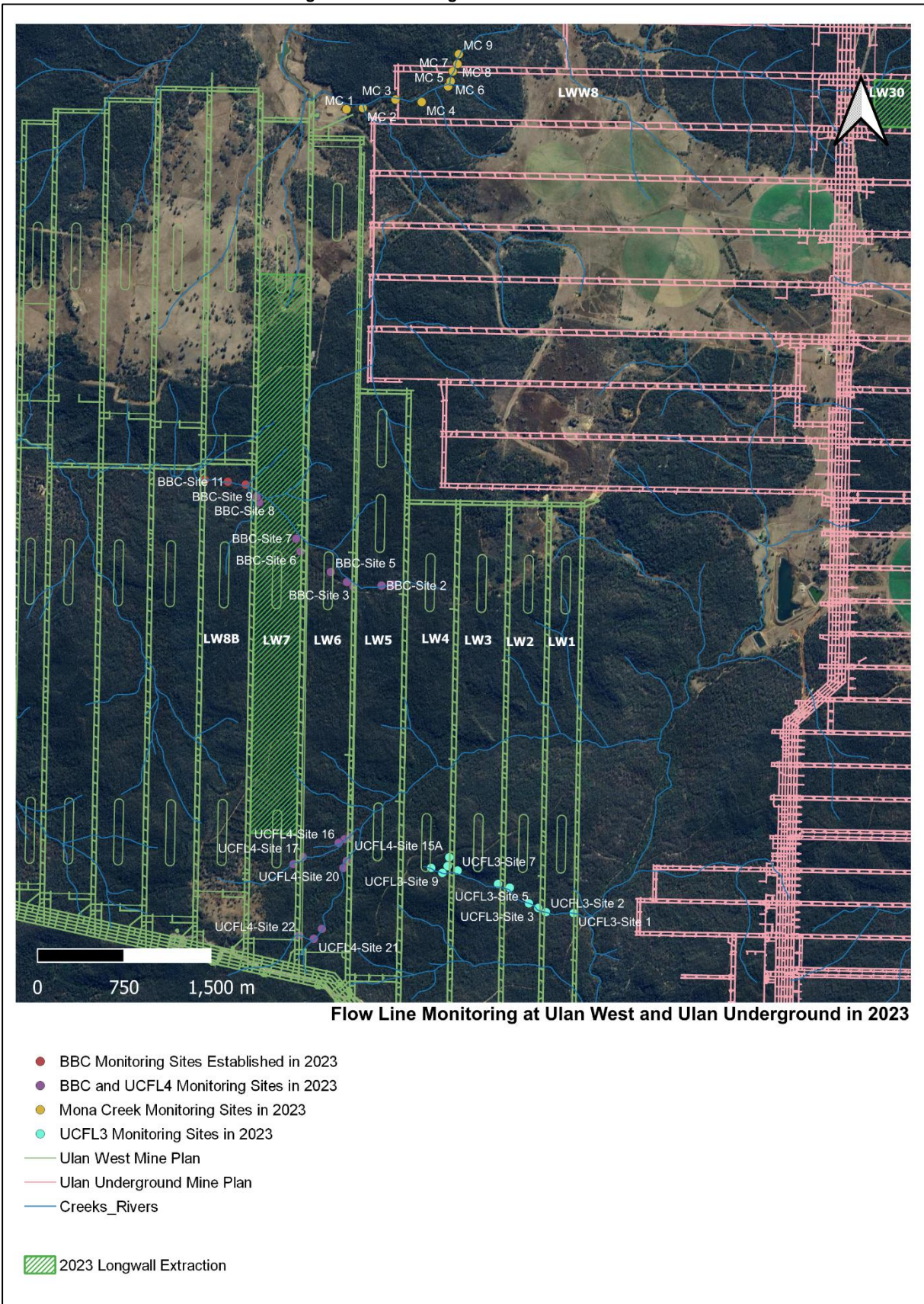


1.2 Scope

The scope for the 2023 flow line monitoring program included a walk over inspection by PE along:

- A section of Ulan Creek Flowline 4 (UCFL4) (**Figure 1-2**):
 - Site 15, Site 15A, Site 16, Site 17, Site 18, Site 19, Site 20, Site 21, Site 21A and Site 22.
 - **Notes:** Site 23, Site 24, Site 24, Site 25 and Site 26 were not inspected in 2023 as they had not been undermined by LW7.
- A section of Brokenback Creek (BBC) (**Figure 1-2**)
 - BBC 1, BBC 2, BBC 3, BBC 4, BBC 5, BBC 6, BBC 7, BBC 8, BBC 9, BBC 10, BBC 11 and BBC 12.
 - **Notes:** BBC 10 – 11 added in 2023, as pre mining sites associated with the proposed LW8B.
- A section of Mona Creek (MC) (**Figure 1-2**):
 - Sites MC1, MC2, MC3, MC4, MC5, MC6, MC7, MC8 and MC9.
 - **Notes:** Sites established by UCMPL in 2020 and reinspected by UCMPL in 2022. Sites remain pre mining until LWW8 scheduled commencement in August 2024, as provided in the UGG Extraction Plan.
- A section of Ulan Creek Flowline 3 (UCFL3) (**Figure 1-2**):
 - Site 1, Site 2, Site 3, Site 4, Site 5, Site 6, Site 7, Site 8, Site 8a, Site 9 and Site 10.
 - **Notes:** UCFL3 is located above LW1 - LW4, with the completion of LW4 in December 2018. UCMPL requested a walk over inspection along the flowline in 2023 to identify and record subsidence related impacts.

