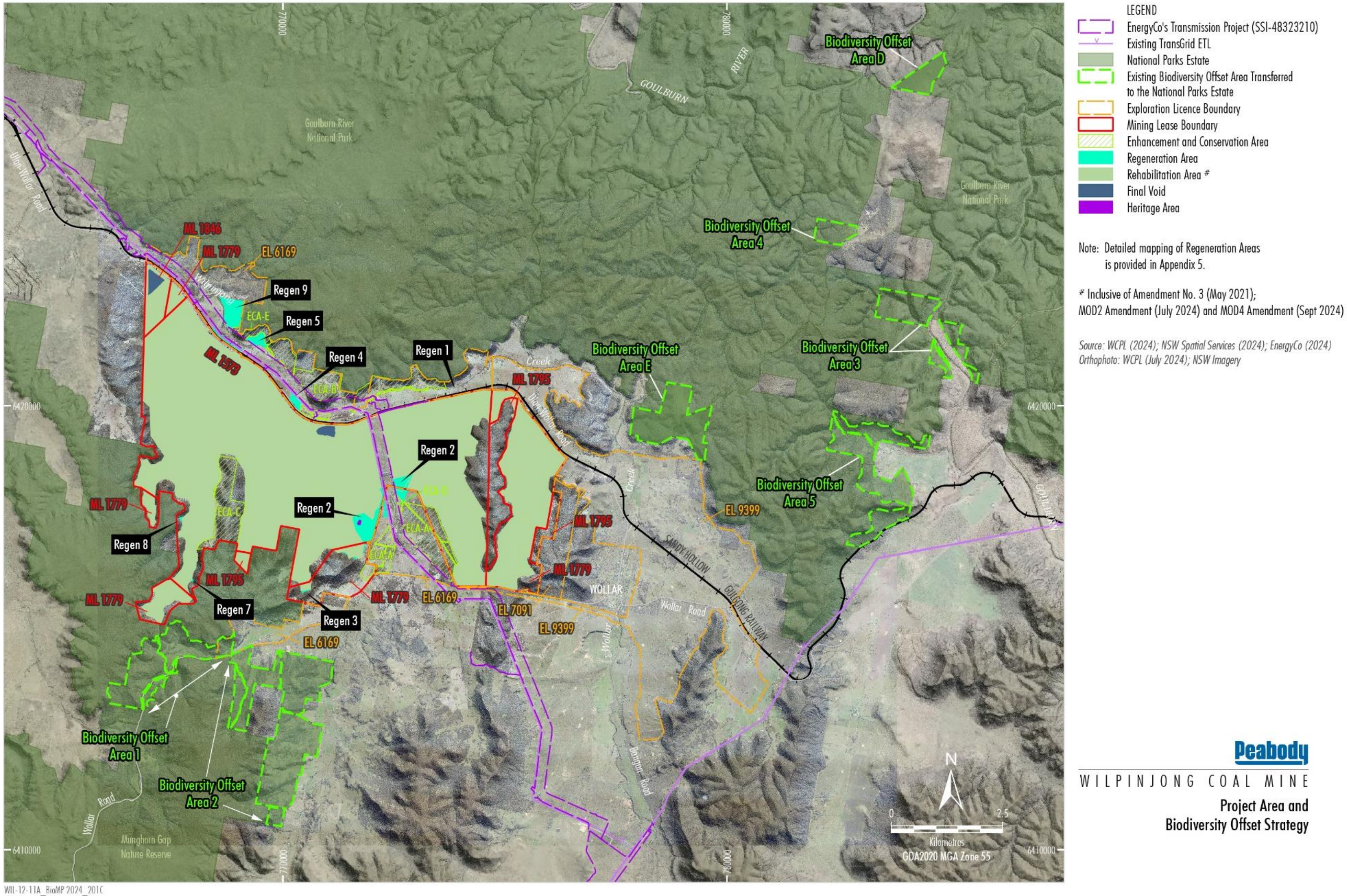
APPENDIX 4

BIODIVERSITY

Biodiversity Offset Strategy

All land within Biodiversity Offset Areas D and E were transferred to the National Parks Estate on the 13 January 2016.

All land within Biodiversity Offset Areas 1-5 (BOAs) were transferred to the National Parks Estate on the 02 August 2023


LEGEND
EnergyCo's Transmission Project (SSI-48323210)
Existing TransGrid ETL
National Parks Estate
Existing Biodiversity Offset Area Transferred to the National Parks Estate
Exploration Licence Boundary
Mining Lease Boundary
Enhancement and Conservation Area
Regeneration Area
Rehabilitation Area #
Final Void
Heritage Area
Note: Detailed mapping of Regeneration Areas is provided in Appendix 5.
Inclusive of Amendment No. 3 (May 2021); MOD2 Amendment (July 2024) and MOD4 Amendment (Sept 2024)
Source: WCPL (2024); NSW Spatial Services (2024); EnergyCo (2024)
Orthophoto: WCPL (July 2024); NSW Imagery
Goulburn River National Park
GOULBURN RIVER
Biodiversity Offset Area D
Biodiversity Offset Area 4
Biodiversity Offset Area E
Biodiversity Offset Area 3
Biodiversity Offset Area 5
Biodiversity Offset Area 1
Biodiversity Offset Area 2
Regen 1
Regen 2
Regen 3
Regen 4
Regen 5
Regen 7
Regen 8
Regen 9
ECA-A
ECA-B
ECA-C
ECA-E
ML 1846
ML 1779
ML 1573
ML 1795
EL 6169
EL 7091
EL 9399
WOLLAR
Wollar Road
SANDY HOLLOW GULGONG RAILWAY
Ulan Wollar Road
Munghorn Gap Nature Reserve
Kilometres
GDA2020 MGA Zone 55
Peabody
WILPINJONG COAL MINE
Project Area and Biodiversity Offset Strategy
WIL-12-11A_BioMP 2024_201C

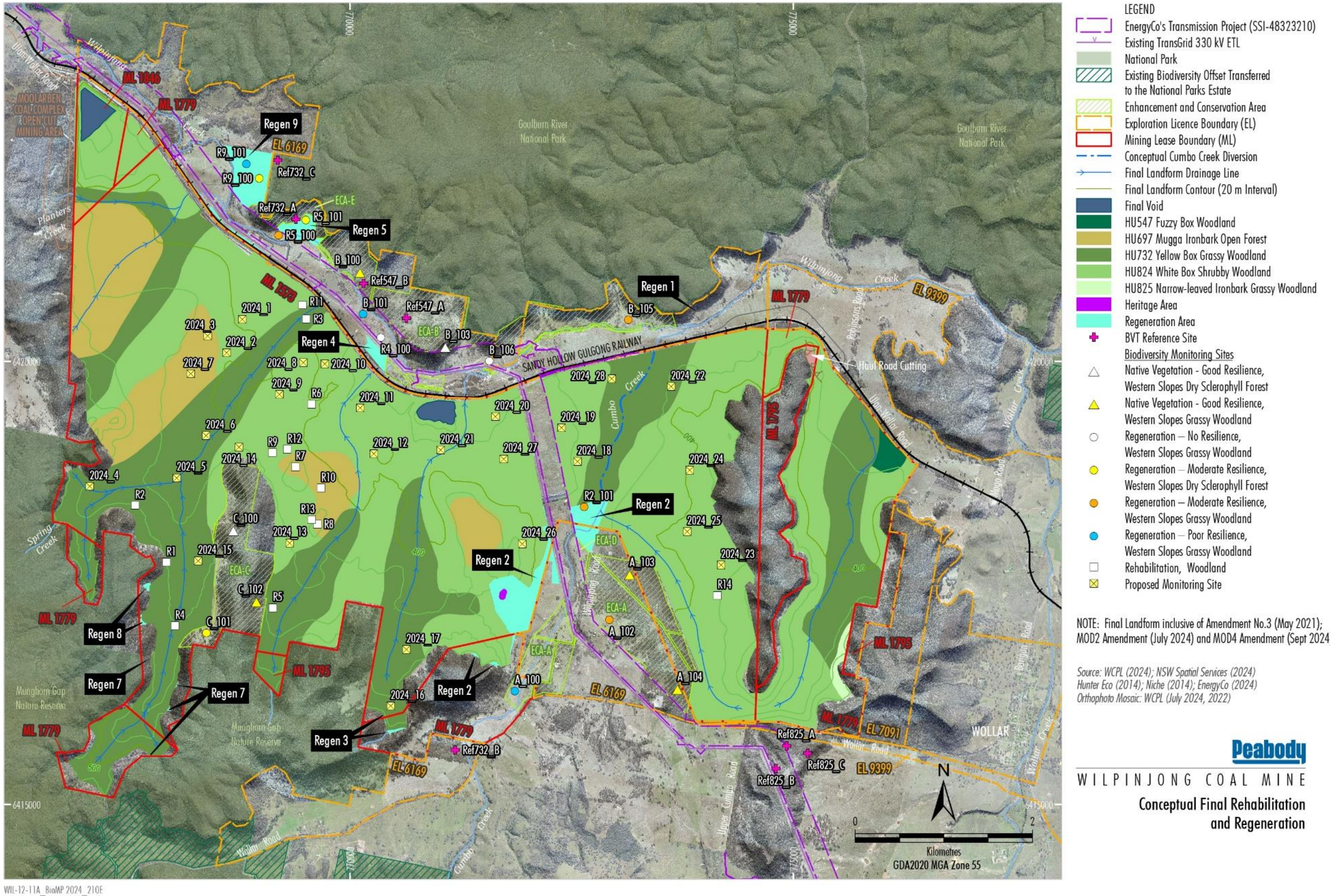

LEGEND
EnergyCo's Transmission Project (SSI-48323210)
Existing TransGrid 330 kV ETL
National Park
Existing Biodiversity Offset Transferred to the National Parks Estate
Enhancement and Conservation Area
Exploration Licence Boundary (EL)
Mining Lease Boundary (ML)
Conceptual Cumbo Creek Diversion
Final Landform Drainage Line
Final Landform Contour (20 m Interval)
Final Void
HU547 Fuzzy Box Woodland
HU697 Mugga Ironbark Open Forest
HU732 Yellow Box Grassy Woodland
HU824 White Box Shrubby Woodland
HU825 Narrow-leaved Ironbark Grassy Woodland
Heritage Area
Regeneration Area
BVT Reference Site
Biodiversity Monitoring Sites
Native Vegetation - Good Resilience, Western Slopes Dry Sclerophyll Forest
Native Vegetation - Good Resilience, Western Slopes Grassy Woodland
Regeneration – No Resilience, Western Slopes Grassy Woodland
Regeneration – Moderate Resilience, Western Slopes Dry Sclerophyll Forest
Regeneration – Moderate Resilience, Western Slopes Grassy Woodland
Regeneration – Poor Resilience, Western Slopes Grassy Woodland
Rehabilitation, Woodland
Proposed Monitoring Site
NOTE: Final Landform inclusive of Amendment No.3 (May 2021); MOD2 Amendment (July 2024) and MOD4 Amendment (Sept 2024
Source: WCPL (2024); NSW Spatial Services (2024)
Hunter Eco (2014); Niche (2014); EnergyCo (2024)
Orthophoto Mosaic: WCPL (July 2024, 2022)
Peabody
WILPINJONG COAL MINE
Conceptual Final Rehabilitation and Regeneration
Goulburn River National Park
SANDY HOLLOW GULGONG RAILWAY
Regen 1
Regen 2
Regen 3
Regen 4
Regen 5
Regen 7
Regen 8
Regen 9
ML 1779
ML 1795
ML 1846
EL 6169
EL 7091
EL 9399
Munghorn Gap Nature Reserve
MOOLARBEN COAL COMPLEX OPEN CUT MINING AREA
Haul Road Cutting
WOLLAR
Kilometres
GDA2020 MGA Zone 55
WIL-12-11A_BioMP 2024_210E

Table A6 Three Year Management Schedule

Management Domains	Three Year Management Measures (2024-2026)												
	Cultural Heritage Management	Fencing, Gates & Signage	Access Tracks	Waste Management	Erosion & Soil Management	Grazing & Stock Management	Seed Collection & Propagation	Habitat Augmentation	Revegetation	Weed Management	Vertebrate Pest Control	Monitor Die Back (Phytophthora cinnamon)	Bushfire Management
ECA_A	✓[1]	✓[2]	✓[3]	✓[4]	✓[5]	✓[6]	✓[7]	✓[8]	✓[9]	✓[10]	✓[11]	✓[12]	✓[13]
ECA_B	✓[1]	✓[2]	✓[3]	✓[4]	✓[5]	✓[6]	✓[7]	✓[8]	✓[9]	✓[10]	✓[11]	✓[12]	✓[13]
ECA_C	✓[1]	✓[2]	✓[3]	✓[4]	✓[5]	✓[6]	✓[7]	✓[8]	✓[9]	✓[10]	✓[11]	✓[12]	✓[13]
ECA_D	✓[1]	✓[2]	✓[3]	✓[4]	✓[5]	✓[6]	✓[7]	✓[8]	✓[9]	✓[10]	✓[11]	✓[12]	✓[13]
ECA_E	✓[1]	✓[2]	✓[3]	✓[4]	✓[5]	✓[6]	✓[7]	✓[8]	✓[9]	✓[10]	✓[11]	✓[12]	✓[13]
Regeneration Area 1	✓[1]	✓[2]	✓[3]	✓[4]	✓[5]	✓[6]	✓[7]	✓[8]	✓[9]	✓[10]	✓[11]	✓[12]	✓[13]
Regeneration Area 2	✓[1]	✓[2]	✓[3]	✓[4]	✓[5]	✓[6]	✓[7]	✓[8]	✓[9]	✓[10]	✓[11]	✓[12]	✓[13]
Regeneration Area 3, 7 & 8	✓[1]	✓[2]	✓[3]	✓[4]	✓[5]	✓[6]	✓[7]	✓[8]	✓[9]	✓[10]	✓[11]	✓[12]	✓[13]
Regeneration Area 4	✓[1]	✓[2]	✓[3]	✓[4]	✓[5]	✓[6]	✓[7]	✓[8]	✓[9]	✓[10]	✓[11]	✓[12]	✓[13]
Regeneration Area 5	✓[1]	✓[2]	✓[3]	✓[4]	✓[5]	✓[6]	✓[7]	✓[8]	✓[9]	✓[10]	✓[11]	✓[12]	✓[13]
Regeneration Area 6	✓[1]	✓[2]	✓[3]	✓[4]	✓[5]	✓[6]	✓[7]	✓[8]	✓[9]	✓[10]	✓[11]	✓[12]	✓[13]
Regeneration Area 9	✓[1]	✓[2]	✓[3]	✓[4]	✓[5]	✓[6]	✓[7]	✓[8]	✓[9]	✓[10]	✓[11]	✓[12]	✓[13]
Rehabilitation Areas	NA	NA	NA	NA	✓[5]	NA	✓[7]	✓[8]	✓[9]	✓[10]	✓[11]	✓[12]	✓[13]
Residual Areas	✓[1]	✓[2]	✓[3]	✓[4]	✓[5]	✓[6]	✓[7]	✓[8]	✓[9]	✓[10]	✓[11]	✓[12]	✓[13]

Notes:
NA = Not Applicable to the Management Domain
✓[1] = As required under the ACHMP
✓[2] = As required repairs to existing fencing, gates and signage will be informed during inspections.
✓[3]= As required repairs to existing tracks will be informed during inspections.
✓[4]= As required waste removal will be informed during inspections. Waste removal campaigns in ECAs have been completed.
✓[5]= Opportunistic repair of erosion channels will be undertaken when determined to be necessary after identification and mapping.
✓[6]= Livestock to be excluded from areas of native regeneration unless utilised for any management programs.
✓[7]= Continuation of Seed Collection Program inclusive of local species. Seed collectors are suitably trained and qualified.
✓[8]= As required, habitat augmentation opportunities are identified and assessed.
✓[9]= As required, identification of opportunities to increase native plant species richness inclusive of supplementary planting.
✓[10]= Seasonal identification of target noxious weed species and management as required.
✓[11]= Program drafted in consultation with NSW Local Land Services.
✓[12]= As required by this BMP.
✓[13]= Maintenance and repair of bushfire prevention infrastructure as required.

Biodiversity Reports

Biodiversity Research Pty Ltd

167 McKanes Falls Rd, South Bowenfels, NSW 2790

Telephone: 0421 841 726

Email: andrew.lothian@biodiversitymonitoring.com.au

ABN: 54 617 530 686

www.biodiversitymonitoring.com.au

Monitoring of Microbats at Slate Gully Adit (Pit 8), Wilpinjong Coal Mine, NSW for 2025

for

Peabody Energy Pty Ltd

Prepared for: James Heesterman
Prepared by: Biodiversity Monitoring Services
Date: 17 February 2026

Document History

Report	Version	Prepared by	Checked by	Submission Method	Date
Adit monitoring	Issue 1	Mikaela Cole	Andrew Lothian	email	17 Feb 2026

1.0 Introduction

Biodiversity Monitoring Services (BMS) was engaged by Wilpinjong Coal Pty Ltd (WCPL) to undertake the 2025 annual microbat monitoring at the abandoned oil shale mine (adit) in Slate Gully, Wilpinjong Coal Mine (WCM). This adit supports colonies of two microbat species: the Eastern Horseshoe-bat (*Rhinolophus megaphyllus*) and Large Bent-winged Bat (*Miniopterus orianae oceanensis*, formerly known as Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*). Monitoring undertaken since April 2017 indicates that less than 50 Eastern Horseshoe-bats inhabit the mine workings throughout the year. From exit counts conducted to date, numbers of this species do not vary substantially throughout the year. Counts of the Large Bent-winged Bat inhabiting the mine vary considerably more throughout the year.

WCPL is approved to mine Slate Gully (Pit 8) adjacent to the adit. Topsoil stripping at the northern end of Slate Gully began in November 2019. Overburden extraction in Slate Gully began in early 2020 approximately 600m to the northeast of the adit. Previous plans estimated Pit 8 to come within 150m of the adit in approximately 2021. However, by February 2023 only a clean water drain had been constructed within 150m of the adit, with the nearest active cut in Pit 8 remaining still approximately 430m away. By February 2024, topsoil stripping had occurred approximately 100m from the adit, with the Pit 8 active cut still approximately 350m from the adit. As of February 2025, the active cut is approximately 190m from the adit, with the extraction coming past the adit in late 2025. Bats within the workings have been subject to vibration and noise, and once exiting have been, and will be, subject to artificial lighting (Linley 2016). There is also the potential for dust and fumes associated with the open cut operations. Generally there is a paucity of scientific literature on the impacts of mining (and the above impacts) on cave-roosting bats.

Exit counts of bats leaving the adit, as well as capture of exiting bats[1], has been undertaken over the past nine years to determine what species are utilising the adit and how their numbers and sexual composition change throughout the year (Fly By Night 2017; Fly By Night 2018; Fly By Night 2019; Biodiversity Monitoring Services 2025). This has given a firm basis to monitor colonies of the two species roosting within the workings as the adjacent area is strip mined for coal. Previously we recommended that continual monitoring of bat activity via an ultrasonic bat call detector would provide a superior method to monitor the roost long term. This report details the results of automated monitoring over a 12-month period from January 2025 to December 2025, as well as concurrent monthly hand counts of bats exiting the workings.

[1] Harp trapping was conducted over the period 2017-2019 (autumn, winter, summer) and then discontinued at the request of NSW DCCEEW (formerly OEH at the time). Enough data was obtained to determine the site was not a breeding roost, but forms an important overwintering and seasonal roost, with composition of sex/age/individuals in the roost changing seasonally. Harp trapping was again conducted at the adit in July 2024 to determine if the species/sex/age composition of the roost had changed between monitoring events.