Figure 1-2 Monitoring of Flow Lines in 2023



1.3 Summary of Approved Impacts

The approved subsidence impacts and environmental consequences relating to surface water are described in the *2009 Ulan Coal - Continued Operations Environmental Assessment* (Project EA) and subsequent modifications. Within each Extraction Plan a description of the potential subsidence impacts on ephemeral drainage lines, includes but is not limited to:

- UW Extraction Plan:
 - *Diversion of overland flow into sub-surface strata through cracks and lowering of the groundwater possibly causing potholes on flow lines.*
 - *Changes to the length of time that ephemeral streams and pools located directly above longwall panels hold water after periods of heavy rain.*
 - *Vertical subsidence causing ponding in the flatter areas where the stream gradients are low.*
 - *Potential to locally change the course of flow lines in flatter areas.*
 - *Nick-point erosion on stream channels where the gradient is locally steepened on the upstream side of longwall panels; and*
 - *Compression fracturing and upsidence where sandstone rock strata is exposed in the valley floor.*
- UGG Extraction Plan:
 - *Horizontal fracturing and upsidence is expected in topographic low points where the stream bed is comprised of sandstone rock strata. There is also potential for open tension cracks to occur along drainage channels located directly over and around the edges of longwall panels. The effect of any cracks in a drainage channel would be similar to that of other compression cracking and would tend to divert surface water downward into the overburden strata.*
 - *The main surface impacts are considered to be that ephemeral streams and pools located directly above longwall panels are not likely to hold water for as long after rain as they did prior to mining.*
 - *Subsidence impacts are expected to be consistent with those described in the UCCO Project EA. For Mona Creek, the EA predicts a significant loss of base flow when creeks are directly mined under.*

1.3.1 2020 Annual Review of Subsidence Monitoring

SCT Operations Pty Ltd (SCT) completed their assessment of subsidence monitoring at UCMLP for 2020, which included a review of the 'nick point' erosion, particularly observed along point within UCFL4 in 2020. As described by SCT in their *2020 Annual Review of Subsidence Monitoring at Ulan West and Ulan Underground Mines* (March, 2021):

- *Impacts to surface water courses were consistent with expectation.*
- *SCT inspected section of these flowlines in February 2021 after the mining of Longwall 5. These flowlines are ephemeral and there was no significant flow at the time of the inspection. There was evidence of high intensity rainfall events causing regressive nick point erosion, most likely initiated at points of increased grade caused by subsidence. There was also evidence of temporary ponding and deposition on the upstream side of chain pillars.*
- *Mining has caused 1.2-1.5m of subsidence across the central part of each longwall panel with generally less than 0.2m over the chain pillars. Stream gradients are locally increased or*

reduced from the background of 15mm/m by up to 30mm/m causing oversteepening in some parts to 45mm/m and reversing of the gradient in others to -15mm/m to cause localised ponding. Nick point erosion occurs naturally during floods and is expected to cause sections of the drainage lines located above the chain pillars to cut down up to 1.3m relative to their pre-mining levels. Sections on the upstream side of chain pillars are likely to flatten and pond during periods of heavy rain. Sections on the downstream side of chain pillars are expected to be subject to increased velocities with potential for increased erosion.

1.4 Monitoring Methodology

The methodology as provided by UCMPL from the Extraction Plans, includes a pre¹ and post mining inspection, applying an observational walk over of selected flow lines (**Section 1.2**) to:

- Document the presence of surface cracking and erosion, surface ponding or out of channel flows;
- Document any significant erosive or depositional features for qualitative evaluation; and
- Continue annually thereafter for a period of two years post mining.

The 2023 monitoring program utilised photographic monitoring points established during pre-mining inspections and sites established by UCMPL to enable comparative assessments if subsidence related impacts identified during post-mining inspections were observed and/or monitor the impacts for change. Impacts encountered outside of established sites were also recorded whilst walking between sites.

1.4.1 Post Mining Monitoring Criteria

In accordance with the Extraction Plans and as instructed by UCMPL, sites not reinspected in 2023, as in previous years, were either:

- Outside of the two-year post mining period; and/or
- No observed perceptible impacts at post mining inspections; and/or
- No perceptible change to previously recorded impacts after two years post mining period.

Refer to **Table 3-1** and **Table 3-2** for further information regarding the monitoring status of sites.

1.4.2 Ulan West Longwall Schedule

Table 1-1 Ulan West Longwall Extraction Progress

Longwall	Commencement	Duration of Mining	Completion
LW1	May 2014	12 Months	May 2015
LW2	May 2015	12 Months	May 2016
LW3	July 2016	15 Months	October 2017
LW4	November 2017	14 Months	December 2018
LW5	March 2019	14 Months	June 2020
LW6	August 2020	22 Months	June 2022
LW7	July 2022	21 Months	04 April 2024 [^]
LW8	May 2024 [^]	22 Months [^]	10 February 2026 [^]

Notes: [^]Forecast completion

¹ Pre mining inspections were disrupted and could not be undertaken during COVID restrictions.

1.4.3 Ulan Underground Longwall Schedule

Table 1-2 Ulan Underground Longwall Extraction Progress

Longwall	Commencement	Duration of Mining	Completion
LWW6	February 2020	15 Months	April 2021
LWW7	June 2021	14 Months	June 2022
LW30	July 2022	13 Months	July 2023
LW31	October 2023	14 Months	August 2024 [^]
LWW8	August 2024 [^]	15 Months	October 2025 [^]
LW32	October 2025 [^]	12 Months	September 2026 [^]

Notes: [^]Forecast completion

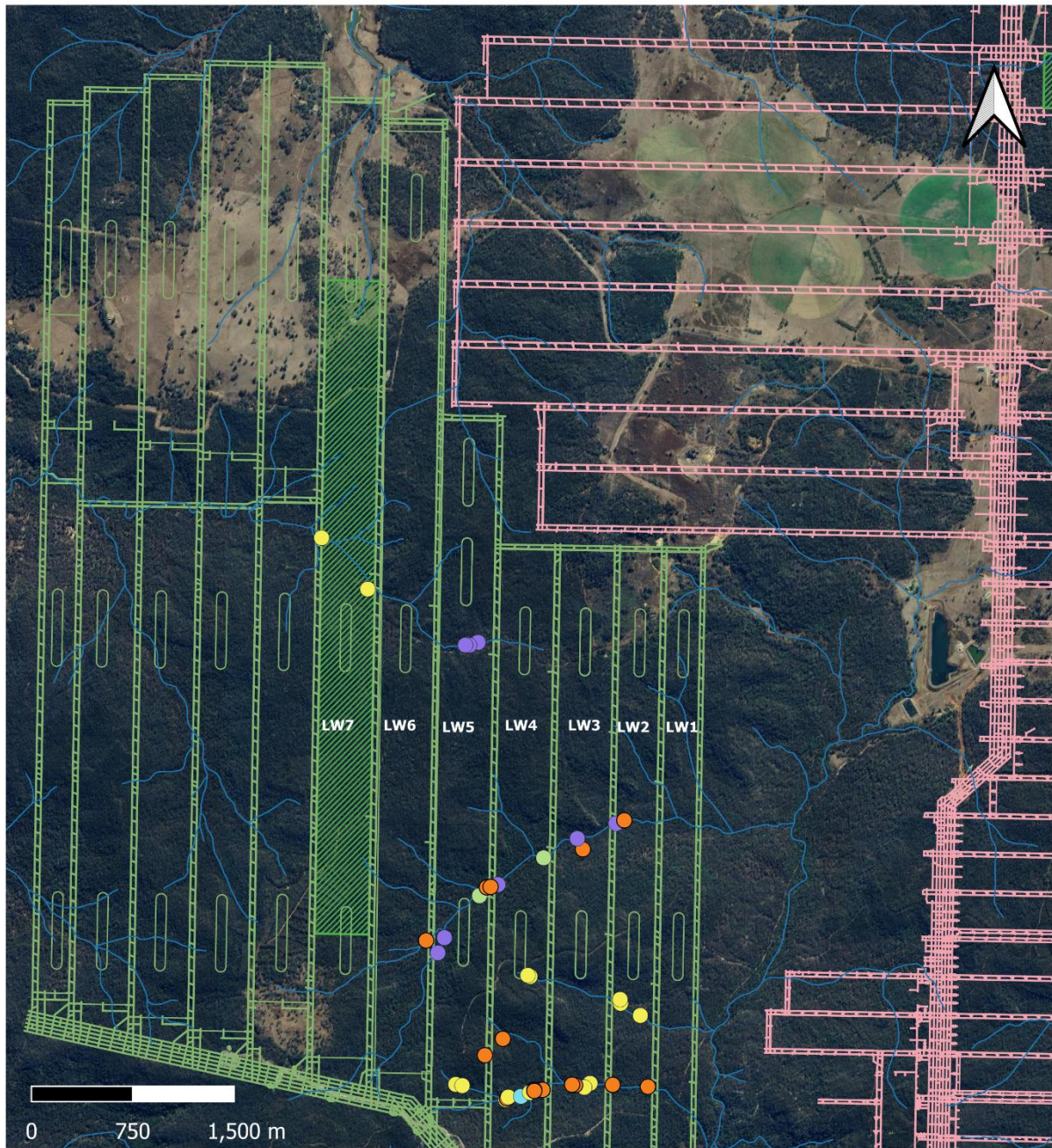
1.5 Limitations

The following limitations encountered during the 2023 annual monitoring of flow lines need to be considered including:

- The signal of the GPS was lost on occasion making it difficult to return to established monitoring site/s;
- Although every effort was made to identify subsidence related impacts after mining, possibly impacts may not have been observed during the post mining inspections. Impacts may have not been perceptible for example due to fallen trees across the flow line, excessive leaf litter, accumulation of flood debris/sediments within and above the flow line from high flow events and time constraints in the field for example;
- Due to above annual average rainfall in 2020², 2021² and 2022² the amount of ground vegetation had substantially increased making it difficult to identify potential impacts through the dense ground cover;
- Flowing water and/or saturated ground in 2022 was observed from UCFL4-Site 9 to UCFL4-Site 26 and from BBC-Site 4 to BBC-Site 9. These conditions also impeded observations during post mining inspections for subsidence impacts; and
- High flow creek event/s, for example in 2020, made it difficult to either locate established monitoring pegs as flood debris and/or creek flows may have removed or obscured the peg.

² Annual Review 2020, Annual Review 2021 and Annual Review 2022 by UCMP

Figure 1-3 Observed Subsidence Impacts



Subsidence Impacts Identified During Flow Line Monitoring (Ulan West)

- Observed Impacts**
- Cracking
 - Minor Cracking
 - Minor Uplifting
 - Nick Point Erosion
 - Ponding
 - Creeks_Rivers
 - Ulan West Mine Plan
 - Ulan Underground Mine Plan
- 2023 Longwall Extraction

2.0 Site Locations

2.1 Monitoring Sites

Table 2-1 Tributaries of Ulan Creek Monitoring Sites

Monitoring Site Ref#	Easting	Northings
Ulan Creek Flow Line 2 (UCFL2)		
UCFL2-Site 1	756688	6431941
UCFL2-Site 1A	756323	6432193
UCFL2-Site 2	756430	6432149
UCFL2-Site 2A	756333	6432176
UCFL2-Site 3	756190	6432179
UCFL2-Site 3A	756062	6432195
UCFL2-Site 4	755680	6432216
UCFL2-Site 4A	755978	6432183
UCFL2-Site 5	755497	6432170
UCFL2-Site 5A	755902	6432206
UCFL2-Site 6	755485	6432154
UCFL2-Site 6A	755865	6432180
UCFL2-Site 7	755385	6432099
UCFL2-Site 7A	755787	6432196
UCFL2-Site 8	755252	6432545
UCFL2-Site 8A	755767	6432206
UCFL2-Site 9	755287	6432096
UCFL2-Site 10	755275	6432089
UCFL2-Site 11	755116	6432138
UCFL2-Site 12	754797	6432300
Ulan Creek Flow Line 4 (UCFL4)		
UCFL4-Site 1	757299	6434118
UCFL4-Site 1A	756151	6434160
UCFL4-Site 2	757188	6434123
UCFL4-Site 2A	755635	6433931
UCFL4-Site 3	757013	6434076
UCFL-Site 3A	755814	6434028
UCFL4-Site 4	756800	6434107
UCFL4-Site 4A	755870	6434041
UCFL4-Site 5	756576	6434188
UCFL4-Site 5A	755830	6434031
UCFL4-Site 6	756513	6434179
UCFL4-Site 7	756390	6434142
UCFL4-Site 8	756176	6434169
UCFL4-Site 9	756091	6434137
UCFL4-Site 10	755875	6434041
UCFL4-Site 11	755203	6433683
UCFL4-Site 12	755111	6433622
UCFL4-Site 13	754807	6433311
UCFL4-Site 14	754770	6433177

Monitoring Site Ref#	Eastings	Northings
UCFL4-Site 15	754674	6433267
UCFL4-Site 15A	754719	6433286
UCFL4-Site 16	754622	6433235
UCFL4-Site 17	754311	6433113
UCFL4-Site 18	754231	6433051
UCFL4-Site 19	754692	6433077
UCFL4-Site 20	754663	6433017
UCFL4-Site 21	754407	6432403
UCFL4-Site 22	754282	6432433
UCFL4-Site 22A	754178	6433020
UCFL4-Site 21A	754477	6432490
UCFL4-Site 23	754234	6432411
UCFL4-Site 24	754084	6432940
UCFL4-Site 25	753858	6432893
UCFL4-Site 26	753803	6432888
Ulan Creek Flow Line 3 (UCFL3)		
UCFL3-Site 1	756659	6432626
UCFL3-Site 2	756418	6432635
UCFL3-Site 3	756351	6432671
UCFL3-Site 4	756271	6432711
UCFL3-Site 5	756105	6432847
UCFL3-Site 6	756004	6432879
UCFL3-Site 7	755653	6432995
UCFL3-Site 8	755567	6433034
UCFL3-Site 8a	755581	6433110
UCFL3-Site 9	755521	6432975
UCFL3-Site 10	755424	6433018