2.0 Survey Methodologies

Manual Exit Counts

Bats were counted leaving the adit by Andrew Lothian (BMS) each month. The counter was in position half an hour before sunset, and counts were conducted until no more bats exited for a period of 10 minutes (or more bats flew into the roost than flew out in a 10 minute period). Due to differences in flight behaviour (speed and direction of travel upon exit), an assessment could be made of the species composition of bats leaving the adit, although this assessment is becoming increasingly difficult with the new counting position and multiple exit apertures. Notes were made of the time of first bat exiting the adit, the total number of bats exiting the adit, and the presence of each of the target species. This methodology has been published recently (Lothian and Hoye 2023).

Although the method has remained the same over time, the position of counting was forced to change in 2023 with the installation of a new steel box culvert creating multiple exit points for the bats. Instead of lying down near the entrance counting bats as they flew over (or to the side in the case of Horseshoe-bats), the counter must now be located further out from the entrance to allow observation of both the end of the culvert and the natural aperture over the culvert. It took a few months to choose the optimal position, potentially resulting in manual counts conducted from April 2023 beingless accurate than previous counts. Using a torch to light the entrance created delays in exit by some individual bats, and sitting side-on to the adit made it difficult to differentiate bats from the rock wall behind (as opposed to being backlit by the sky). The new counting position increases the likelihood of miscounting Eastern Horseshoe-bats, however, over summer when Bent-winged bats are absent, more focus can be applied to this species.

A new setup was trialled in 2025 which appears to balance the need for lighting the entrance and the disturbance this causes to the exiting bats. A torch is placed on the ground approximately 1-2m in from of the tunnel, pointing upward and outward. This allows bats exiting the tunnel to be uplighted, without creating disturbance by pointing lights back at the adit. It still remains difficult to count both the tunnel and the existing aperture over the top.

Automated Echolocation Call Detection

An Anabat Express detector (Titley Scientific) was placed twenty metres in front of the entrance of the mine adit to sample microbats on a nightly basis (**Figure 2-1**; **Plate 2-1**). The detector was powered via a 12 volt gel cell battery connected to a small solar panel. Files were downloaded monthly in conjunction with manual counts of bats exiting the workings. This allowed a nightly activity index of the two target microbat species to be determined. While the nightly activity cannot be directly compared to numbers of each species roosting within the workings, together with exit counts it provides an estimation/index of bat numbers.

Previous echolocation survey indicated that placement of a detector a distance of approximately 20 metres from the adit provided the best indicator of bat activity for the two species (Fly By Night 2019). The Eastern Horseshoe-bat undertakes circling behaviour when it exits the adit at dusk. Therefore, echolocation call activity undertaken at the adit gives inflated activity for this species. From presence during the counts, Eastern Horseshoe-bats tend to come and go frequently, particularly at the start of the night. Large Bent-winged Bat tend to all come out in a short space of time then return in smaller groups through the night.

Figure 2-1: Location of Slate Gully Adit (WCPL 2026). Note topsoil stripping has passed adit, and the extraction pit is almost level with the adit (pit progression is southward).

Plate 2-A: Slate Gully adit entrance prior to installation of steel pipe to maintain opening in the event of a collapse (mid 2019), also prior to installation of steel box tunnel (Apr 2023). Detector and solar panel setup 20m in front of adit.

3.0 Weather

Weather conditions on manual count nights (and the two nights prior) were recorded. Data was obtained from the Wilpinjong Meteorological Station, approximately 4.5km west of the adit.

Table 3-1: Weather conditions during survey (Peabody Energy 2026).

Date	Minimum Temperature (°C)	Maximum Temperature (°C)	Rainfall (mm)	Comments
16/12/2023	15.3	32.9	0	
17/12/2023	13.6	35.8	0	
18/12/2023	21.4	38.1	0	Hot, 0% cloud, no wind, no rain but humid
28/01/2024	17.5	29.7	0	
29/01/2024	20.5	37.6	0	
30/01/2024	24.7	33.0	0	Hot, 0% cloud, moderate wind, no rain but humid
10/02/2024	18.6	24.5	0	
11/02/2024	18.5	25.3	0	
12/02/2024	16.6	32.9	0	Hot, 0% cloud, no wind, no rain but humid
23/03/2024	11.5	23.2	0	
24/03/2024	14.7	27.6	0	
25/03/2024	10.5	28.9	0	Mild, 0% cloud, no wind, no rain, full moon
27/04/2024	5.1	21.4	0	
28/04/2024	6.3	24.6	0.2	
29/04/2024	6.8	24.8	0.6	Mild, 100% cloud, no wind, light rain first 15min, no moon at time of count
20/05/2024	0.7	18.2	0	
21/05/2024	2.9	18.8	0	
22/05/2024	4.0	18.9	0.2	Cold, 0% cloud, no wind, no rain, full moon
15/06/2024	9.1	12.6	9.6	
16/06/2024	4.7	14.9	0	
17/06/2024	2.5	15.8	0	Cold, 75% cloud, no wind, no rain but recent – wet ground, gibbous moon
30/06/2024	6.5	16.4	12.0	
01/07/2024	5.1	14.1	0.6	
02/07/2024	4.0	13.2	0	Cold, 100% cloud, no wind, light rain before exit time, waning crescent
10/08/2024	6.3	20.7	0.4	
11/08/2024	9.3	18.1	0	
12/08/2024	8.8	15.5	0	Cold, 100% cloud, light wind, light rain during count
07/09/2024	7.9	27.8	0.2	
08/09/2024	9.0	18.3	0	

Date	Minimum Temperature (°C)	Maximum Temperature (°C)	Rainfall (mm)	Comments
09/09/2024	5.3	20.6	0.4	Cool, 0% cloud, no wind, no rain, waxing crescent
01/10/2024	9.1	23.3	0	
02/10/2024	8.1	21.4	0	
03/10/2024	10.3	20.8	0	Cool, 0% cloud, no wind, no rain, no moon during count
12/11/2024	15.9	23.5	0.2	
13/11/2024	13.7	29.9	0	
14/11/2024	12.7	29.8	0.4	Mild, 0% cloud, strong wind, no rain but been wet this week, near full moon
16/12/2024	21.1	35.2	0	
17/12/2024	18.5	36.2	0	
18/12/2024	16.7	27.4	0	Cool, 100% cloud, strong wind, no rain, no moon during count
21/01/2025	13.2	34.5	0	
22/01/2025	16.3	36.2	0	
23/01/2025	18.8	27.6	0	Mild, 100% cloud, moderate wind, no rain, no moon during count
09/02/2025	17.6	33.4	6.0	
10/02/2025	16.5	24.0	24.2	
11/02/2025	15.7	25.8	3.8	Warm, 0% cloud, light wind, no rain but 20mm of rain overnight and this morn so ground wet, full moon rising straight ahead of adit
23/03/2025	20.0	26.7	0	
24/03/2025	19.6	26.7	0	
25/03/2025	19.8	25.6	0	Mild, 100% cloud, strong wind, no rain, no moon during count
26/04/2025	12.4	22.5	4.4	
27/04/2025	12.8	17.0	7.4	
28/04/2025	9.6	24.1	0.2	Cool, 50% cloud, no wind, no rain but wet ground so rain over previous night/morning, no moon during count
26/05/2025	6.4	13.2	17.8	
27/05/2025	9.4	15.5	22.2	
28/05/2025	6.7	16.2	0	Cold, 0% cloud, no wind, no rain but saturated ground so substantial rain previous night/morning, no moon during count
14/06/2025	-0.3	16.2	0	
15/06/2025	1.5	16.5	0	
16/06/2025	-0.5	16.2	0	Cold, 0% cloud, no wind, no rain, no moon during count
20/07/2025	-2.7	15.9	0	
21/07/2025	-0.2	17.0	0	
22/07/2025	5.2	18.6	6.4	Cold, 100% cloud, no wind, no rain, no moon during count

Date	Minimum Temperature (°C)	Maximum Temperature (°C)	Rainfall (mm)	Comments
31/08/2025	-0.4	19.0	0	
01/09/2025	0.9	20.0	0	
02/09/2025	5	-	0.2	Cold, 0% cloud, no wind, no rain, half-gibbous moon overhead during count
23/09/2025	2.1	18.5	0	
24/09/2025	4.3	20.9	0	
25/09/2025	5.4	21.2	0	Mild, 0% cloud, no wind, no rain, no moon during count
18/10/2025	16.0	28.5	0	
19/10/2025	12.1	29.9	0	
20/10/2025	12.0	34.7	0	Warm, 0% cloud, no wind, no rain, no moon during count
09/11/2025	11.7	23.4	0	
10/11/2025	7.9	25.3	0	
11/11/2025	6.4	26.3	0	Mild, 0% cloud, light wind, no rain, no moon during count
15/12/2025	13.4	32.5	0	
16/12/2025	18.4	27.3	0	
17/12/2025	17.7	33.6	0	Warm, 0% cloud, light wind, no rain, no moon during count, dusty
17/01/2026	-	-	-	
18/01/2026	-	-	-	
19/01/2026	-	-	-	Mild, 0% cloud, strong wind, no rain, no moon during count, dusty

4.0 Results

Manual Exit Counts

Under the previous adit inspection/monitoring regime (2017-2019), exit counts were conducted over two nights alongside trapping of bats. Data comparing total exit counts over the last eight years are presented in **Table 4-1**. Count data from monthly surveys since June 2019 are presented in **Table 4-2**.

Table 4-1: Counts of bats exiting adit during April, June and December surveys from 2017-2025

	Apr 2017	**Apr 2018**	**Apr 2019**	**Apr 2020**	**Apr 2021**	**Apr 2022**	**Apr 2023**	**Apr 2024**	**Apr 2025**
Minimum count	603	640	460	55	289	527	221	534	390
Maximum count	669	705	603	55	289	527	221	534	390

	Jun 2017	**Jun 2018**	**Jun 2019**	**Jun 2020***	**Jun 2021**	**Jun 2022**	**Jun 2023**	**Jun 2024**	**Jun 2025**
Minimum count	665	1000	94	92	788	705	363	390	739
Maximum count	720	1029	94	246	823	705	363	390	739

	Dec 2017	**Dec 2018**	**Dec 2019**	**Dec 2020**	**Dec 2021**	**Dec 2022***	**Dec 2023**	**Dec 2024**	**Dec 2025**
Minimum count	10	9	12	20	15	15	3	9	12
Maximum count	10	9	12	20	15	22	5	9	12

*Note: two counts were conducted in June 2020 due to a required maintenance visit. Access issues in 2022 meant there were two December counts due to a late November count. January count in 2023 was one day late, resulting in two February counts.

Table 4-2: Hand counts of bats exiting adit, and detector activity levels adjacent to the adit since monthly counts began in June 2019 – total (confident), raw # passes (all calls for all species). Detector located 20m from adit entrance in forest vegetation so more than just adit occupants are recorded. MIOR denotes *Miniopterus orianae oceanensis*. RMEG denotes *Rhinolophus megaphyllus*. VTRO denotes *Vespadelus troughtoni*. VPUM denotes *Vespadelus pumilus* (could be high calling *Vespadelus troughtoni* which is known from the area).

Survey Date	Max. count	Min. count	First/last bat	Species present	# RMEG passes	# MIOR passes**	Total passes
24 Jun 2019	94	94	-	MIOR/RMEG	14 (11)	740 (487)	952
29 Jul 2019	93	93	-	MIOR/RMEG	42 (34)	850 (597)	1376
21 Aug 2019	99	99	17:45/18:45	MIOR/RMEG	114 (104)	707 (492)	1222
23 Sep 2019	267	267	18:15/19:30	MIOR/RMEG	88 (79)	873 (602)	1431
29 Oct 2019	80	80	19:44/20:29	MIOR/RMEG	NA	NA	569
22 Nov 2019	29	29	19:50/20:45	RMEG	Data Missing	Data Missing	Data missing
19 Dec 2019	12	12	20:20/21:20	RMEG	24 (14)	96 (59)	240
09 Jan 2020	8	8	20:29/21:15	RMEG	2 (1)	354 (274)	671
19 Feb 2020	59	59	19:56/21:00	MIOR/RMEG	Data missing	Data missing	Data missing
23 Mar 2020	17	17	19:33/20:20	RMEG	10 (10)	417 (311)	1365
21 Apr 2020	55	55	17:52/18:55	MIOR/RMEG	53 (45)	403 (225)	866
18 May 2020	66	66	17:25/18:35	MIOR/RMEG	Data missing	Data missing	Data missing
18 Jun 2020	92	92	17:21/18:20	MIOR/RMEG	10 (8)	354 (230)	612
25 Jun 2020*	246	246	17:19/18:32	MIOR/RMEG	18 (16)	570 (400)	816
15 Jul 2020	518	499	17:32/18:31	MIOR/RMEG	16 (13)	541 (332)	786
13 Aug 2020	682	682	17:43/18:55	MIOR/RMEG	18 (16)	580 (389)	845
08 Sep 2020	538	538	18:05/19:29	MIOR/RMEG	15 (10)	585 (440)	1012
14 Oct 2020	66	66	19:33/20:30	MIOR/RMEG	17 (13)	782 (727)	1362
18 Nov 2020	16	16	20:09/20:49	RMEG	5 (4)	261 (191)	508

Survey Date	Max. count	Min. count	First/last bat	Species present	# RMEG passes	# MIOR passes**	Total passes
23 Dec 2020	20	20	20:27/20:59	RMEG	7 (6)	229 (161)	511
28 Jan 2021	12	12	20:26/21:06	RMEG	22 (22)	436 (383)	1357
24 Feb 2021	27	1	19:57/19:37	VPUM?/RMEG	20 (16)	350 (283)	956
17 Mar 2021	47	28	19:32/20:21	MIOR/RMEG	14 (13)	284 (200)	1357
18 Apr 2021	289	270	17:52/19:02	MIOR/RMEG	15 (10)	698 (495)	942
12 May 2021	518	498	17:24/18:24	MIOR/RMEG	4 (4)	1092 (936)	1277
15 Jun 2021	823	788	17:16/18:26	MIOR/RMEG	1 (1)	794 (653)	979
12 Jul 2021	497	497	17:24/18:20	MIOR/RMEG	19 (17)	528 (399)	603
04 Aug 2021	419	419	17:45/18:40	MIOR/RMEG	29 (24)	548 (471)	787
10 Sep 2021	890	890	18:08/19:10	MIOR/RMEG	19 (17)	748 (588)	991
04 Oct 2021	624	624	19:15/20:20	MIOR/RMEG	37 (32)	897 (714)	1383
01 Nov 2021	28	28	19:44/20:30	MIOR(1)/RMEG	42 (37)	524 (439)	1037
02 Dec 2021	15	15	20:14/20:54	RMEG	7 (4)	398 (285)	706
19 Jan 2022	8	8	20:31/21:11	RMEG	21 (20)	751 (575)	1220
17 Feb 2022	17	17	20:05/20:45	RMEG	18 (12)	268 (146)	427
16 Mar 2022	29	29	19:35/20:25	VTRO?/RMEG	9 (5)	1013 (823)	1722
21 Apr 2022	527	527	17:47/18:27	MIOR/RMEG	4 (3)	1059 (908)	1594
16 May 2022	396	396	17:25/18:15	MIOR/RMEG	2 (1)	856 (705)	1026
21 Jun 2022	705	705	17:16/18:06	MIOR/RMEG	2 (2)	1068 (929)	1300
29 Jul 2022	661	661	17:30/18:30	MIOR/RMEG	15 (13)	651 (505)	866
18 Aug 2022	974	974	17:47/18:30	MIOR/RMEG	12 (6)	1199 (1017)	1497
27 Sep 2022	1050	1050	18:10/19:10	MIOR/RMEG	7 (6)	1124 (1013)	1435

Survey Date	Max. count	Min. count	First/last bat	Species present	# RMEG passes	# MIOR passes**	Total passes
28 Oct 2022	-	-	-	-	5 (4)	757 (605)	1046
7 Dec 2022*	22	22	20:13/20:43	MIOR(1)/RMEG	17 (15)	830 (761)	1281
28 Dec 2022	15	15	20:29/20:59	RMEG	8 (5)	327 (213)	444
01 Feb 2023*	6	6	20:24/20:54	RMEG	18 (15)	561 (371)	761
15 Feb 2023	19	17	20:10/20:40	RMEG	13 (11)	749 (640)	1305
14 Mar 2023	278	278	19:34/20:24	MIOR/RMEG	20 (16)	916 (747)	1484
26 Apr 2023***	221	221	17:36/18:46	MIOR/?	24 (22)	1101 (1027)	3829
22 May 2023***	323-388	288	17:03/18:13	MIOR/?	6 (5)	553 (394)	716
18 Jun 2023	363	363	17:05/18:14	MIOR/RMEG	14 (7)	502 (399)	643
17 Jul 2023	225	225	17:24/18:34	MIOR/RMEG	4 (2)	519 (405)	590
26 Aug 2023	666	666	17:47/19:16	MIOR/RMEG	0 (0)	1158 (999)	1432
19 Sep 2023	731	731	18:13/20:13	MIOR/RMEG	4 (2)	502 (415)	1707
25 Oct 2023	27	23	19:34/20:38	MIOR/RMEG	5 (4)	240 (178)	679
23 Nov 2023^	4	4	20:01?(20:15)/ 20:41	RMEG	1 (1)	59 (16)	1163
18 Dec 2023	5	3	20:29/20:59	RMEG	7 (4)	32 (9)	793
30 Jan 2024	11	8	20:23/21:04	RMEG	5 (4)	67 (29)	1060
12 Feb 2024	10	9	20:10/20:55	RMEG	18 (16)	39 (12)	734
25 Mar 2024	729	729	19:15/20:05	MIOR/RMEG?	25 (23)	66 (23)	1858
29 Apr 2024	534	534	17:35/18:45	MIOR/RMEG	2 (1)	124 (61)	967
22 May 2024	351	351	17:24/18:34	MIOR/RMEG?	2 (2)	157 (45)	787
17 Jun 2024	390	390	17:22/18:28	MIOR/RMEG	5 (5)	177 (61)	1464

Survey Date	Max. count	Min. count	First/last bat	Species present	# RMEG passes	# MIOR passes**	Total passes
02 Jul 2024^^	N/A harp	147	NA harp	MIOR/RMEG	13 (11)	105 (44)	1903
12 Aug 2024	176	174	17:32/18:32	MIOR	14 (11)	130 (66)	616
09 Sep 2024	1178	912	18:07/19:51	MIOR/RMEG	2 (2)	70 (25)	2217
03 Oct 2024	735	735	18:17/19:36	MIOR/RMEG	0 (0)	109 (10)	1385
14 Nov 2024	20	20	19:58/20:38	MIOR(12)/RMEG	0 (0)	92 (49)	1595
18 Dec 2024	9	9	20:30/21:09	MIOR(1?)/RMEG	8 (6)	78 (33)	709
23 Jan 2025	7	7	20:24/21:04	MIOR(1)/RMEG	10 (10)	45 (17)	1258
11 Feb 2025	97	97	20:03/20:43	MIOR/RMEG	16 (9)	110 (37)	684
25 Mar 2025	254	254	19:19/20:18	MIOR/RMEG	12 (10)	100 (52)	1695
28 Apr 2025	390	390	17:32/18:41	MIOR/RMEG	4 (2)	160 (39)	858
28 May 2025	503	503	17:20/18:50	MIOR/RMEG	3 (3)	148 (36)	1064
16 Jun 2025	739	739	17:17/18:27	MIOR/RMEG/ other spp?	3 (2)	170 (45)	650
22 Jul 2025	638	638	17:40/19:00	MIOR/RMEG	8 (6)	130 (40)	954
02 Sep 2025*	690	690	17:51/19:41	MIOR/RMEG	1 (1)	129 (33)	1348
25 Sep 2025	680	680	18:18/19:28	MIOR/RMEG	11 (11)	68 (25)	1721
20 Oct 2025	26	26	19:36/20:15	MIOR(6?)/RMEG	10 (9)	44 (28)	377
11 Nov 2025	30	29	19:53/20:22	RMEG	11 (10)	39 (6)	596
17 Dec 2025	12	12	20:18/20:58	MIOR(2)/RMEG	4 (4)	63 (34)	916
19 Jan 2026	8	8	20:28/20:59	RMEG	NA	NA	NA

*Two counts were conducted in June 2020 due to a required maintenance visit. Access issues in 2022 meant the November count was pushed back into early December, resulting in two December counts. January count in 2023 was one day late, resulting in two February counts. August count in 2025 was late, resulting in two September counts.