Notes: Coordinate System: GDA2020 MGA Zone 55

Table 2-2 Brokenback Creek Monitoring Sites

Monitoring Site Ref#	Eastings	Northings
Brokenback Creek (BBC)		
BBC-Site 1	755093	6435473
BBC-Site 2	754994	6435465
BBC-Site 3	754750	6435456
BBC-Site 4	754695	6435496
BBC-Site 5	754554	6435583
BBC-Site 6	754292	6435760
BBC-Site 7	754255	6435872
BBC-Site 8	753934	6436187
BBC-Site 9	753912	6436235
BBC-Site 10	753817	6436341
BBC-Site 11	753662	6436365
BBC-Site 12	753463	6436380

Notes: Coordinate System: GDA 2020 MGA Zone 55

Table 2-3 Mona Creek Monitoring Sites

Monitoring Site Ref#	Eastings	Northings
Mona Creek (MC)		
MC 1	754691	6439594
MC 2	754832	6439604
MC 3	755115	6439678
MC 4	755342	6439657
MC 5	755571	6439792
MC 6	755593	6439837
MC 7	755612	6439922
MC 8	755652	6439987
MC 9	755664	6440072

Notes: Coordinate System: GDA 2020 MGA Zone 55

3.0 Results

3.1 Ephemeral Tributary - Flow Line 4

Ulan Creek Flow Line 4 (UCFL4) is a tributary of Ulan Creek and flows across the surface of the Ulan West underground mine plan in an easterly direction into Ulan Creek (**Figure 1-1**). Channel stability monitoring of UCFL4 first commenced in 2014³ by Barnson Pty Ltd (Barnson).

The initial pre-mining monitoring of sites above the Ulan West mine (i.e., Sites 1 to 8) by Barnson in 2014 described the stability of UCFL4 ranging from unstable to stable. Sites 1 to 5 were established as control sites as they were not directly located above a longwall panel. Site 6, Site 7 and Site 8 were located over LW1 and LW2.

As mining progressed, additional sites were established by PE in advance of the longwall and/or at impacts identified between established sites that justified further monitoring, including:

- Site 9 and Site 10 for LW2 and LW3 in 2015;
- Site 1A, Site 2A, Site 3A, Site 4A and Site 5A in 2017.
- Site 11 for LW4 in 2019.
- Site 12 and Site 13 for LW5 in 2018;
- Site 14 for LW5 in 2020;
- Site 15, Site 15A, Site 16, Site 17, Site 18, Site 19, Site 20, Site 21, Site 21A and Site 22 for LW6 and LW7 in 2021; and
- Site 22A, Site 23, Site 24, Site 25 and Site 26 for LW7 and LW8B in 2022.

A brief pre mining description for each site and any observed impacts during post mining inspections are provided in **Appendix A. Table 3-1** provides a summary of impacts observed and the condition of the observed impact over successive monitoring periods and if the site has achieved the post mining monitoring criteria.

Table 3-1 Summary of Monitoring Results for UCFL4

Site ID	Longwall	Impacts Observed	Type of Impact	Condition of Impact	Continue Monitoring
UCFL4-Site 1	NA	No	-	-	No ¹
UCFL4-Site 1A	LW2	Yes	Cracking	No Change	No ³
UCFL4-Site 2	NA	No	-	-	No ¹
UCFL4-Site 2A	LW3	Yes	Potential Ponding	No Change	No ²
UCFL4-Site 3	NA	No	-	-	No ¹
UCFL4-Site 3A	LW3	Yes	Erosion	No Change	No ⁴
UCFL4-Site 4	NA	No	-	-	No ²
UCFL4-Site 4A	LW3	Yes	Minor Cracking	No Change	No ¹
UCFL4-Site 5	LW1	No	-	-	No ²
UCFL4-Site 5A	LW3	Yes	Erosion	No Change	No ⁴
UCFL4-Site 6	LW1	No	-	-	No ²
UCFL4-Site 7	LW2	No	-	-	No ²
UCFL4-Site 8	LW2	No	-	-	No ²
UCFL4-Site 9	LW2	Yes	Erosion	No Change	No ⁴
UCFL4-Site 10	LW3	No	-	-	No ²
UCFL4-Site 11	LW4	Yes	Erosion	No Change	No ⁴

³ UCML Creek Stability Assessments 2014 by Barnson Pty Ltd (March 2015)

Site ID	Longwall	Impacts Observed	Type of Impact	Condition of Impact	Continue Monitoring
UCFL4-Site 12	LW5	No	-	-	No ⁴
UCFL4-Site 13	LW5	Yes	Erosion	No Change	No ⁴
UCFL4-Site 14	LW5	Yes	Erosion	No Change	No ⁴
UCFL4-Site 15	LW6	No	-	-	No ⁵
UCFL4-Site 15A	LW5-CP	No	-	-	No ⁵
UCFL4-Site 16	LW6	No	-	-	No ⁵
UCFL4-Site 17	LW6	No	-	-	No ⁵
UCFL4-Site 18	LW7	No	-	-	Yes
UCFL4-Site 19	LW6	No	-	-	No ⁵
UCFL4-Site 20	LW6	No	-	-	No ⁵
UCFL-Site 21	LW6	No	-	-	No ⁵
UCFL4-Site 21A	LW6	No	-	-	No ⁵
UCFL4-Site 22	LW6	No	-	-	No ⁵
UCFL4-Site 22A	LW7	No (pre mining)	-	-	Yes
UCFL4-Site 23	LW7	No (pre mining)	-	-	Yes
UCFL4-Site 24	LW7	No (pre mining)	-	-	Yes
UCFL4-Site 25	LW7	No (pre mining)	-	-	Yes
UCFL4-Site 26	LW8	No (pre mining)	-	-	Yes

Notes: Sites inspected in 2023 CP= Chain Pillar

¹ Sites removed from the 2020 monitoring program by UCMLP achieving post mining monitoring criteria (**Section 1.4.1**).

² Sites removed from the 2021 monitoring program by UCMLP achieving post mining monitoring criteria (**Section 1.4.1**).

³ Sites removed from the 2022 monitoring program by UCMLP achieving post mining monitoring criteria (**Section 1.4.1**).

⁴ Sites to be considered for removal by UCMLP for the 2023 monitoring program achieving post mining monitoring criteria (**Section 1.4.1**).

⁵ Sites to be considered for removal by UCMLP for the 2024 monitoring program achieving post mining monitoring criteria (**Section 1.4.1**).

3.2 Ulan Creek Tributary - Flow Line 2

Ulan Creek Flow Line 2 (UCFL2) was added to the creek stability monitoring program in 2015. UCFL2 is a tributary of Ulan Creek and flows across the surface of Ulan West underground mine to the east, before turning southeast into Ulan Creek (**Figure 1-1**).

Sites 1 to 4 along UCFL2 were established by PE in 2015 during post mining inspections. Site 1 is located on the eastern edge of the chain pillar LW1 not directly over the panel, Site 2 and Site 3 above LW2 and Site 4 above LW3.

As mining progressed, additional sites were established by PE at impacts identified during post mining inspections that justified further monitoring, including:

- Site 1A, Site 2A, Site 3A, Site 4A, Site 5A, Site 6A, Site 7A and Site 8A for LW2 and LW3 in 2017;
- Site 5, Site 6, Site 7, Site 8, Site 9 and Site 10 for LW4 in 2019;
- Site 11 and Site 12 for LW5 in 2020.

A brief description for each site and any observed impacts during post mining inspections are provided in **Appendix B. Table 3-2** provides a summary of impacts observed and the condition of the observed impact over successive monitoring periods and if the site has achieved the post mining monitoring criteria.

Table 3-2 Summary of Monitoring Results for UCFL2

Site ID	Longwall	Impacts Observed	Type of Impact	Condition of Impact	Continue Monitoring
UCFL2-Site 1	LW1	No	-	-	No ¹
UCFL2-Site 1A	LW2	Yes	Minor Cracking	No Change	No ²
UCFL2-Site 2	LW2	No	-	-	No ¹
UCFL2-Site 2A	LW2	Yes	Minor Cracking	No Change	No ²
UCFL2-Site 3	LW2	No	-	-	No ¹
UCFL2-Site 3A	LW2	Yes	Cracking	No Change	No ³
UCFL2-Site 4	LW3	No	-	-	No ²
UCFL2-Site 4A	LW3	Yes	Cracking	No Change	No ²
UCFL2-Site 5	LW4	Yes	Cracking	No Change	No ²
UCFL2-Site 5A	LW3	Yes	Cracking	No Change	No ²
UCFL2-Site 6	LW4	Yes	Cracking	No Change	No ²
UCFL2-Site 6A	LW3	Yes	Cracking	No Change	No ²
UCFL2-Site 7	LW4	Yes	Cracking	No Change	No ²
UCFL2-Site 7A	LW3	Yes	Cracking	No Change	No ³
UCFL2-Site 8	LW4	Yes	Cracking	No Change	No ²
UCFL2-Site 8A	LW3	Yes	Cracking	No Change	No ²
UCFL2-Site 9	LW4	Yes	Cracking	No Change	No ²
UCFL2-Site 10	LW4	Yes	Cracking	No Change	No ²
UCFL2-Site 11	LW5	Yes	Cracking	No Change	No ³
UCFL2-Site 12	LW5	Yes	Cracking	No Change	No ³

Notes: No sites were reinspected in 2023, removed by UCMPML from the monitoring program (refer to **Section 1.4.1**)

¹ Sites removed from the 2021 monitoring program by UCMPML achieving post mining monitoring criteria (**Section 1.4.1**).