**# *M. orianae oceanensis* passes will include background level of *Vespadelus vulturnus* passes as data has been pooled for the two species whose call characteristics overlap in this region.

***New steel box culvert installed 26 April 2023. New setup means counting location is further out from entrance, which makes it very hard to note presence or absence of Eastern Horseshoe-bat unless they are observed during twilight. Also took a few months to work out the best counting position. Also took the bats a bit of time to acclimatise to and start using the tunnel.

^Access to adit was delayed. Previous night's monitoring data suggests bats first exit was at 20:01, but only got to adit at 20:15 to start count. Bats exiting the adit during this time may have been missed in the nightly count. Consider this an underestimate.

^^Adit was harp trapped for media release and to confirm composition of colony. No count was made, other than measuring bats pulled out of harp trap across adit for an hour around exit time.

Cells marked "Data missing" are nights/months where there has been an equipment failure that was not picked up until the next count. "NA" denotes data that is not yet available due to analysis not being completed.

Automated Echolocation Call Detection

The automated echolocation call detection equipment operated successfully throughout 2025. Issues in 2020 were rectified by more frequent formatting of memory cards. As with previous years, activity of the Eastern Horseshoe-bat (*Rhinolophus megaphyllus*) was generally low and relatively consistent (**Figures 4-1a** to **4-1g**). Wet weather caused mild conditions through much of 2021-2022, meaning activity was much more stable than earlier years, with no obvious seasonal change in activity. 2023 started off with slightly elevated activity (though not comparable to that seen in 2019), but returned to low even activity levels from end of May. Activity was consistently low in 2024, with only slight increases in activity in March-April and August-September. Activity was similarly low in 2025 with only slight increases in activity February-April and mid August- mid October. Activity peaked for 2025 in early April. Historically, activity for this species declines over winter and increases between mid-September and late April. The 2020 October-December period was characterised by pulses of increased activity on occasional nights (50-100 passes over average), but few large spikes in activity were observed through 2021-2025. While oscillations in activity from night to night are seen, the overall picture is one of relative stability in 2024-2025, with slight seasonal increase in autumn and spring. Since May 2023, activity levels rarely exceeded 25 passes per night. Monthly count data supports this with Eastern Horseshoe-bat numbers varying from 8 to 29 over the summer months from December 2017 to December 2022, but dropping to 3 to 11 over November-December 2023-24. November-December counts in 2025 were in the range of the earlier years; 8-29. Numbers from our monthly counts provide no evidence for gross changes in Eastern Horseshoe-bat numbers through spring-summer 2019. It could be that during the peak of the drought, individuals may have moved into the area either to escape bushfires to the east, or simply to access more permanent water sources in the vicinity of the adit. Though not resulting in increases in the Slate Gully adit occupation, other roosts likely exist in the local area, particularly when considering the type of shelter used by this species (avens in boulders and caves with dark zones; *pers. obs.* author). Alternatively, bats may have needed to spend more time foraging for insects in the drought, leading to increased activity to satisfy energetic requirements. Kohles *et al.* (2024) found bat foraging bouts and foraging distance both increased when insects were less abundant. Steady activity through 2021-2022 could be a result of more stable climatic conditions, with weather generally milder than expected throughout the year. However, whilst relatively steady in the beginning of 2023, activity appears to decline from June 2023 and continue through into 2024. Late 2024 and 2025 saw some resurgence, but not near the levels seen from 2019 to early 2021. The removal of these water sources by the approaching mine pit may potentially explain the reduction in numbers by late 2023.

Long-term averaged climatic data from site was not available at the time of writing. Gulgong Post Office monthly climate statistics show higher than average maximum temperatures for all but July 2025, and higher than average minimum temperatures for February-May and July, August and October (BOM 2026, data based on 1970-2019). 2025 rainfall was above average in January, March, May and September. 2025 rainfall was below average in February, April, June, July and October and well below average in August, November and December (BOM 2026, data based on 1881-2025). As per Kohles *et al.* (2024), we might expect that declining availability of insects in dry conditions may increase activity demands in order to meet food requirements.

Reductions in activity with no concurrent reduction in actual counts of individuals over the summer months could be indicative of reduced microphone sensitivity over time. The microphone was replaced with a brand new unit in February 2024 with no obvious improvement in call activity suggesting declining microphone sensitivity has not been an issue.

Activity levels of the Large Bent-winged Bat (*Miniopterus orianae oceanensis*) showed greater seasonal variation and the night to night variation was greater than that of the Eastern Horseshoe-bat (**Figures 4-2a** to **4-2g**). While activity increased during 2020 from February, the increase in activity during 2021 was seen in early April. 2022 saw an increase in activity in mid April, suggesting an even later return from summer maternity roosts with subadults than that seen in 2021. 2023-2024 saw increases from late February of each year. 2025 the increase built from early March. Monthly counts support this, suggesting that there is yearly variation, with Large Bent-winged Bats returning between mid-February and late March, with the majority arriving by mid-April. 2020 activity peaked in late August-September, while 2021 showed peaks in June and October. Peaks in 2022 occurred in April and June-July, while 2023 data showed peaks in April-May and August. 2024 showed peaks in March-April, mid-June and September, with high activity continuing into December. 2025 data shows activity peaks in June, with activity declining from September onwards. In early years, there seemed to be a large decline in activity in mid-late October as bats leave for summer/maternity roosts. This decline pushed back to early November in 2022, and shifted forward to late September in 2023. While there was a decline through late October in 2024 and 2025, activity resurged and remained relatively high all the way through to December, with Bent-winged Bats being picked up in both October/November and December counts (albeit in low numbers) in both years. Typically by late November activity appears to be reduced to a level that indicates all bats are gone from the cave and only general foraging activity for the species is being picked up outside the cave entrance. This pattern mirrors that from counts of bats exiting the workings undertaken since April 2017, whereby Large Bent-winged Bats are gone by late October/early November (Fly By Night 2017; Fly By Night 2018; Fly By Night 2019). Within this pattern, large oscillations in activity of this species did occur from night to night. While activity levels sometimes varied by only a few passes per night at other times it varied by up to 1800 passes per night. 2024 showed the most volatility in activity indices. This did not change much in 2025 with variation across nights still seen. This nightly variation could reflect changes in the number of individuals roosting within the workings, as well as other factors including ambient temperature and prey abundance. Rain can interfere with the effectiveness of the microphone, so the volatility over 2021-2022 could be due to wet conditions. As La Nina subsides, we have not seen a reduction in volatility, suggesting this is not the cause of the night by night variation. The yearly pattern of use at Slate Gully is similar to that recorded at urban roosts in Sydney and Newcastle (Hoye and Spence 2004).

The increase in variability in activity of Large Bent-winged Bat is in stark contrast to the continued decline in activity variability in Eastern Horseshoe-bat being seen over the years of monitoring. This (and the fact the microphone was replaced in February 2024) suggest the changes are not a result of changing microphone sensitivity.

Data used to monitor Large Bent-winged Bat activity is a combination of call pulse identifications. Due to the huge volume of calls generated by continuous recording each year, we have used an automated call identification analysis program (Ana-lyse© A.J. Hoye) to label the data. In the region around Mudgee, call pulses for Large Bent-winged Bats in cluttered environments are very similar to those of the Little Forest Bat (*Vespadelus vulturnus*) and Chocolate Wattled Bat (*Chalinolobus morio*). Because of the overlap in call parameters, a combination of these species was used to generate various indices for Large Bent-winged Bat activity. The large numbers of cave roosting bats using the adit should dwarf the number of either of the other tree roosting species. As such, the background level of tree-roosting bat activity could be considered relatively constant through the year (noting tree roosting species will have reduced activity over winter). If we subtract that constant activity of Little

Forest/Chocolate Wattled Bats away from the pooled activity figure, seasonal variation in Large Bent-winged activity should still be seen. This is why there is activity recorded for Large Bent-winged Bats over the summer period when there are none present in counts. By looking at recorded activity levels over the November-January 2020 period when Large Bent-winged were absent from the adit, a background level of activity of 50-250 call pulses was able to be observed. This is likely to be the background level of Little Forest Bat activity. That activity was slightly higher in the summer months of 2021, and approached 400 pulses/night (in some cases surpassed 800 pulses/night) in summer months in 2022-2025. For consistency's sake, the correction factor has been retained at 150 pulses/night across all years (noting that background activity is likely to have increased on par with increases seen in Large Bent-winged Bat activity in the recent years). The low level of Large Bent-winged Bat activity seen over the summer months when individuals have vacated the mine workings probably represents males and non-breeding females present in a nearby roost that still forage over the site. Individuals can travel at least 10km (perhaps up to 30km) from a roost to feed in a night.

Correlation of bat activity with blast dates has the potential to reveal changes in activity as a result of "pulse" disturbance. "Pulse disturbance" is typically short term in nature and can often be of higher magnitude/intensity (e.g. blasting). Blast dates (Pits 3 and 8) from March 2020 to December 2025 were plotted against activity index of both species (**Figure 4-3**). Only Pit 8 blast dates were provided in 2020 which may explain the increase in blast occurrences in 2021. Pit 3 had not experienced a blast between April 2021 and January 2025. There were 21 blasts in Pit 3 throughout 2025. As the Pit 3 blasts are just the other side of the ridge from the adit, they have been included. Pit 7 could also be close to the adit, but has not been included in these analyses, and hasn't seen a blast since September 2023. Large Bent-winged Bat activity declined after some blasts, and increased after others, i.e. there was little correlation between bat activity at the roost and blasting activity. The magnitude of the changes also differed each time. Currently, there does not appear to be any clear change in activity of either species relative to blast dates.

Potential "press disturbance" (disturbance associated with constant long term phenomena which may not necessarily be high impact in nature) impacts as a result of increased activity within the vicinity of the adit will be analysed as mining advances toward the adits location. Examples of "press disturbance" include light spill from mine or noise from machinery, both of which have been noted during monthly counts through 2024 and 2025.

As a requirement within the Biodiversity and Blast Management Plans, video surveillance and review of recorded footage is undertaken with each blast conducted in Pit 8 (Slate Gully). Footage is reviewed five minutes pre and post blast event to evaluate potential impacts to the adit and bat activity. Of the 2020 data collected and reviewed, blast activity was not seen to disturb or induce diurnal bat flight activity outside of the adit. No disturbances (bats leaving adit during daylight) were observed during 2021, 2022 or 2023 monitoring (pers. comm. Josh Frappell; pers. comm. James Heesterman). In April 2024 Kieren Bennetts notified Andrew Lothian of adit video footage from the time post their most recent blast (presume 26 April 2024). This footage contained approximately four frames of a vague object moving from right to left of the culvert immediately after the blast. After reviewing the footage, BMS concludes that the object is likely to be falling debris (dust cloud) from the adit entrance rather than an exiting bat. This explains the dirt that continually accumulates at the bottom right hand corner of the culvert each month which BMS removes during count visits. There were no recorded diurnal exits observed on camera during 2025. BMS have no data to assess whether bats are roused and undertaking diurnal flight within the adit. For blasts that were more than four days from other blasts, short term responses of Eastern Horseshoe-bat (**Figure 4-4**) and Large Bent-winged Bat (**Figure 4-**

5) were plotted. Data is presented for the five days leading up to a blast, and the five days after. Data has been summarised into means with standard errors. Two potential hypotheses exist for disturbance of bats post blasting. The first is an increase in activity as bats have been roused into activity by the pressure/sound waves. The second could be a reduction in activity whereby bats are reluctant to leave the safety of the adit due to the recent disturbance. A lack of variation in activity after a blast, outside of the variation seen prior to the blast, would be considered an absence of impact. Blast density in 2025 was much higher than previous years.

Unfortunately, out of 74 blast events in 2025, only two were independent of other blasts (more than four days from other blasts). For this reason, all figures and analyses have been recalculated using data from three days before and three days after a blast (2020-2025). This now increases the number of blast events analysed from 79 to 129.

It can be observed from raw data that in 58 of 130 blasts, Eastern Horseshoe-bat activity declined from the night before to the night of (after) the blast. 57 of 130 blasts saw an increase in activity, and 15 blasts saw no change in activity. Not only does this show mixed responses, but when referring to **Figure 4-4** on average the response is a decrease in activity on the night before the blast as well as the night of the blast (both of very small magnitude). Large Bent-winged Bat activity declined in 70 of 130 blast nights relative to previous nights, which is also seen in average data (**Figure 4-5**). 58 of 130 blasts saw an increase in activity, while 2 blasts saw no change in activity. In the case of the Bent-winged Bat, the magnitude of the decline was no greater than variation seen in nights prior to the blast. The mixed results and small changes relative to normal nightly variation in activity suggest no impact from blasting in Pits 3 or 8 on the two bat species. The slight declining trend in Bent-winged Bats did not carry forward to 2024-25, with some of the highest pass rates of Bent-winged Bat occurring in 2024. Neither species' decline was more than what would be expected from nightly variation, and overlapping Standard Error bars suggest changes are not likely to be significant. One-way Repeated Measures ANOVAs were run on the activity data over the seven nights (from 130 independent blast events). Neither Eastern Horseshoe-bat nor Large Bent-winged Bat activity were significantly different between any of the nights.

Additional analyses were conducted on Eastern Horseshoe-bat and Large Bent-winged Bat activity pre and post blasts, but were restricted to the winter period when bats may utilise torpor to conserve energy. One-way Repeated Measures ANOVAs showed no significant differences between nightly activity before and after blasts, but power of both analyses was low due to small sample size (only 35 winter blast events). BMS will monitor this metric going forward as more data becomes available.

As bat activity did not seem to change in response to mine blasts, BMS investigated changes in bat activity with minimum nightly temperature. Minimum temperature was amplified so changes in temperature could be viewed at the scale of changes in bat activity. In 2021 there appeared to be an inverse response in bat activity with minimum temperature. As minimum temperature drops, bat activity is increased. However, in 2022 the relationship seemed to change seasonally, or when the Large Bent-winged Bat was present/absent. From early April to early October, Large Bent-winged Bat activity roughly correlated directly with minimum overnight temperature (i.e. as minimum temperature goes up, activity goes up). This happens to be the period in which Large Bent-winged Bat inhabit the adit as a non-breeding roost. 2023 saw a similar relationship to 2022, with activity positively correlated with minimum temperature over the early April to early September period. Over the warmer months, the relationship between temperature and activity was poorly defined. Whether this has to do with the absence of Bent-winged Bats, or if it is a product of minimum overnight temperature having no control over activity above a certain temperature threshold is unable to be determined. 2025 saw the return of the inverse relationship between activity and temperature over the April to September period, with no clear relationship outside of this period. As there is no clear relationship seen, it is likely that other climatic variables contribute to bat activity each night (i.e. moon phase, wind speed, time of minimum temperature, etc.).

Regressions were run on confident Eastern Horseshoe-bat (R.megC) and Large Bent-winged Bat (M tot + Vvul P/Po) against minimum temperature. There was a very small positive correlation between R.megC and minimum temperature (r^2=0.0013, not significant). There was a small negative relationship between Large Bent-winged Bat activity and minimum nightly temperature (r^2=0.037, significant $p < 0.001$). This is not a surprising result, as the Bent-winged Bats leaving over summer means there are less individuals present (hence less activity) when minimum temperatures are likely to be higher. When adjusted for the April to October period, the Bent-winged Bat relationship changes to a neutral/no relationship (r^2=0.000). Overall this suggests the relationship between bat activity and minimum nightly temperature are very weak.