² Sites removed from the 2022 monitoring program by UCMPML achieving post mining monitoring criteria (**Section 1.4.1**).

³ Sites to be considered for removal by UCMPML for the 2023 monitoring program, achieving post mining monitoring criteria (**Section 1.4.1**).

3.3 Ulan Creek Tributary - Flow Line 3

Ulan Creek Flow Line 3 (UCFL3) was inspected in 2023. UCFL3 is located above LW1 - LW4, with the completion of LW4 in December 2018. UCMPML requested an inspection in 2023 to identify and record subsidence related impacts.

UCFL3 is a tributary of Ulan Creek and flows across the surface of Ulan West underground mine to the east into Ulan Creek (**Figure 1-1**).

A brief description for each site and any observed impacts during post mining inspections are provided in **Appendix C**. **Table 3-3** provides a summary of impacts observed and the condition of the observed impact over successive monitoring periods and if the site has achieved the post mining monitoring criteria.

Table 3-3 Summary of Monitoring Results for UCFL3

Site ID	Longwall	Impacts Observed	Type of Impact	Condition of Impact	Continue Monitoring
UCFL3-Site 1	LW1	No	-	-	No
UCFL3-Site 2	LW1	No	-	-	No
UCFL3-Site 3	LW2	No	-	-	No
UCFL3-Site 4	LW2	Yes	Minor Cracking	-	TBA ¹
UCFL3-Site 5	LW2	Yes	Minor Cracking	-	TBA ¹
UCFL3-Site 6	LW3	No	-	-	No
UCFL3-Site 7	LW3	No	-	-	No
UCFL3-Site 8	LW4	No	-	-	No

Site ID	Longwall	Impacts Observed	Type of Impact	Condition of Impact	Continue Monitoring
UCFL3-Site 8a	LW4	No	-	-	No
UCFL3-Site 9	LW4	No	-	-	No
UCFL3-Site 10	LW4	Yes	Minor Cracking	-	TBA ¹

Notes: Sites inspected in 2023

¹TBA = For UCMPL's consideration

3.4 Brokenback Creek

Brokenback Creek (BBC) flows across the surface of Ulan West underground mine, west into the Talbragar River system (**Figure 1-2**). A high flow event in early 2020 within BBC associated with post mining of LW5 had created several large erosion sites within sections of the flow line.

As mining progressed, additional sites were established by PE in advance of the longwall and/or at impacts identified between established sites that justified further monitoring, including:

- Sites 1 to Site 5 were added to the monitoring program for LW5 and LW6 in 2021;
- Site 6 to Site 9 were added for LW7 in 2022; and
- Site 10 to 12 were added for LW8B in 2023.

A brief description for each site and any observed impacts during post mining inspections are provided in **Appendix D. Table 3-4** provides a summary of impacts observed and the condition of the observed impact over successive monitoring periods and if the site has achieved the post mining monitoring criteria.

Table 3-4 Summary of Monitoring Results for BBC

Site ID	Longwall	Impacts Observed	Type of Impact	Condition of Impact	Continue Monitoring
BBC-Site 1	LW5	Yes	Erosion	Remediated	Yes ³
BBC-Site 2	LW5	Yes	Erosion	Remediated	Yes ³
BBC-Site 3	LW6	No	-	-	No ^{1,2}
BBC-Site 4	LW6	No	-	-	No ^{1,2}
BBC-Site 5	LW6	No	Potential Ponding	No Change	No ²
BBC-Site 6	LW7	No	-	-	Yes
BBC-Site 7	LW7	Yes	Cracking	-	Yes
BBC-Site 8	LW7	No	-	-	Yes
BBC-Site 9	LW7	No	Cracking	-	Yes
BBC-Site 10	LW8B	No (pre mining)	-	-	Yes
BBC-Site 11	LW8B	No (pre mining)	-	-	Yes
BBC-Site 12	LW8B	No (pre mining)	-	-	Yes

Notes: Sites inspected in 2023

¹ Sites to be considered for removal by UCMPL for the 2023 monitoring program, achieving post mining monitoring criteria (**Section 1.4.1**).

² Sites to be considered for removal by UCMPL for the 2024 monitoring program, achieving post mining monitoring criteria (**Section 1.4.1**).

³ Although sites are outside the two year post monitoring requirement, UCMPL were completing a series of remediation works of the flow line at these locations where significant erosion had developed. Re-inspection in 2024 is recommended to monitor the remediation efforts of the flow line at these locations.