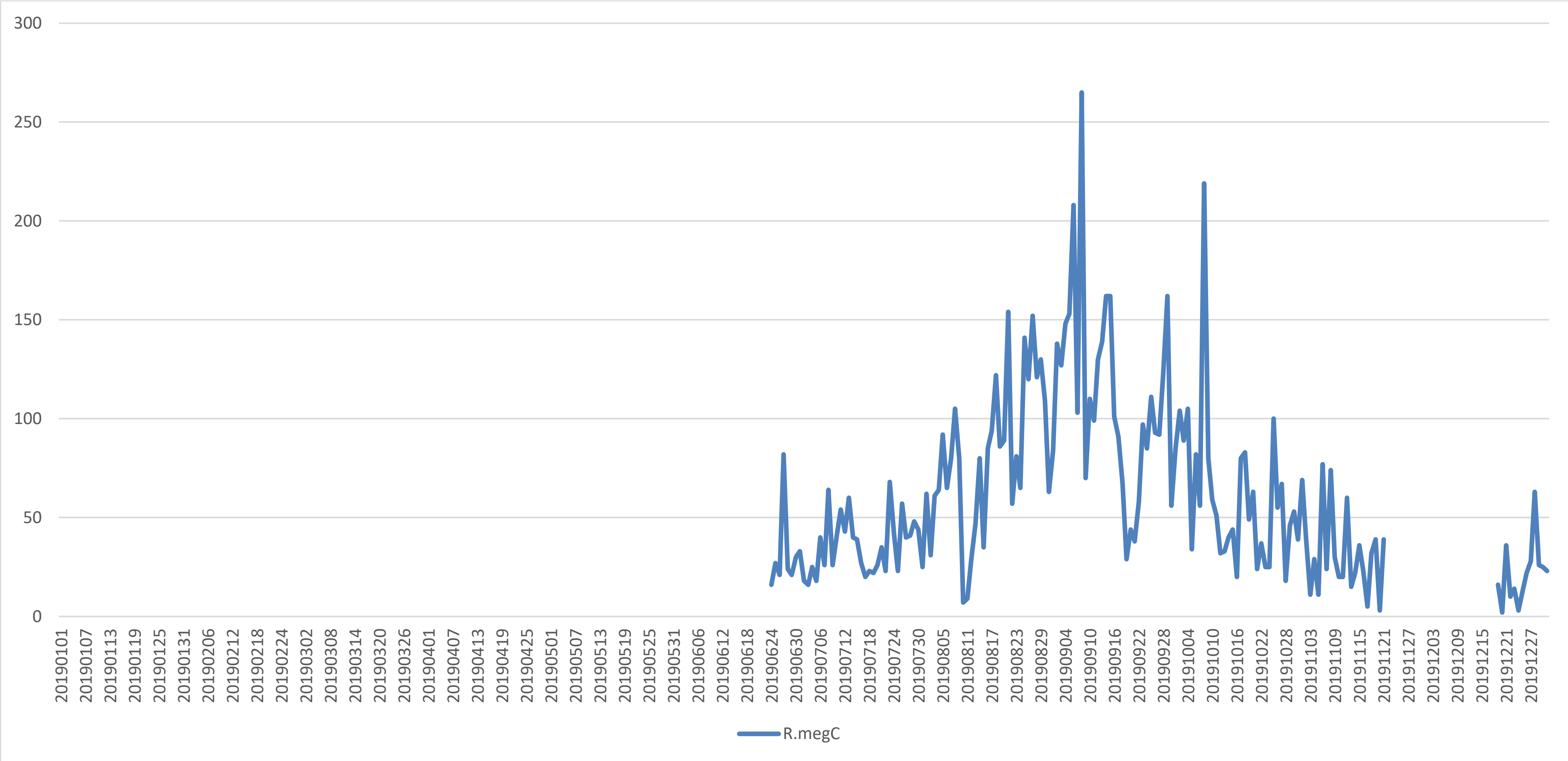


Figure 4-1a: Nightly Eastern Horseshoe-bat activity in 2019

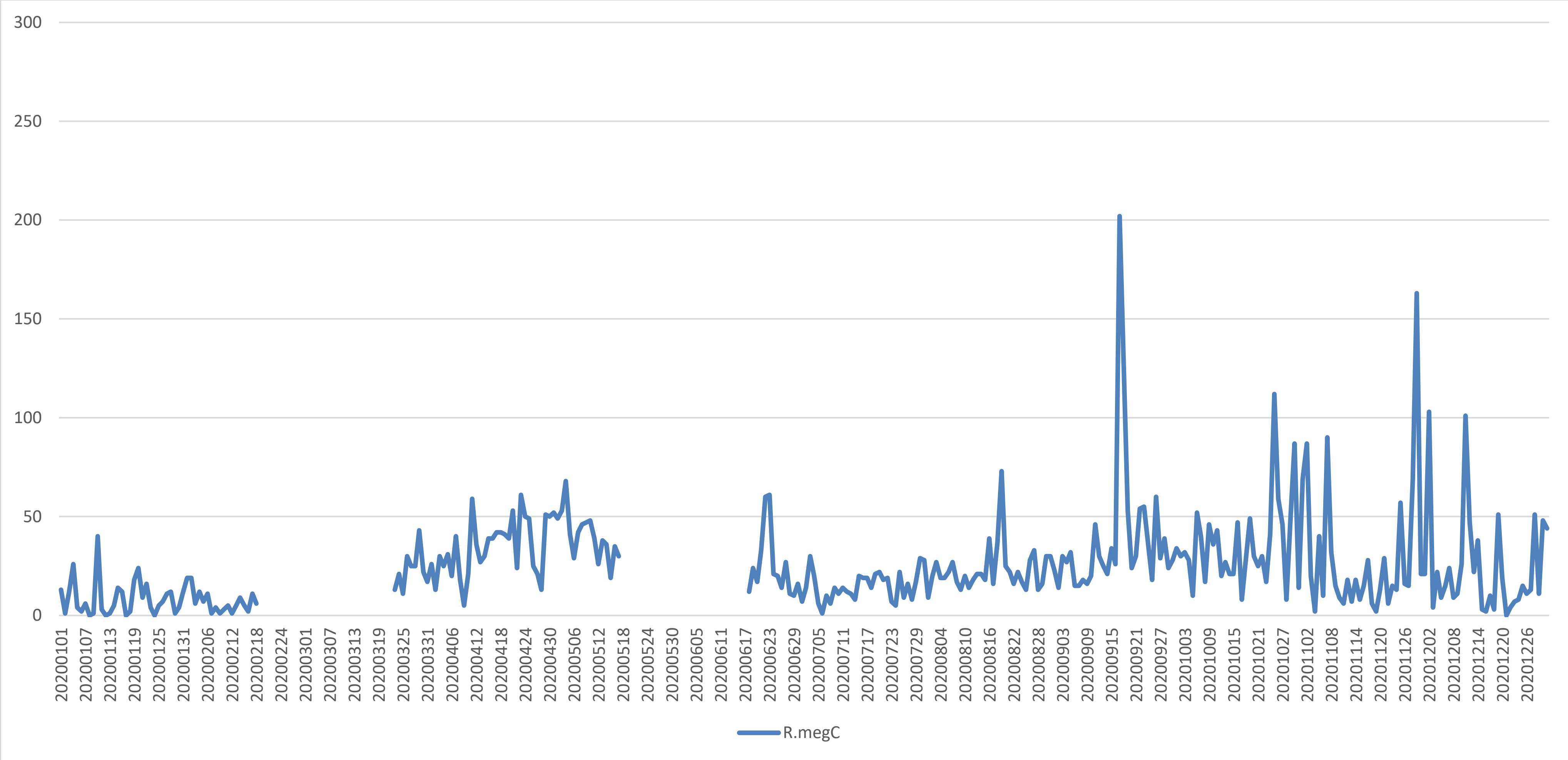


Figure 4-1b: Nightly Eastern Horseshoe-bat activity in 2020

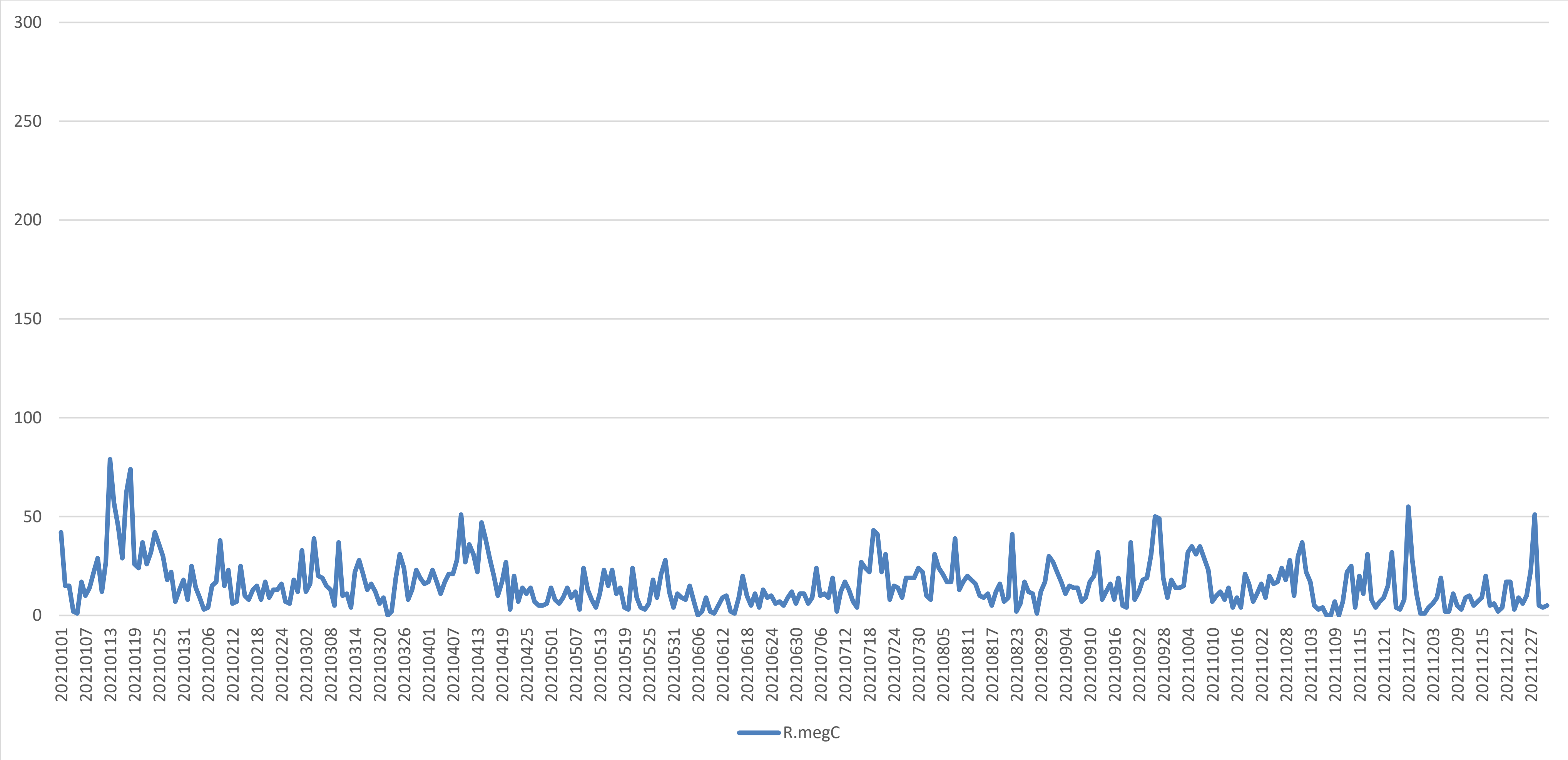


Figure 4-1c: Nightly Eastern Horseshoe-bat activity in 2021

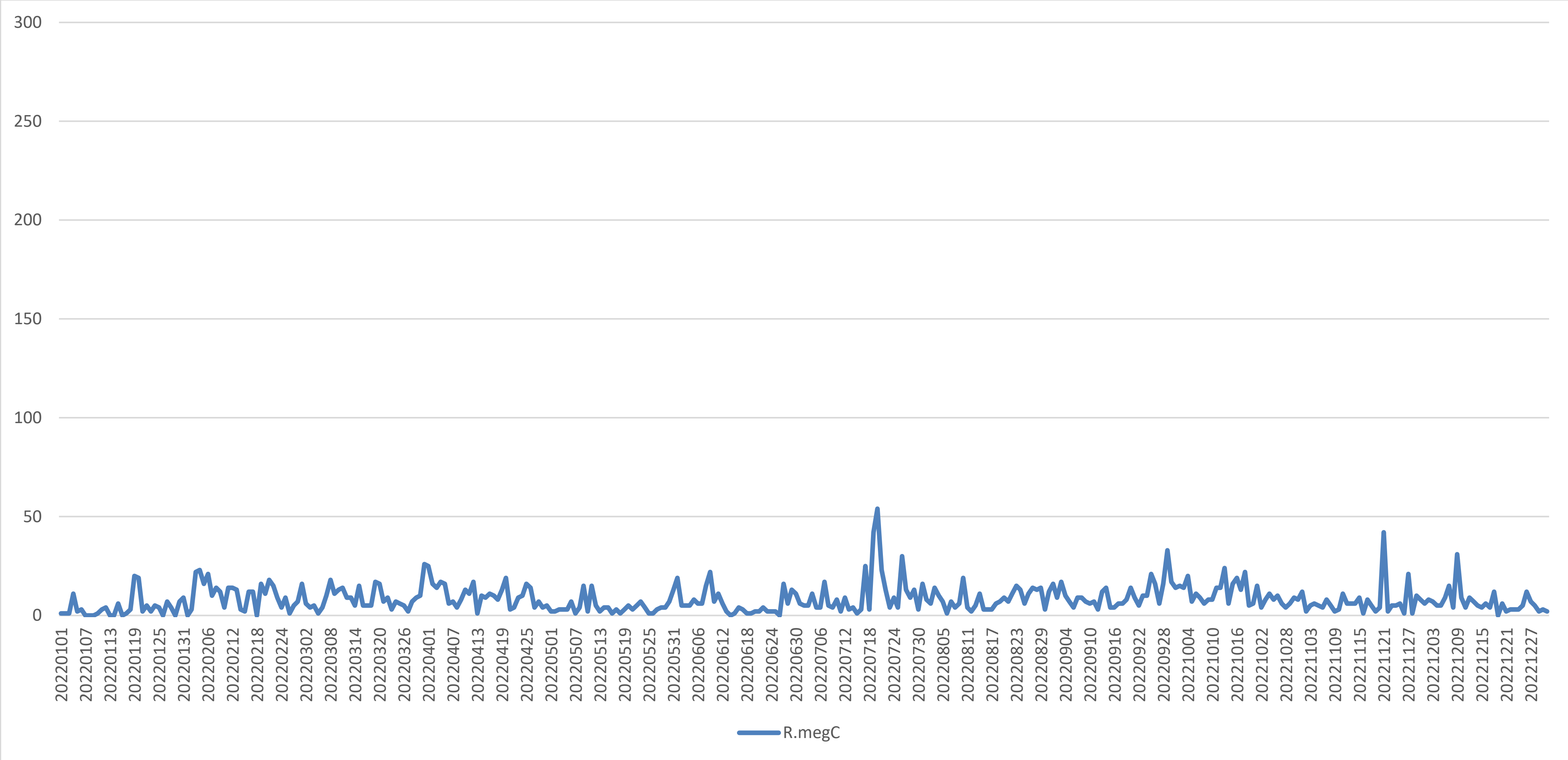


Figure 4-1d: Nightly Eastern Horseshoe-bat activity in 2022

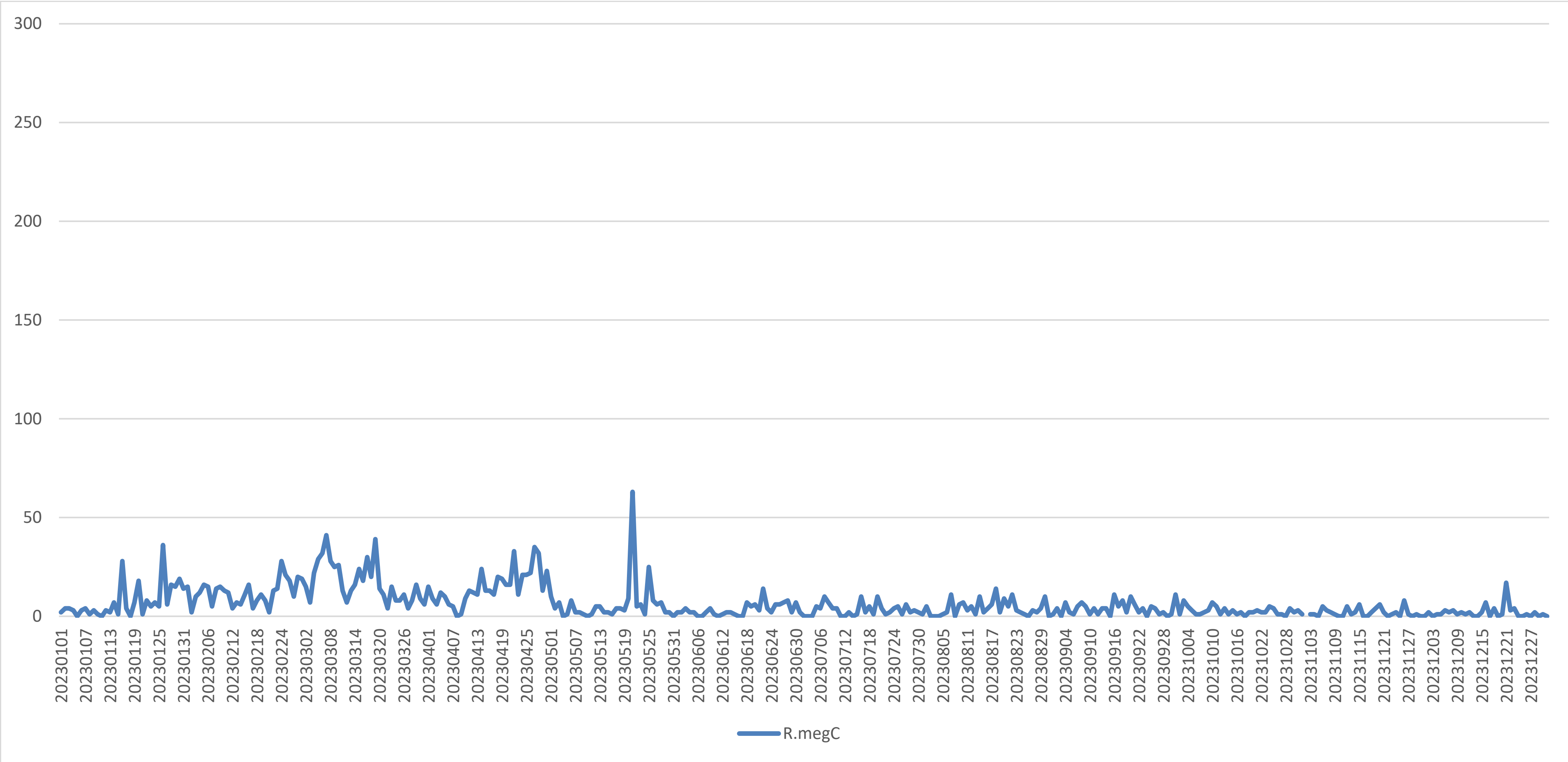


Figure 4-1e: Nightly Eastern Horseshoe-bat activity in 2023

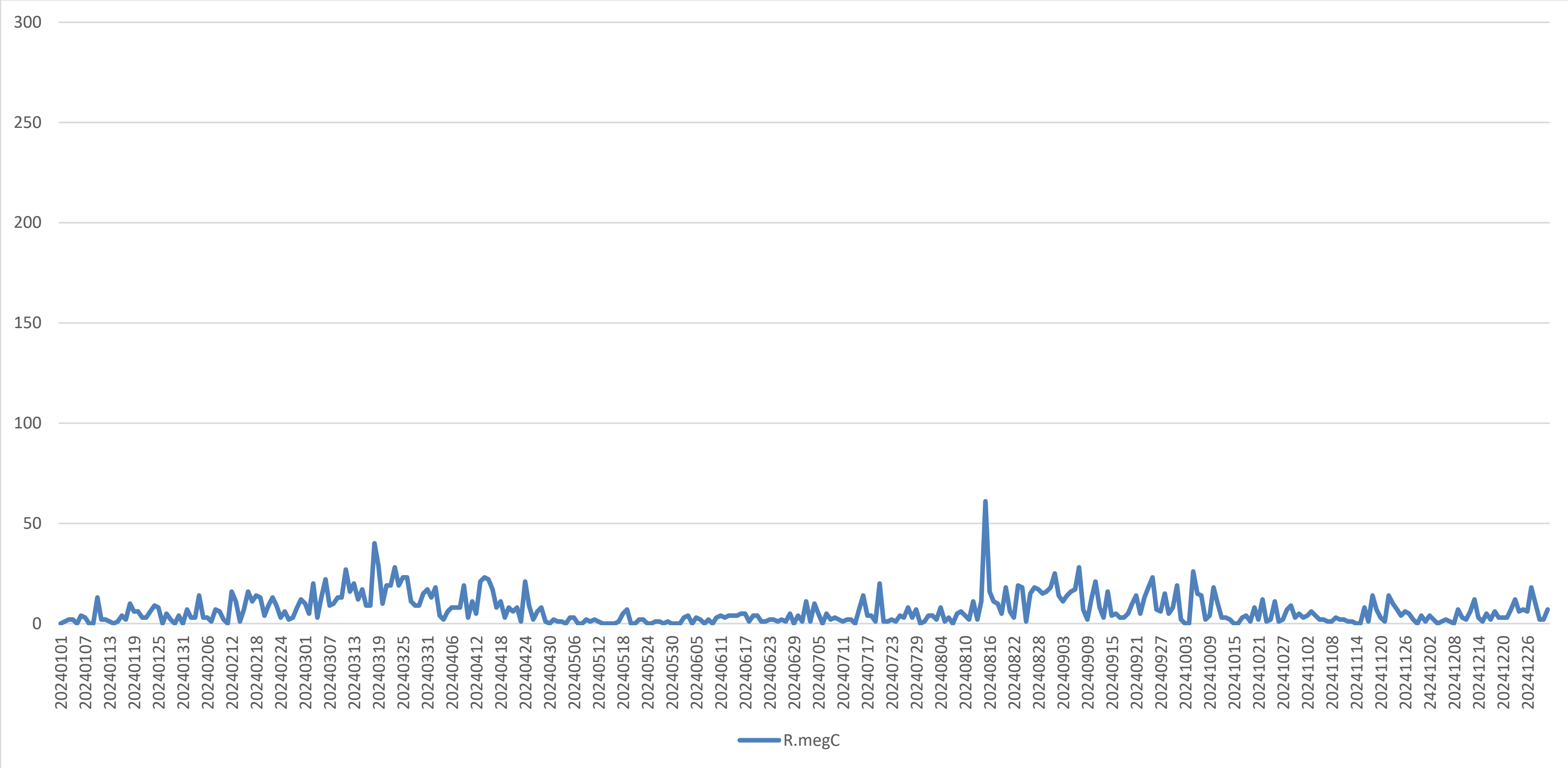


Figure 4-1f: Nightly Eastern Horseshoe-bat activity in 2024

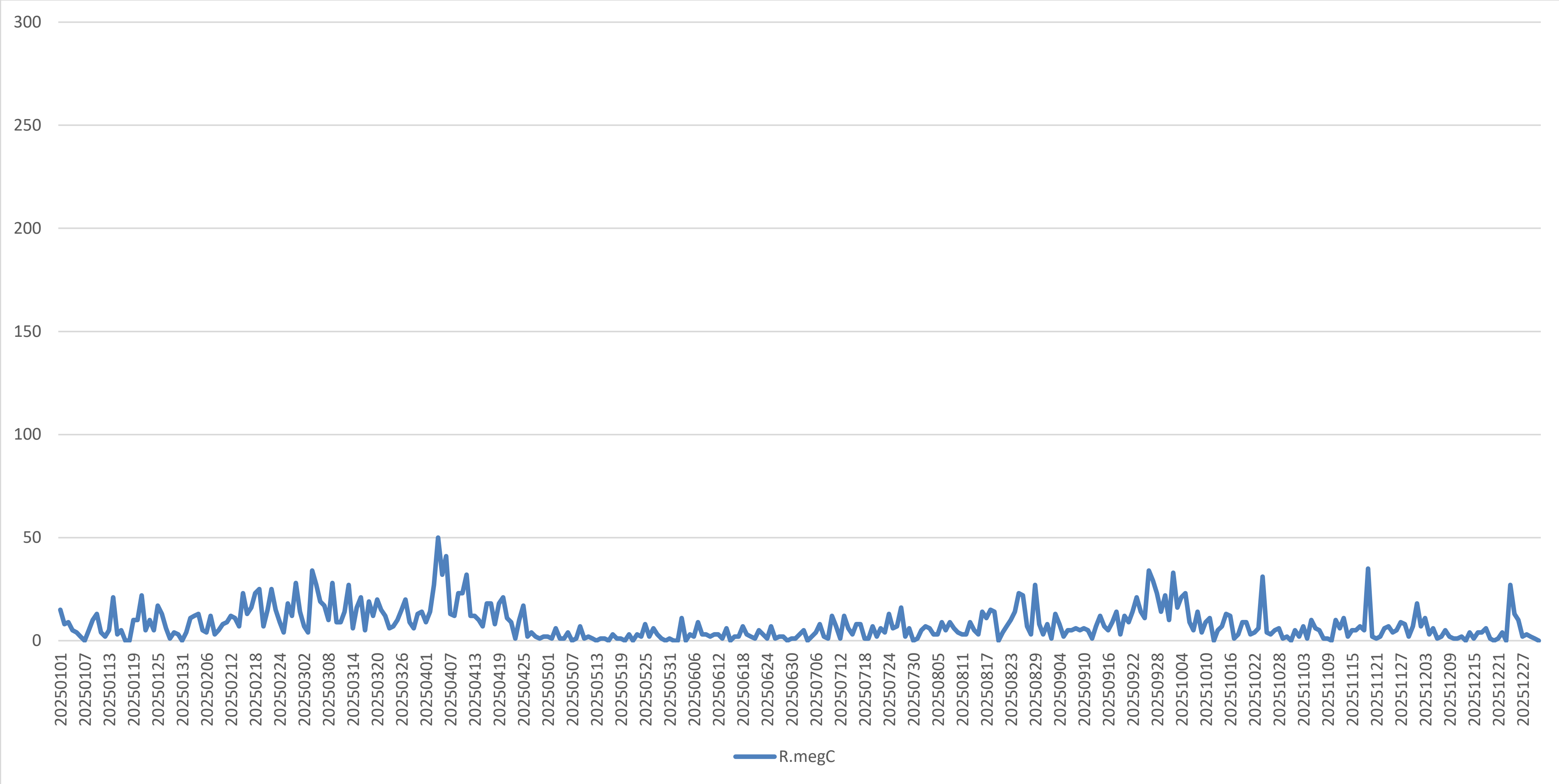


Figure 4-1g: Nightly Eastern Horseshoe-bat activity in 2025

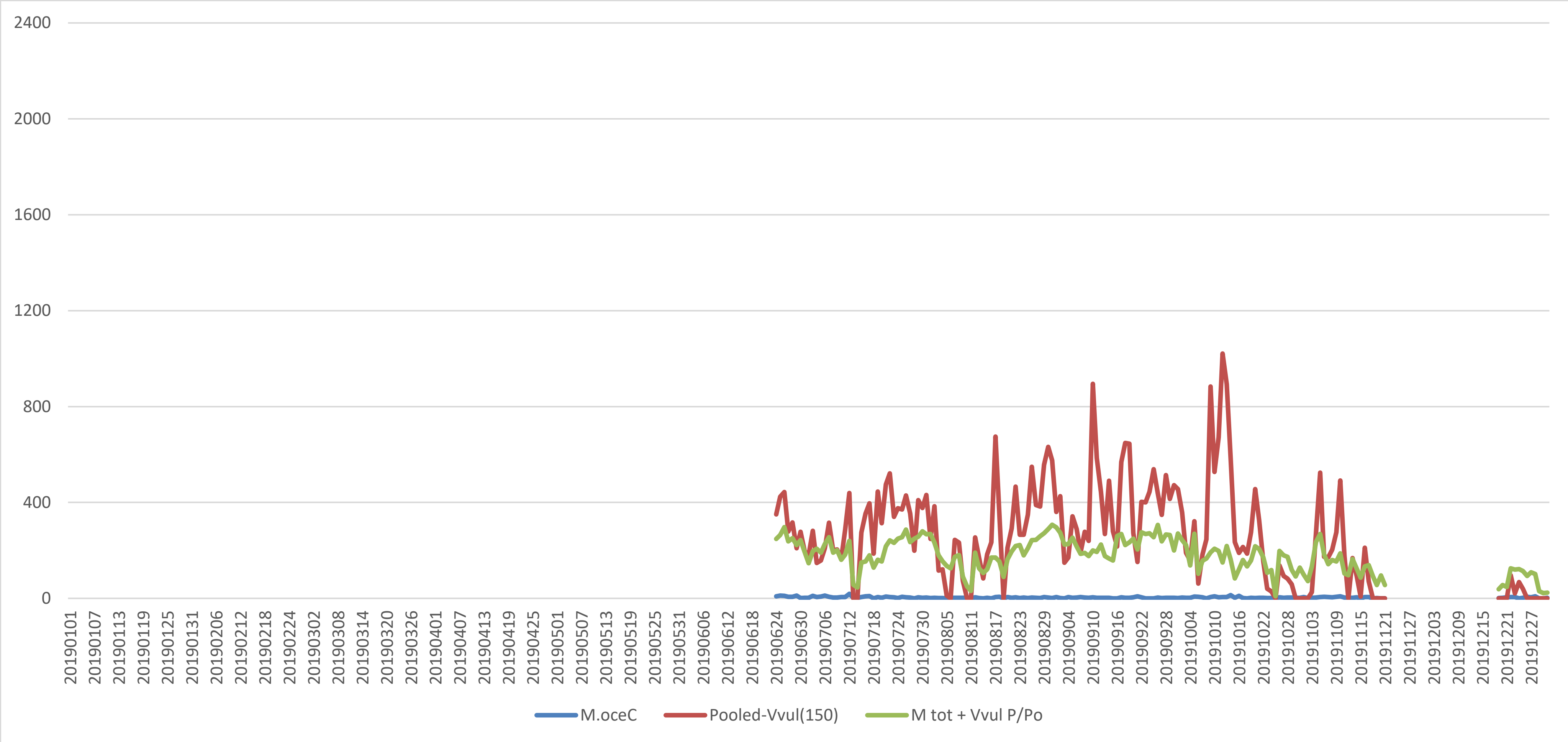


Figure 4-2a: Nightly Large Bent-winged Bat activity in 2019. *M.oceC* represent the number of confident open space Large Bent-winged Bat calls. *Pooled-Vvul(150)* represent the number of pooled confident calls for Large Bent-winged and Little Forest Bats which have similar call parameters (i.e. M.oceC + VvulC – 150). *Mtot+VvulP/Po* represent the number of total Large Bent-winged Bat calls plus calls of Little Forest Bat that were not identified confidently as Little Forest Bat.

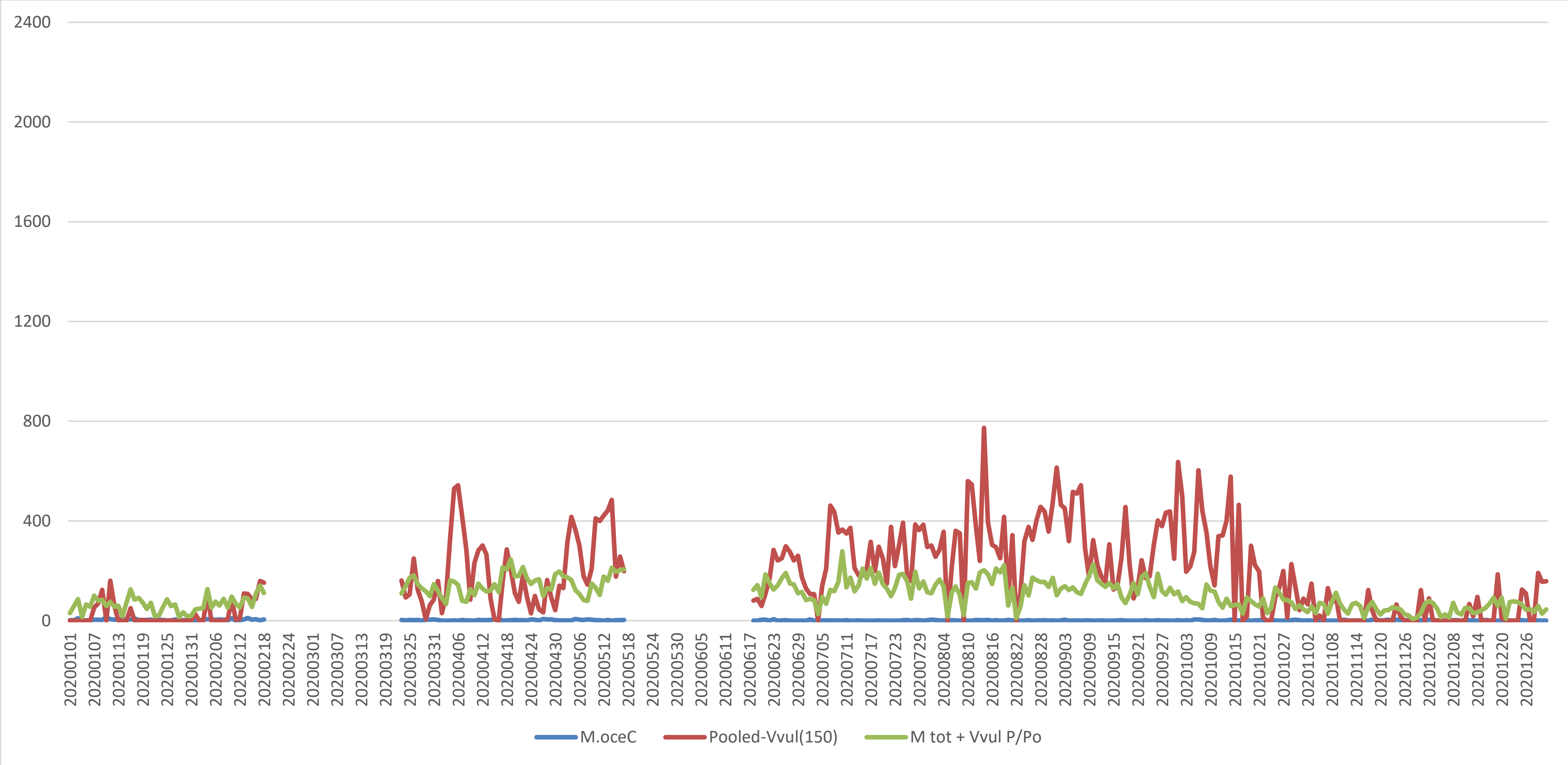


Figure 4-2b: Nightly Large Bent-winged Bat activity in 2020. *M.oceC* represent the number of confident open space Large Bent-winged Bat calls. *Pooled-Vvul(150)* represent the number of pooled confident calls for Large Bent-winged and Little Forest Bats which have similar call parameters (i.e. M.oceC + VvulC – 150). *Mtot+VvulP/Po* represent the number of total Large Bent-winged Bat calls plus calls of Little Forest Bat that were not identified confidently as Little Forest Bat.

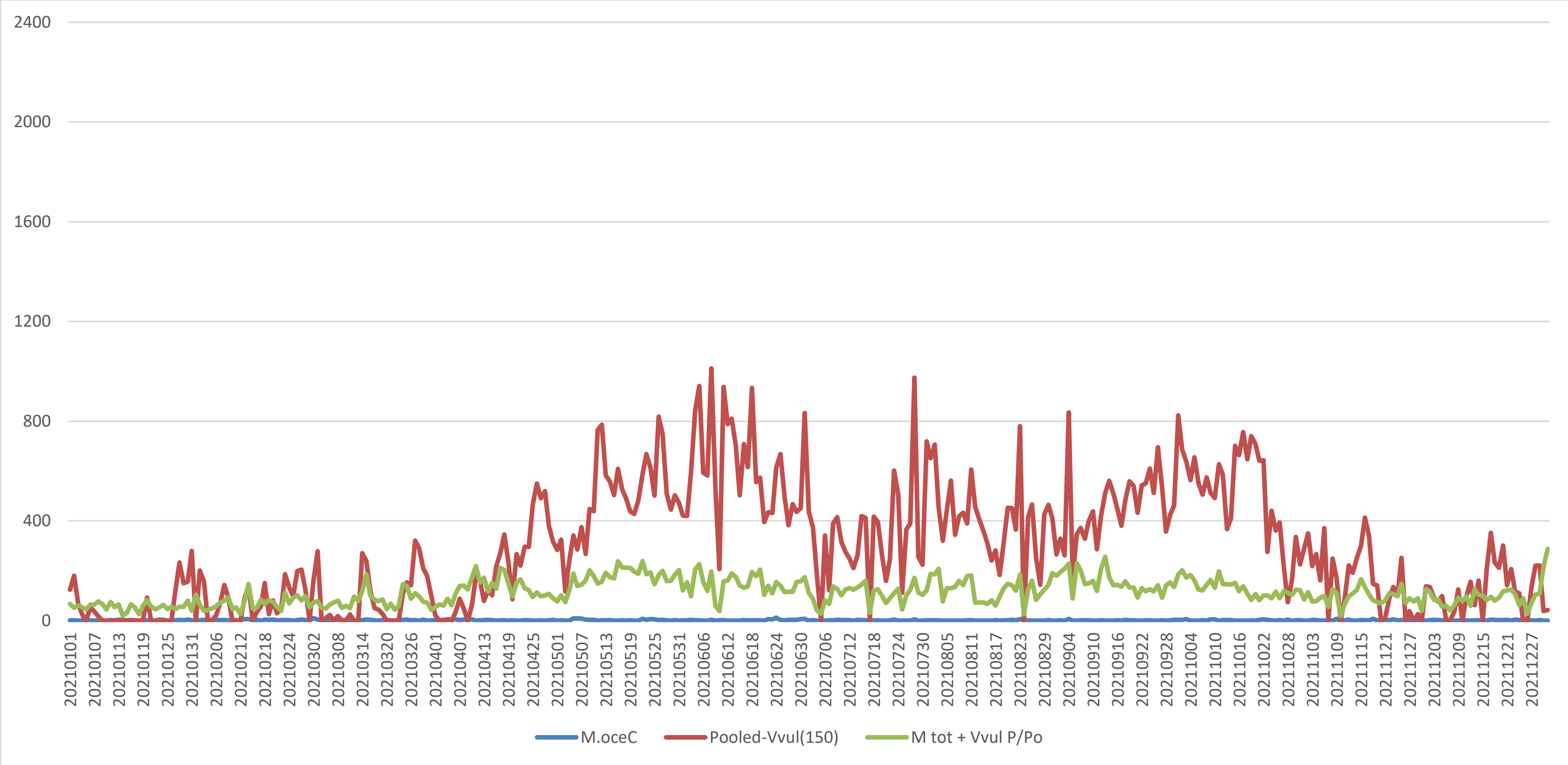


Figure 4-2c: Nightly Large Bent-winged Bat activity in 2021. *M.oceC* represent the number of confident open space Large Bent-winged Bat calls. *Pooled-Vvul(150)* represent the number of pooled confident calls for Large Bent-winged and Little Forest Bats which have similar call parameters (i.e. M.oceC + VvulC – 150). *Mtot+VvulP/Po* represent the number of total Large Bent-winged Bat calls plus calls of Little Forest Bat that were not identified confidently as Little Forest Bat.