3.5 Mona Creek

Mona Creek (MC) flows across the surface of the Ulan Underground mine to the west into the Talbragar River system (**Figure 1-2**). In 2020, UCMPL established pre mining monitoring sites above LWW8, including:

- Sites MC1, MC2, MC3, MC4, MC5, MC6, MC7, MC8 and MC9.

A brief description for each site and any observed impacts during post mining inspections are provided in **Appendix E. Table 3-5** provides a summary of impacts observed and the condition of the observed impact over successive monitoring periods and if the site has achieved the post mining monitoring criteria.

Table 3-5 Summary of Monitoring Results for Mona Creek

Site ID	Longwall	Impacts Observed	Type of Impact	Condition of Impact	Continue Monitoring
MC-1	-	No (pre mining)	-	-	Yes ¹
MC-2	-	No (pre mining)	-	-	Yes ¹
MC-3	-	No (pre mining)	-	-	Yes ¹
MC-4	LWW8	No (pre mining)	-	-	Yes ¹
MC-5	LWW8	No (pre mining)	-	-	Yes ¹
MC-6	LWW8	No (pre mining)	-	-	Yes ¹
MC-7	CP LWW8	No (pre mining)	-	-	Yes ¹
MC-8	-	No (pre mining)	-	-	Yes ¹
MC-9	-	No (pre mining)	-	-	Yes ¹

Notes: Sites inspected in 2023 CP = Chain Pillar

¹ Sites to

4.0 Discussions & Recommendations

The purpose of the post mining monitoring of ephemeral tributaries and creeks above Ulan West and Ulan Underground mine is to identify the presence of surface cracking and erosion, surface ponding or out of channel flows and distinguish between natural erosion and erosion induced from mine subsidence, as required by both Extraction Plans, for a monitoring period of two years post mining. The results of this flow line monitoring will be interpreted by UCMPL's subsidence engineer to validate subsidence predictions made in the respective Extraction Plan and Project EA.

Identified impacts at number of sites to date have included cracking of bedrock material within the channel bed, surface cracking across the channel, ponding and erosion (**Figure 1-3**). Generally, in the absence of significant flow events, these observed impacts have not perceptibly changed during re-inspections over their respective two-year post mining monitoring period.

As observed in 2021 and 2022 there was less visual evidence (e.g. flood debris/sediment accumulation) of significant flow events in 2023 from high intensity rainfall events, when compared to observations made in 2020. The coincidence of such significant flow events with post mining impacts in some places has initiated erosion as identified in BBC, exacerbated existing erosion and changes of channel stability within the flowline as identified in UCFL4 (**Section 1.3**).

Water was observed flowing in 2022 along UCFL4 at post mining sites Site 3A, Site 5A Site 9, Site 11, Site 12, Site 13, Site 14, Site 15A, Site 15, Site 16 and Site 17. Water was observed flowing in 2022 along BBC at post mining sites Site 3, Site 4 and Site 5. No water was observed flowing within UCFL2 at post mining sites inspected in 2022.

No water was observed flowing in the flow lines and creeks (**Section 1.2**) inspected in 2023.

It is recommended that UCMPL continue to record and monitor areas where subsidence impacts have likely occurred in flow lines and creeks above Ulan West and Ulan Underground as required by the relevant Extraction Plan and develop appropriate remediation measures, as required. It is also recommended to inspect recently post mined flow lines after high intensity rainfall events.

5.0 References

- *Umwelt (2009) Ulan Coal - Continued Operations Environment Assessment*
- *Ulan West Extraction Plan for LW1 – LW8*
- *Ulan Underground Extraction Plan Longwalls LW30-LW32 and LWW6 – LWW8*
- *Barnson Pty Ltd (March 2015) UCML Creek Stability Assessments, 2014*
- *Pacific Environmental Pty Ltd (February 2016), 2015 Creek Stability Monitoring Report*
- *Pacific Environmental Pty Ltd (February 2017), 2016 Creek Stability Monitoring Report*
- *Pacific Environmental Pty Ltd (February 2018), 2017 Monitoring of Ulan Creek Tributaries*
- *Pacific Environmental Pty Ltd (February 2020), 2019 Monitoring of Ulan Creek Tributaries*
- *Pacific Environmental Pty Ltd (February 2021), 2020 Monitoring of Ulan Creek Tributaries*
- *Pacific Environmental Pty Ltd (March 2022), 2021 Monitoring of Ulan Creek Tributaries*
- *Pacific Environmental Pty Ltd (March 2023), 2022 Monitoring of Ulan Creek Tributaries*
- *SCT: 2020 Annual Review of Subsidence Monitoring at Ulan West and Ulan Underground Mines (March, 2021)*

APPENDIX A - INSPECTION RESULTS FOR UCFL4

APPENDIX B - INSPECTION RESULTS FOR UCFL2

APPENDIX C - INSPECTION RESULTS FOR UCFL3

APPENDIX D - INSPECTION RESULTS FOR BBC

APPENDIX E - INSPECTION RESULTS FOR MONA CREEK