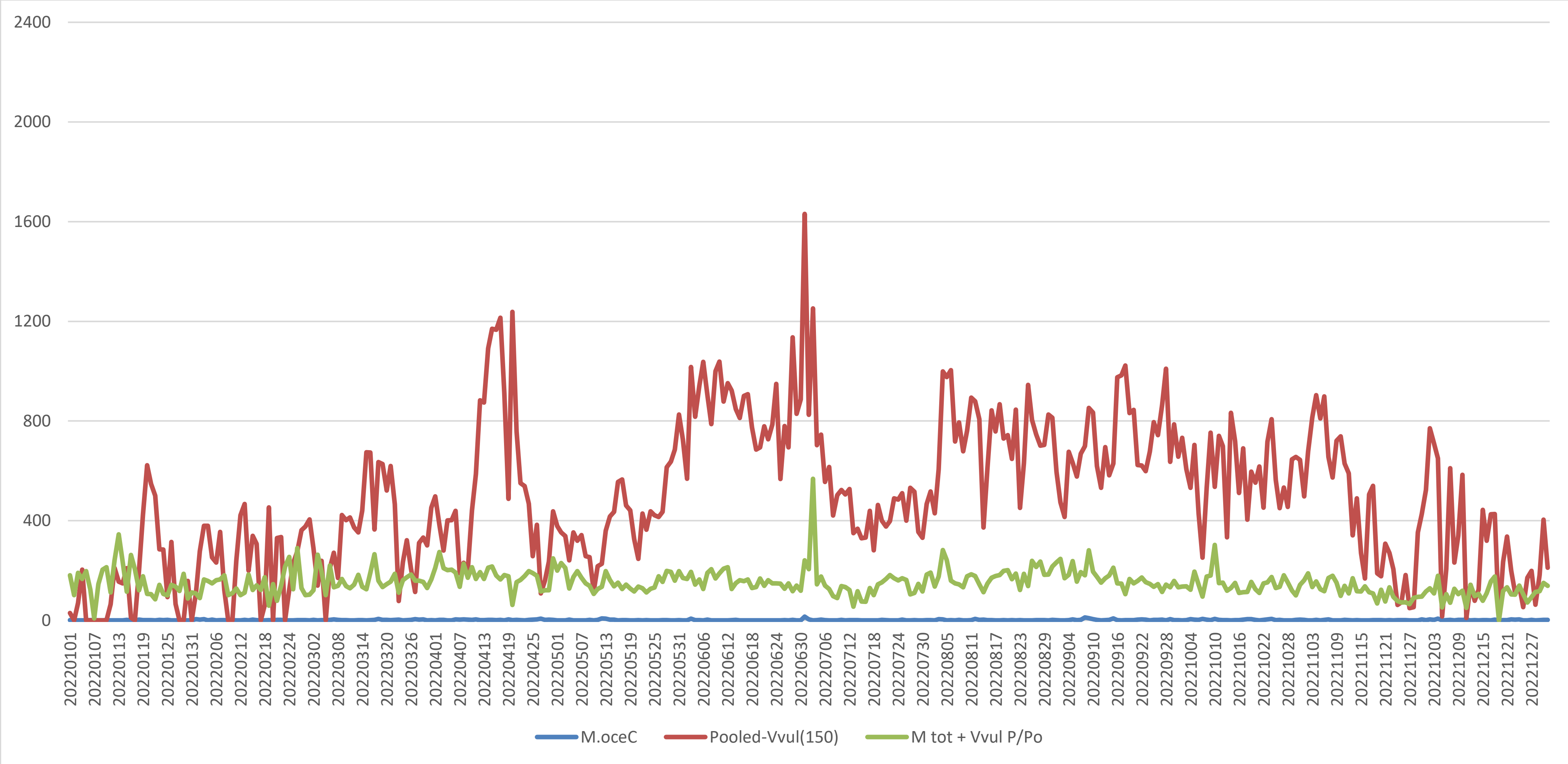


Figure 4-2d: Nightly Large Bent-winged Bat activity in 2022. *M.oceC* represent the number of confident open space Large Bent-winged Bat calls. *Pooled-Vvul(150)* represent the number of pooled confident calls for Large Bent-winged and Little Forest Bats which have similar call parameters (i.e. M.oceC + VvulC – 150). *Mtot+VvulP/Po* represent the number of total Large Bent-winged Bat calls plus calls of Little Forest Bat that were not identified confidently as Little Forest Bat.

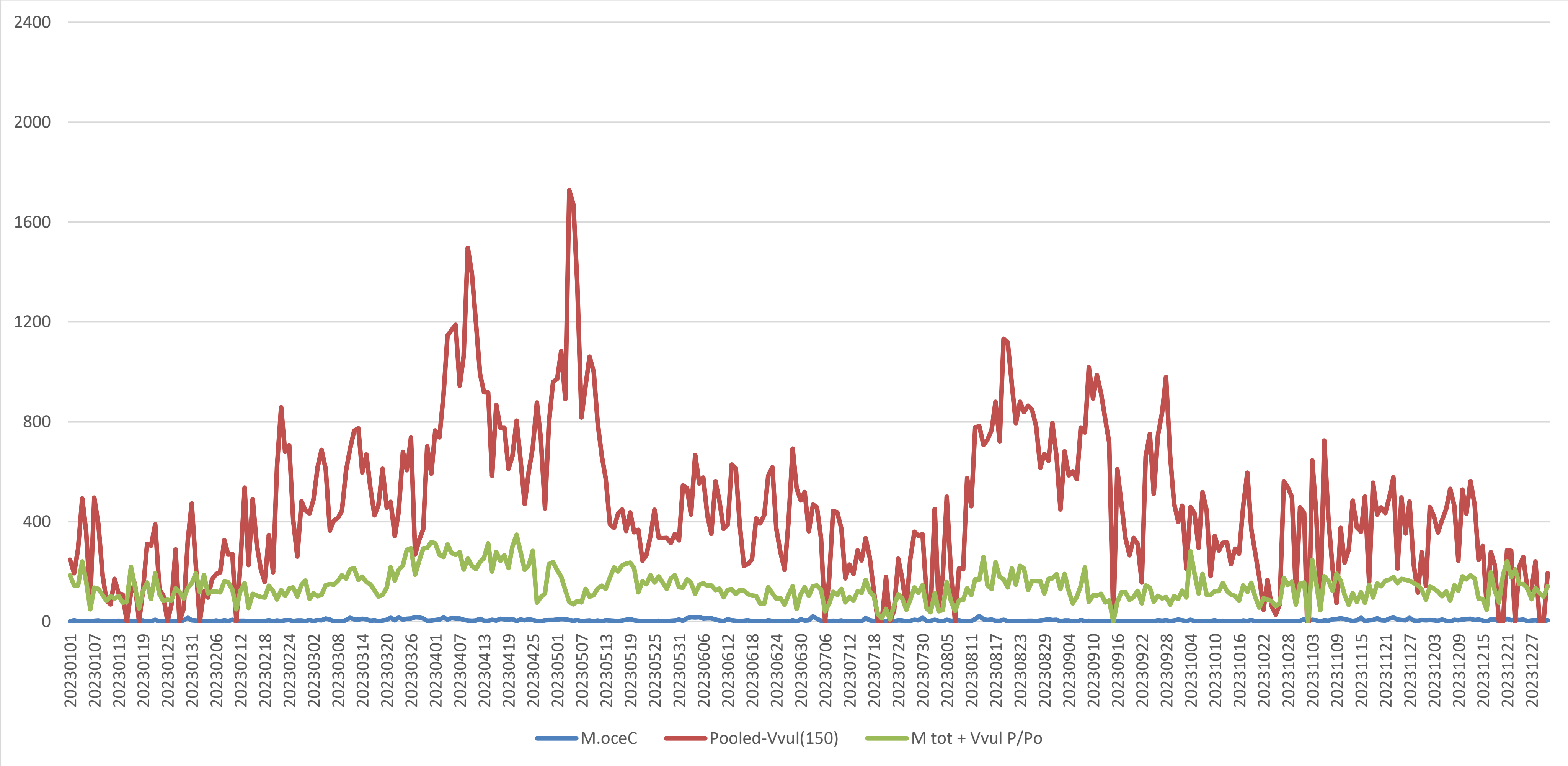


Figure 4-2e: Nightly Large Bent-winged Bat activity in 2023. *M.oceC* represent the number of confident open space Large Bent-winged Bat calls. *Pooled-Vvul(150)* represent the number of pooled confident calls for Large Bent-winged and Little Forest Bats which have similar call parameters (i.e. M.oceC + VvulC – 150). *Mtot+VvulP/Po* represent the number of total Large Bent-winged Bat calls plus calls of Little Forest Bat that were not identified confidently as Little Forest Bat.

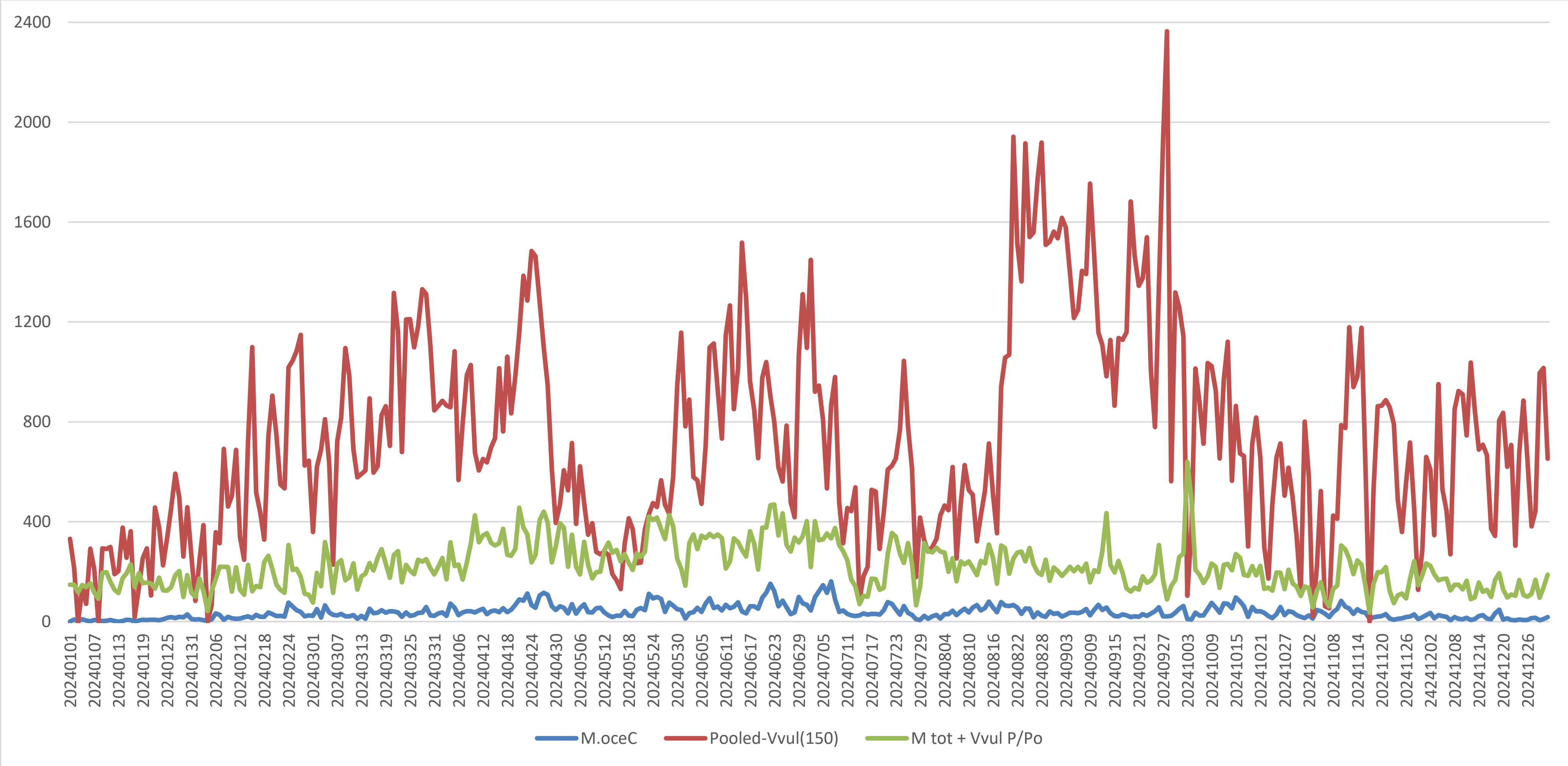


Figure 4-2f: Nightly Large Bent-winged Bat activity in 2024. *M.oceC* represent the number of confident open space Large Bent-winged Bat calls. *Pooled-Vvul(150)* represent the number of pooled confident calls for Large Bent-winged and Little Forest Bats which have similar call parameters (i.e. M.oceC + VvulC – 150). *Mtot+VvulP/Po* represent the number of total Large Bent-winged Bat calls plus calls of Little Forest Bat that were not identified confidently as Little Forest Bat.

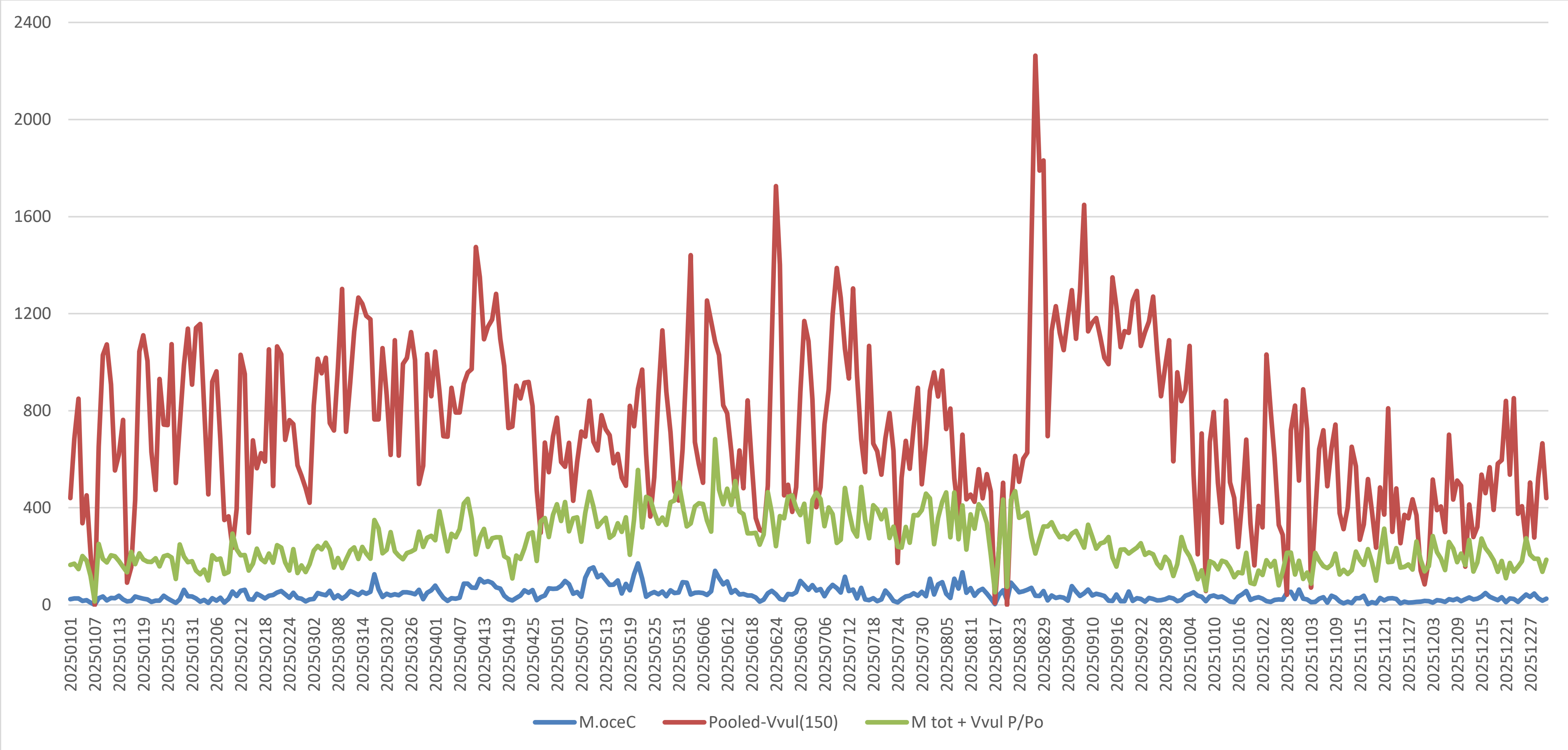
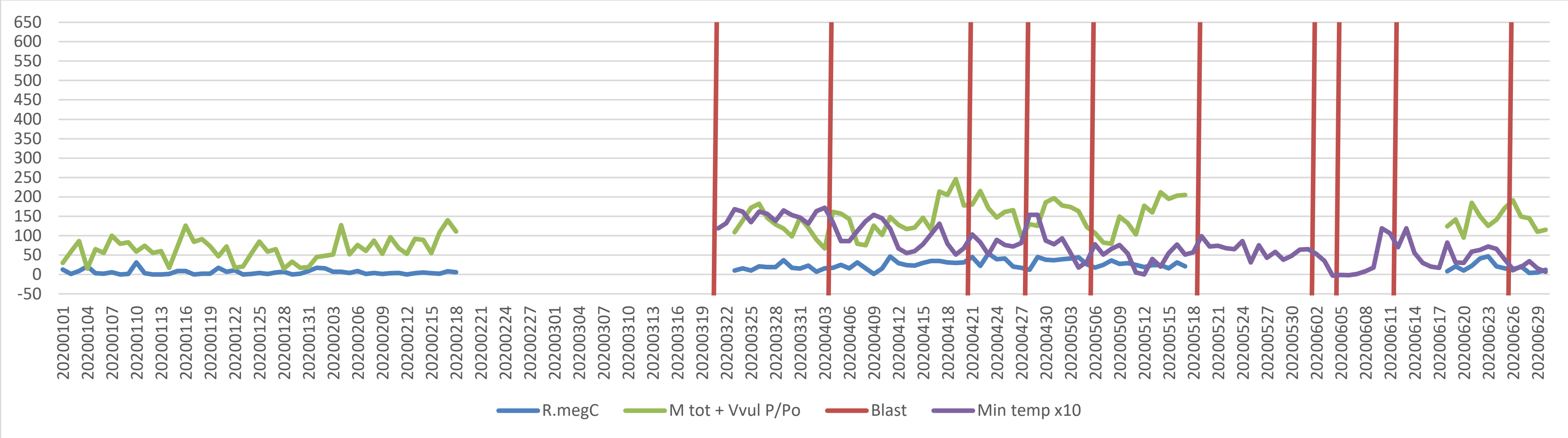


Figure 4-2g: Nightly Large Bent-winged Bat activity in 2025. *M.oceC* represent the number of confident open space Large Bent-winged Bat calls. *Pooled-Vvul(150)* represent the number of pooled confident calls for Large Bent-winged and Little Forest Bats which have similar call parameters (i.e. M.oceC + VvulC – 150). *Mtot+VvulP/Po* represent the number of total Large Bent-winged Bat calls plus calls of Little Forest Bat that were not identified confidently as Little Forest Bat.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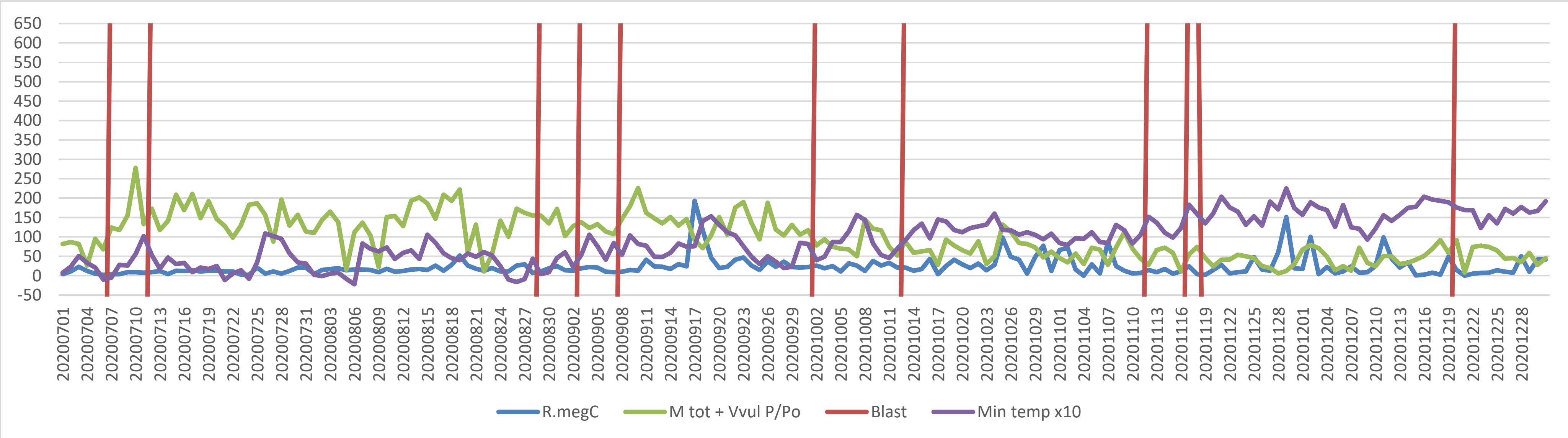
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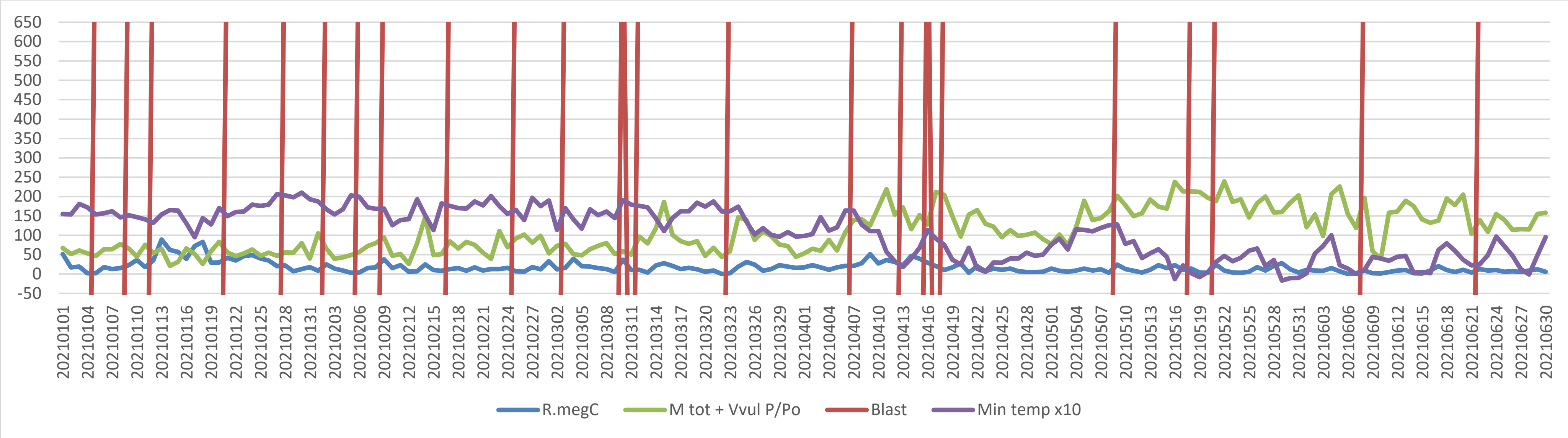
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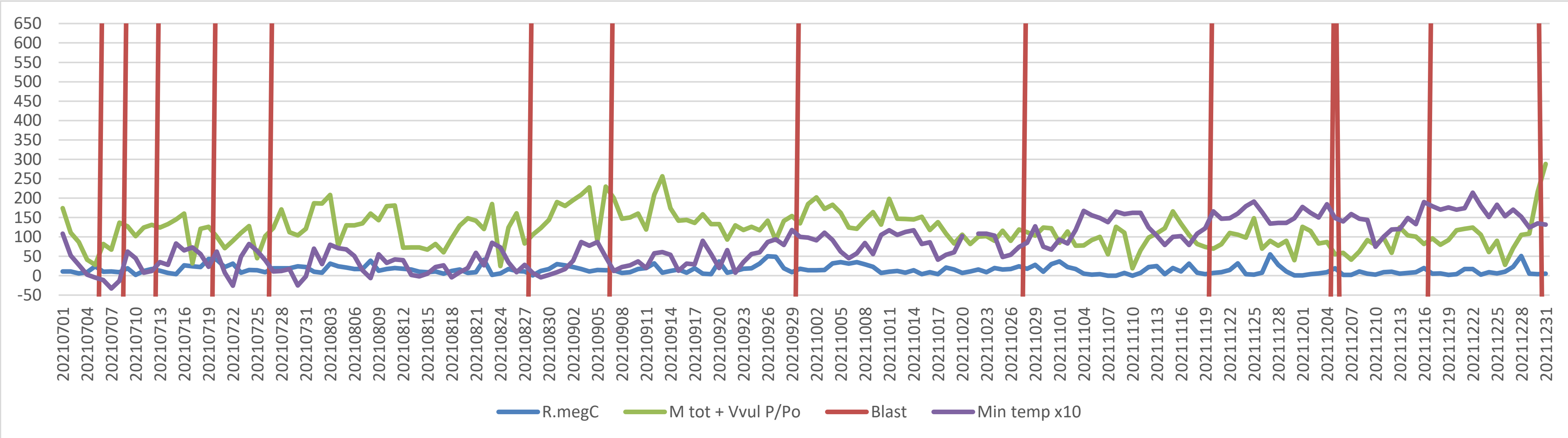
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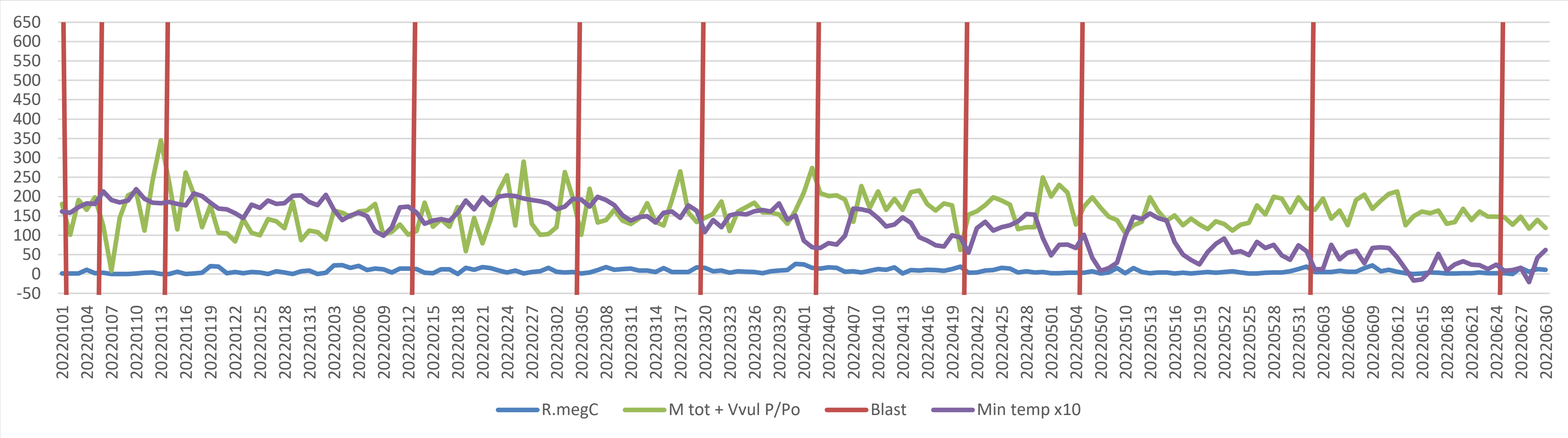
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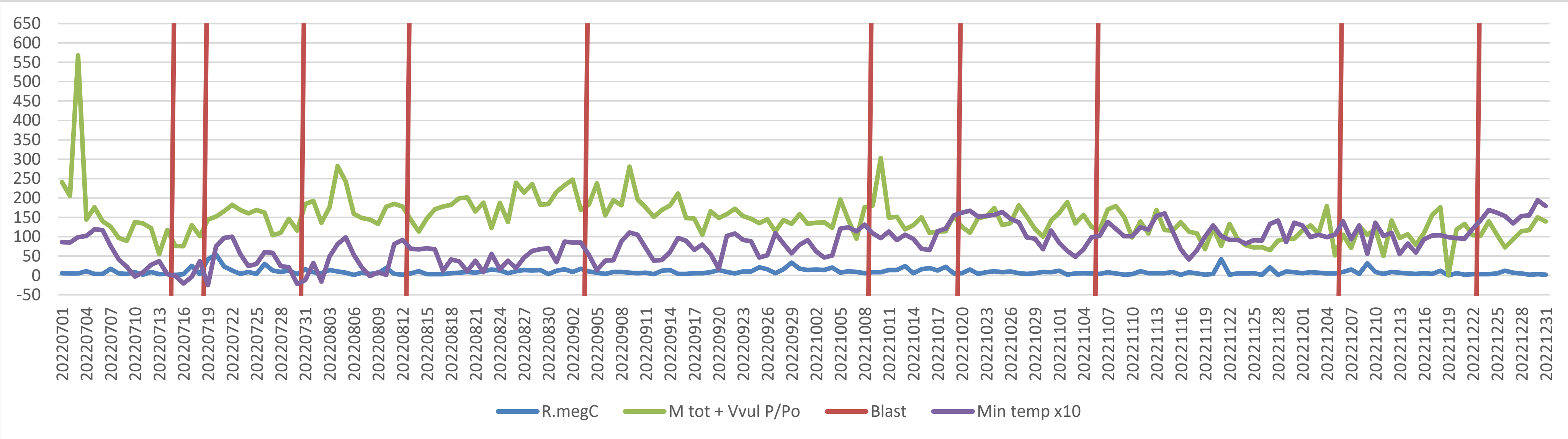
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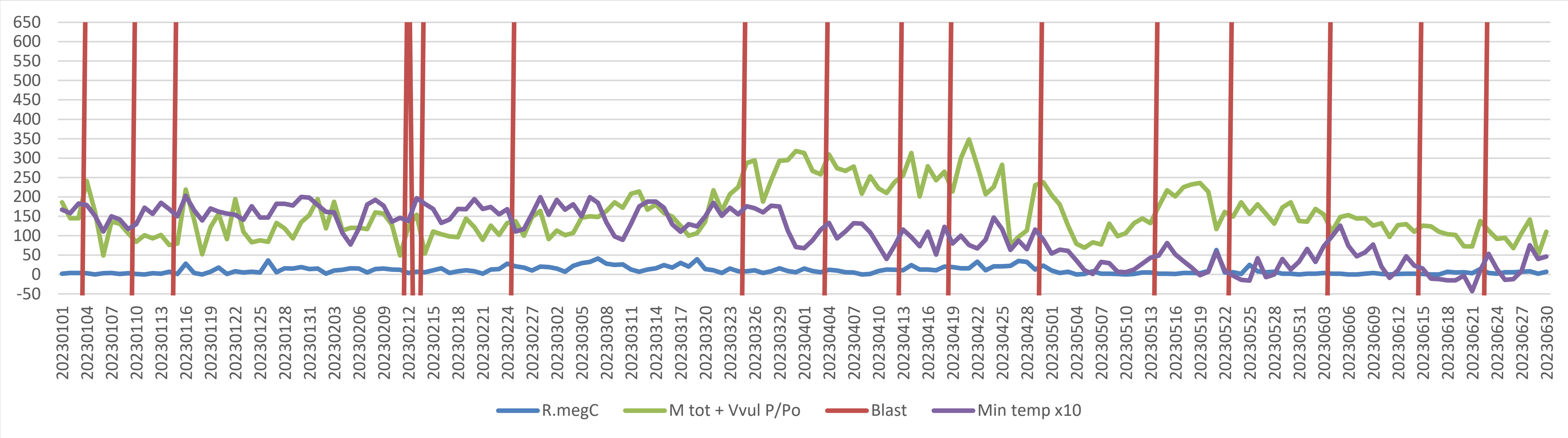
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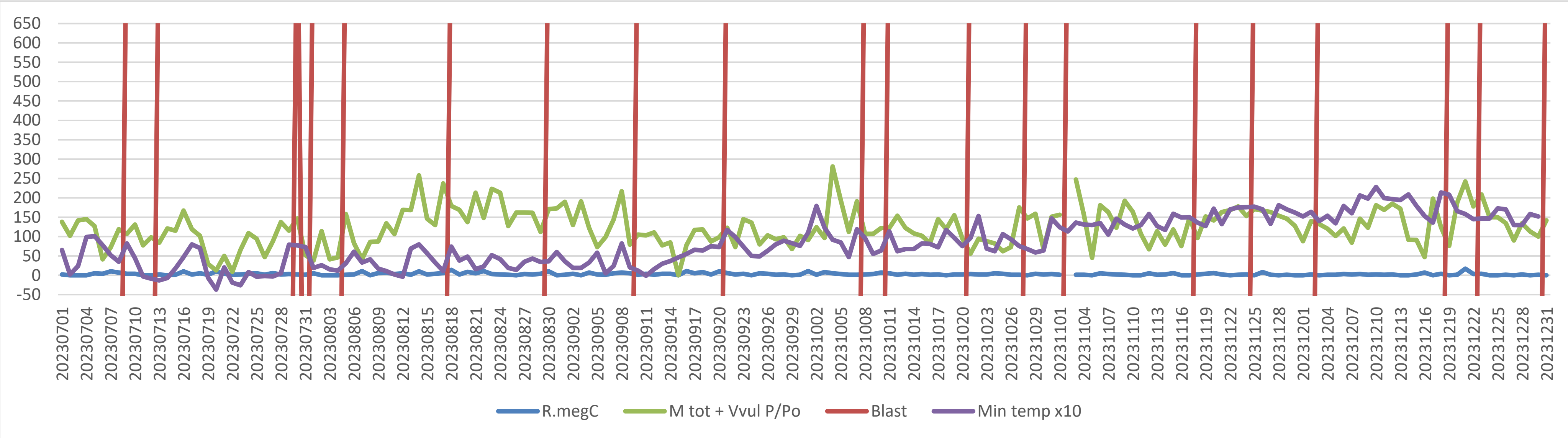
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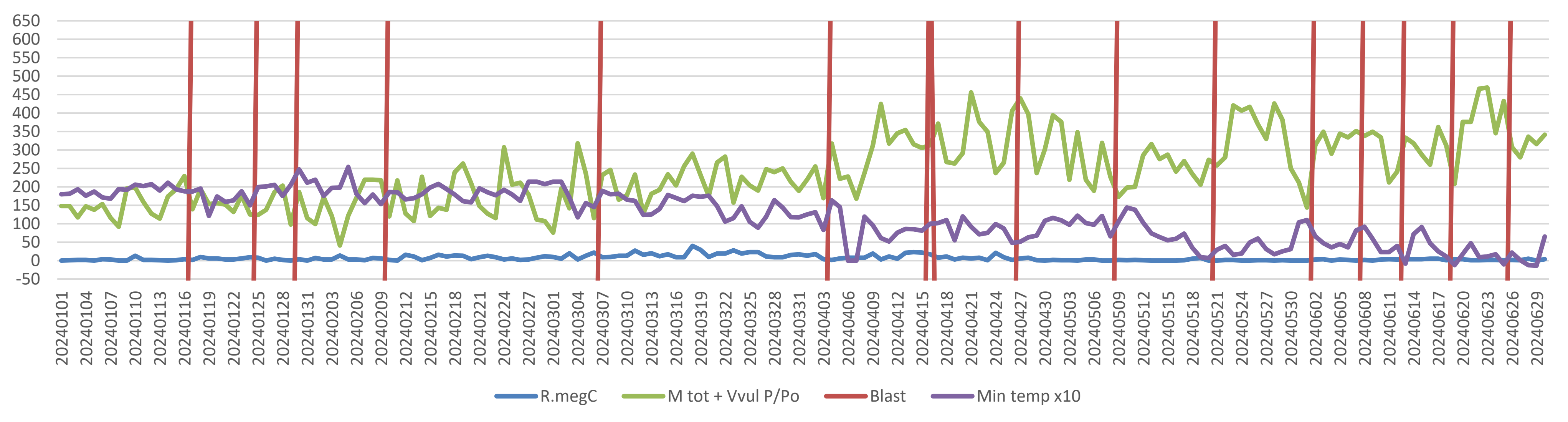
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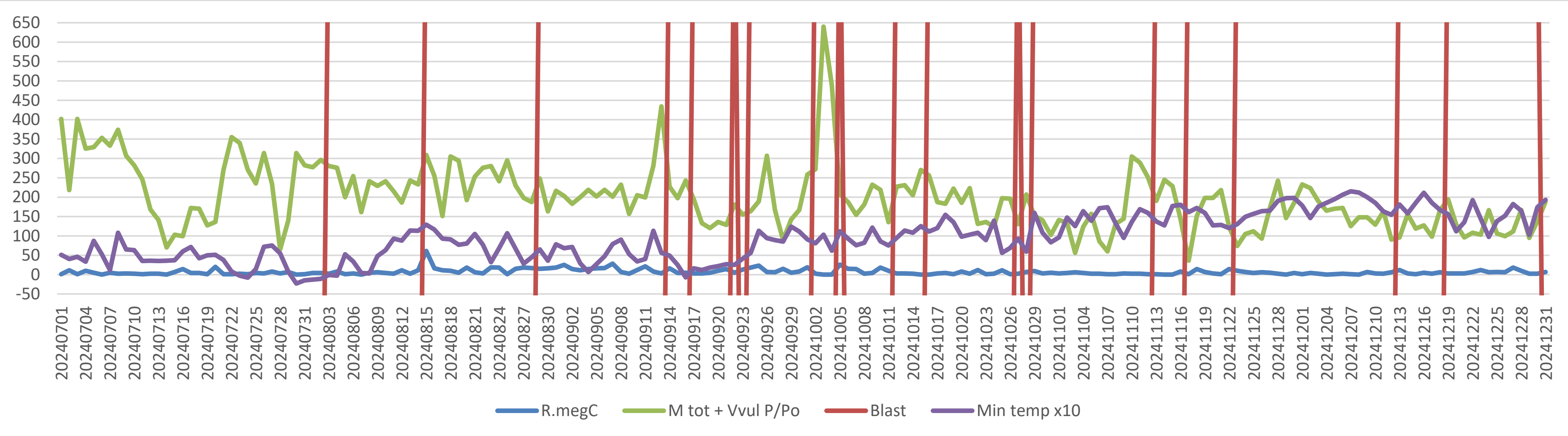
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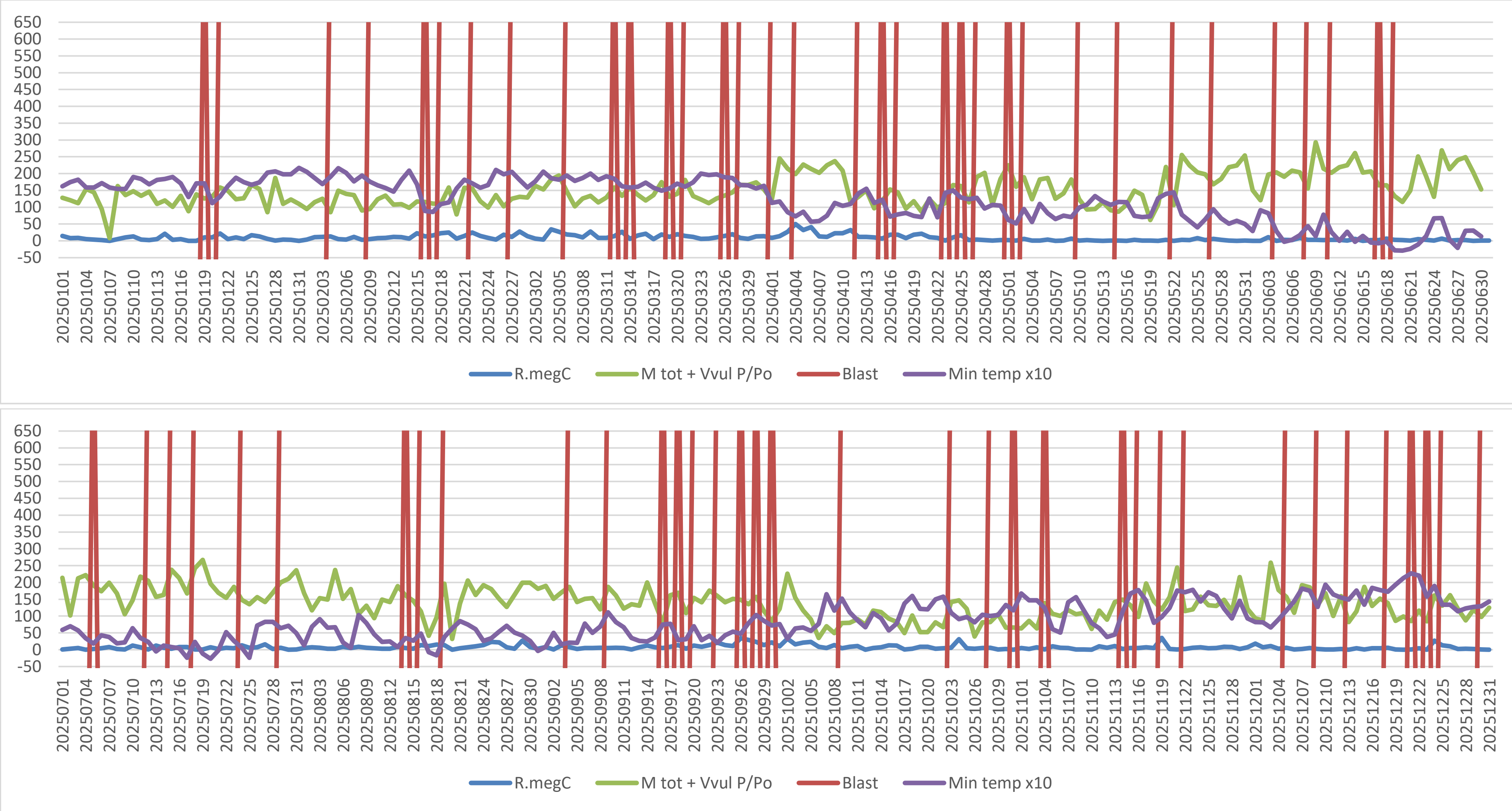

Figure 4-3: Eastern Horseshoe-bat and Large Bent-winged Bat numbers through time with blast dates marked as vertical lines

Minimum temperatures presented as degree Celsius x10 so change in temperature is visible against change in bat activity

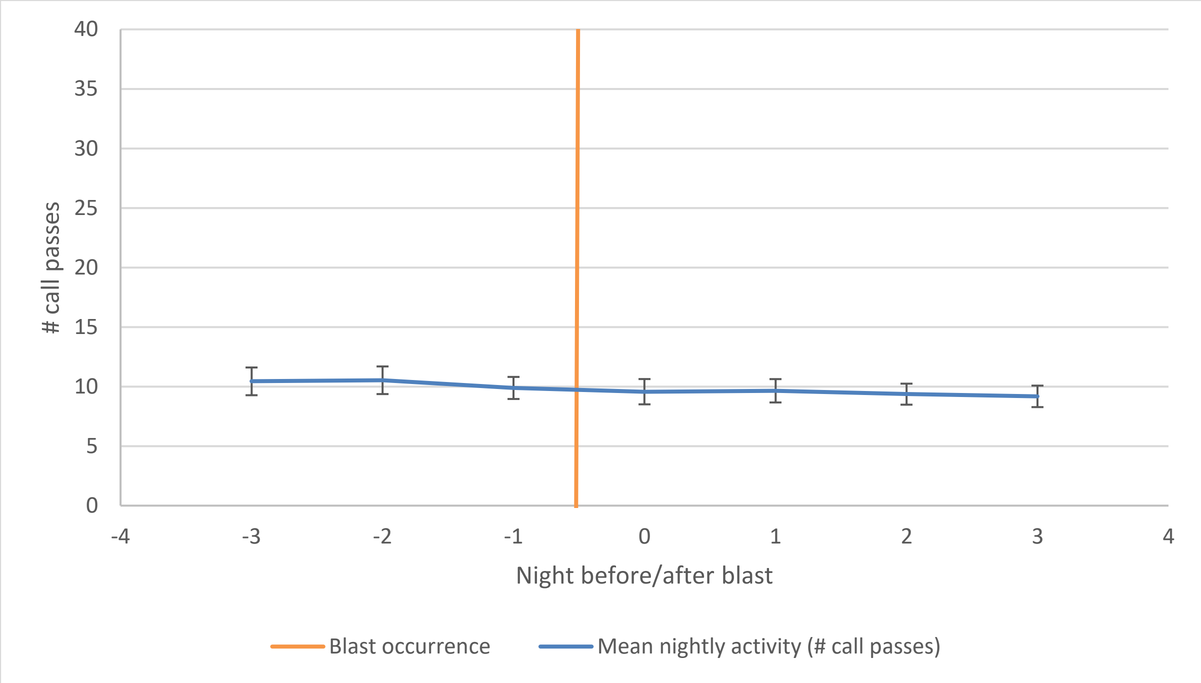

Figure 4-4: Mean short term response by Eastern Horseshoe-bat (R.megC) 2020-2025

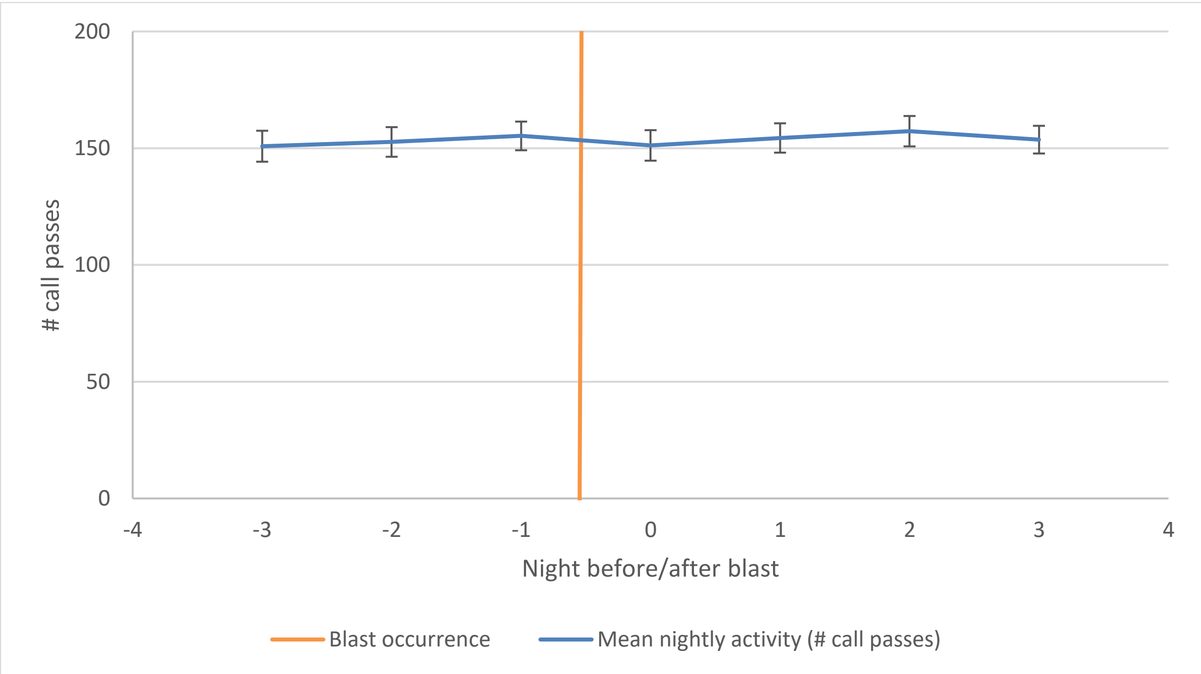

Figure 4-5: Mean short term blast response by Large Bent-winged Bat (M tot + Vvul P/Po) 2020-2025

5.0 Discussion

November 2019 saw the installation of a 900mm diameter steel pipe in the entrance of the adit. Collapsed material was removed, a 20m section of pipe pushed into the entrance, and material back filled around the pipe. The aim of this was to ensure an opening is maintained in the event of an entrance collapse. Modifications to this work were conducted in April 2020 in response to concerns raised via email in March 2020, regarding the height of the backfill material reducing the size of the adit opening. Low numbers of Large Bent-winged Bats were recorded in March 2020, after individuals were found to have returned in February. While the extreme drought and heat conditions experienced through 2019 could explain the large reduction in bat numbers, the fact that numbers had declined since the February count indicated there could be a localised issue. It was postulated that this reduction could be due to the small gap left after material was back filled over the pipe. This material was reduced, increasing the opening to approximately 1.0m in height. By June 2020 numbers were back to where they were in June 2019, and by August 2020 the number of Large Bent-winged Bats counted indicated numbers were back to levels seen in winter 2017.

On 26 April 2023, the steel pipe was removed from the adit and replaced with a larger aperture square steel box tunnel (see **Plate 5-2**). This was in response to the beginning of signs of rock fracture around the adit entrance. The rock around the adit entrance was sprayed with marking paint in September 2022 to facilitate identification of rock that had dislodged from the adit entrance. Minor rock falls (football sized) were observed in December 2022, February 2023, August 2023, September 2023 and April 2025. A larger block (esky sized) was observed to have dislodged from the right hand side of entrance in March 2023. The new tunnel (measuring 1.1m high x 1.3m wide) was constructed of steel plate with the inner surface a combination of painted and bare steel. The old pipe had a cross sectional area of approximately 0.64m^2, while the new tunnel had a sectional area of 1.43m^2. This better suits the requirements of Large Bent-winged Bat flight, with few (if any) bats ever observed using the round pipe. The April 2023 count was conducted on the night of the tunnel installation. Dirt had been piled up on top of the tunnel in an attempt to stabilise the tunnel and close the adit in (forcing bats to use the tunnel). On counting the exit, a small aperture was obviously present in the top of the dirt pile, as approximately 90% of the bats exiting the adit that night used the top rather than the tunnel. Forcing large numbers through a small aperture also meant the exit took longer than it had previously. The author proposed that the mine remove some of the dirt on top of the pipe to allow bats to use their preferred flight path, and reduce the risk of predation by a cat or fox standing in front of the small aperture. In May 2023, the space above the tunnel had been expanded to avoid funnelling bats through a tiny aperture.

From June 2023, a few different observation setups were trialled. Shining a torch out and up from the end of the tunnel allowed counting of the bats exiting the tunnel, but made it hard to pick up bats exiting via the top (or out to the side where Horseshoe-bats prefer to come and go). Lowering the light intensity still allowed counting without preventing the bats from exiting (assessed by turning the light off at the end and listening for bats exiting). This method was modified in 2025 with the torch being placed on the ground approximately 1 m in front of the adit, pointed up and out at 60 degrees from horizontal. That way, bats aren't deterred from exiting as they only cross the beam after exit. Though we miss some of the non-target species, we still pick up most of the target species over most months, and can concentrate on the non-target species over summer.

The smaller aperture of the tunnel has still resulted in slowing the emergence of the bats. Exit counts previously peaked in the 10 minute period 10-30 minutes after first exit, and most bats had exited by

40-50 minutes after first exit. With the new tunnel installed, exits were observed as a steadier stream but a peak at about 20-30 (Mar, Apr, Jun) or 30-40 (Sep, Oct) minutes after the first exit. It now takes 70-100 minutes for the colony to exit with the new setup.

Some very small rocks were observed dislodged from the roof in October 2024, but the main concern in 2024 was the widening of the crack in the wall on the right hand side (western side) of the entrance (**Plates 5-2** and **5-3**). A large acacia fell across the entrance in February 2024, but small branches were pruned so it did not obstruct exiting bats.

Looking at December counts from 2017-2023, the number of Eastern Horseshoe-bats was the lowest on record in 2023. 2024-2025 (7-12) has shown an increase, but numbers are still relatively low. The nine counted in December 2024 match the nine individuals harp trapped in July 2024 (five male, four female). The dry conditions experienced in 2023 may be partly responsible for the drop in numbers, but the removal of farm dams for the mine may also explain the reduction in counts/activity. Blast data does not indicate any obvious impact.

April 2024 counts (both species) were similar to those seen in 2022, but slightly lower than those seen between 2017 and 2019. Whilst April counts were down in 2025 from the previous year, June counts were nearly doubled in 2025 compared to 2024. June counts in 2024 were on par with the lower years, with the higher numbers not building until September 2024. Numbers peaked for 2025 in June at 739. This is the third highest June count behind 2018 and 2021. This is also lower than the peak count in September 2024 (912-1178). Though not entirely absent from the adit in December 2025, the low numbers of Large Bent-winged Bat at the adit (2 in Dec) are not indicative of breeding activity. These numbers are more indicative of non-breeding individuals remaining in the area over summer, and reconfirms the absence of maternity roost in the adit.

Automated echolocation call detection worked successfully at Slate Gully for estimating the activity of the two microbat species roosting within the disused oil shale mine workings. A fault in the detector caused loss of data over several weeks in March and June 2020, but the equipment has functioned without fail throughout 2021-25. One night in 2023 (2 November) recorded no call passes, but it is impossible to tell if this was a glitch in the detector or a genuine absence of activity over one night. The pattern of activity broadly mirrored numbers of bats recorded leaving the adit from hand counts undertaken over several years (Fly By Night 2017; Fly By Night 2018; Fly By Night 2019), with the absence of Large Bent-winged Bats in March 2020 counts the only anomaly. There are some complications with separating Large Bent-winged Bat calls from Little Forest Bat calls in the area, though the overall trends seen in the pooled data make ecological sense. With such large amounts of data to analyse from nights call recording, this is considered sufficient to monitor changes in the two cave-dwelling species utilising the adit.

The activity of the Large Bent-winged Bat recorded at the detector was broadly comparable with the hand counts undertaken simultaneously at the adit. Activity of the Eastern Horseshoe-bat recorded at the detector correlated much more poorly with the hand counts. This can be attributed to the small population of Eastern Horseshoe-bats resident in the workings throughout the year compared with that of the Large Bent-winged Bat. The activity patterns of the Eastern Horseshoe-bat (lots of coming and going) also impacts the suitability of the index for this species. From all the data collected, we estimate the population of Eastern Horseshoe-bats within the adit to be stable at 5-30 individuals. Early years have shown activity of the Eastern Horseshoe-bat peaking during the autumn and spring months, with minor activity declines over winter and summer. This species' activity was relatively consistent over 2021 and 2022. 2023 saw consistent activity over the first half of the year and very low activity since May. 2024 -2025 saw a return to the pattern of peak activity in autumn and spring. Conversely, Large Bent-winged Bat activity fluctuated more in 2024 than during previous years. Activity peaked in April, June and August-September 2024 -2025 (April and July in 2022 and April-May and August-September in 2023). Though the usual decline in activity over summer as females migrate to select maternity roosts to give birth (Hoye and Hall 2008) was seen in summer 2023-24 it was not as evident in summer 2024-25. Activity remained relatively high through October 2024 to March 2025. Patterns of activity do not appear to coincide with noted blasts (data March 2020 to December 2025). The index tracking the number of total Large Bent-winged Bat calls added to those attributed to Little Forest Bat with low confidence (*M tot + Vvul P/Po*, **Figures 4-2a** to **4-2g**) give the best representation of Large Bent-winged Bat numbers in the adit. Looking at bat activity before and after blasts showed mixed (increase/decrease) results. The small changes relative to normal nightly variation in activity suggest no impact from blasting in Pits 3 or 8 on the two bat species.

Results suggest that monitoring of the colony at Slate Gully through nightly recording of echolocation calls provides a feasible means of monitoring use of the disused workings by the two microbat species. Mean monthly activity for the two species can be compared prior to mining taking place in adjacent areas with that post mining. As of February 2025, mining activity is approximately 190m from the adit (350m in February 2024). As the mine moved past in 2025 (topsoil stripping only), we did not detect any significant changes to occupation/activity of the two cave dwelling microbat species. Images from monthly monitoring (**Plates 5-A**, **5-B**, **5-C** and **5-D**) show the adit entrance has maintained integrity despite the nearby blasting in Pits 3 and 8 (and potentially Pit 7). However, some football sized rocks were dislodged from the entrance in the last half of 2022. One larger rock fell from the eastern side of the entrance in 2023. A crack opened up on the right hand side in 2024. Some rock collapse occurred on the right hand side of the adit in April 2025, but it has not blocked the exit over the top of the tunnel, and no further collapses were noted between May and December. Things to look out for in 2026 will be collapse of the western wall of the entrance, and maintaining access to the site for ongoing monitoring.

As a side study, a PIR camera was mounted out the front of the adit, pointed at the tunnel entrance. This was left in place between 17 December 2025 and 19 January 2026. No feral species were noted hanging around the entrance to the tunnel. The only species noted were Bare-nosed Wombat, Red-necked Wallaby, Pied Currawong and Rockwarbler. Other species noted whilst conducting counts over the years have been Rabbit, Black Rat, Fox, Fallow Deer and Common Wallaroo (not including all the birds observed/heard in the forest surrounding the adit). Rockwarblers are often observed entering and exiting the adit before dark. At this point there is nothing to suggest predators are attracted to the adit, but the camera should be redeployed in winter when the Bent-winged Bats are present.

Plate 5-A: Periodic monitoring photo of adit entrance from February 2021 (top), January 2022 (middle) and December 2022 (bottom) showing lack of substantial change

Plate 5-B: Monitoring photos of adit entrance pre culvert installation (March 2023 – top left), afternoon of installation (April 2023 – top right), nine months after installation (January 2024 – bottom left), and 20 months after installation (December 2024 – bottom right). This shows progression of pipe to tunnel with small aperture, tunnel with large aperture. Large crack forming on western side shown with red arrow.

Plate 5-C: Monitoring photos of adit entrance 15 months after installation (July 2024). Harp trapping was conducted to get an update on roost status (species present, sex ratios and recapture of banded individuals). Large crack forming on western side shown with red arrow.

Plate 5-D: Monitoring photo of adit entrance almost three years after installation (April 2025). Shows rock collapse in bottom right (western side – red arrow).

Andrew Lothian — BComm/BSc (Hons), BAM Accredited Assessor (BAAS18110), NSW AUSRIVAS Accredited, ECANSW CPEC, President ECANSW, MRZSNSW, MAMS, MABS, MNSWBA

ECA ECOLOGICAL CONSULTANTS ASSOCIATION of NSW Inc
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CERTIFIED PRACTISING ECOLOGICAL CONSULTANT
REGISTERED NUMBER: 10

Glenn Hoye — BEng/BSc (Hons)

Mikaela Cole — BSc (Hons), MECANSW

17 February 2026

6.0 References

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Wilpinjong Coal Mine

2025 Nest Box Monitoring

Wilpinjong Coal Pty Ltd

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Document Tracking

Project Name:	Wilpinjong Coal Mine: 2025 Nest Box Monitoring
Project Number:	600-25MUD11925
Project Manager:	Kalya Abbey

Version	Prepared by	Reviewed by	Approved by	Status	Date
V1	Ellie Young	Tom Kelly	Kalya Abbey	Final	30/01/2026

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Acknowledgements

This document has been prepared by Eco Logical Australia Pty Ltd with support from Wilpinjong Coal Pty Ltd.

Abbreviations

Abbreviation	Description
BMP	Biodiversity Management Plan
ELA	Eco Logical Australia
WCM	Wilpinjong Coal Mine
WCPL	Wilpinjong Coal Pty Ltd

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1. Introduction

Wilpinjong Coal Pty Ltd (WCPL) is required to undertake nest box monitoring to satisfy Section 7.4.8 of the WCPL Biodiversity Management Plan (BMP). Eco Logical Australia (ELA) was engaged by WCPL to undertake nest box monitoring in the 2026 monitoring period.

WCPL installed nest boxes within the biodiversity management areas across the Wilpinjong Coal Mine (WCM) site to provide enhanced habitat for native fauna species. The locations of the nest boxes are shown below in Figure 1.

ELA is contracted by WCPL to inspect each nest box annually to assess usage and provide advice on maintenance and management. The report presents the results of the nest box inspections completed in January 2026.

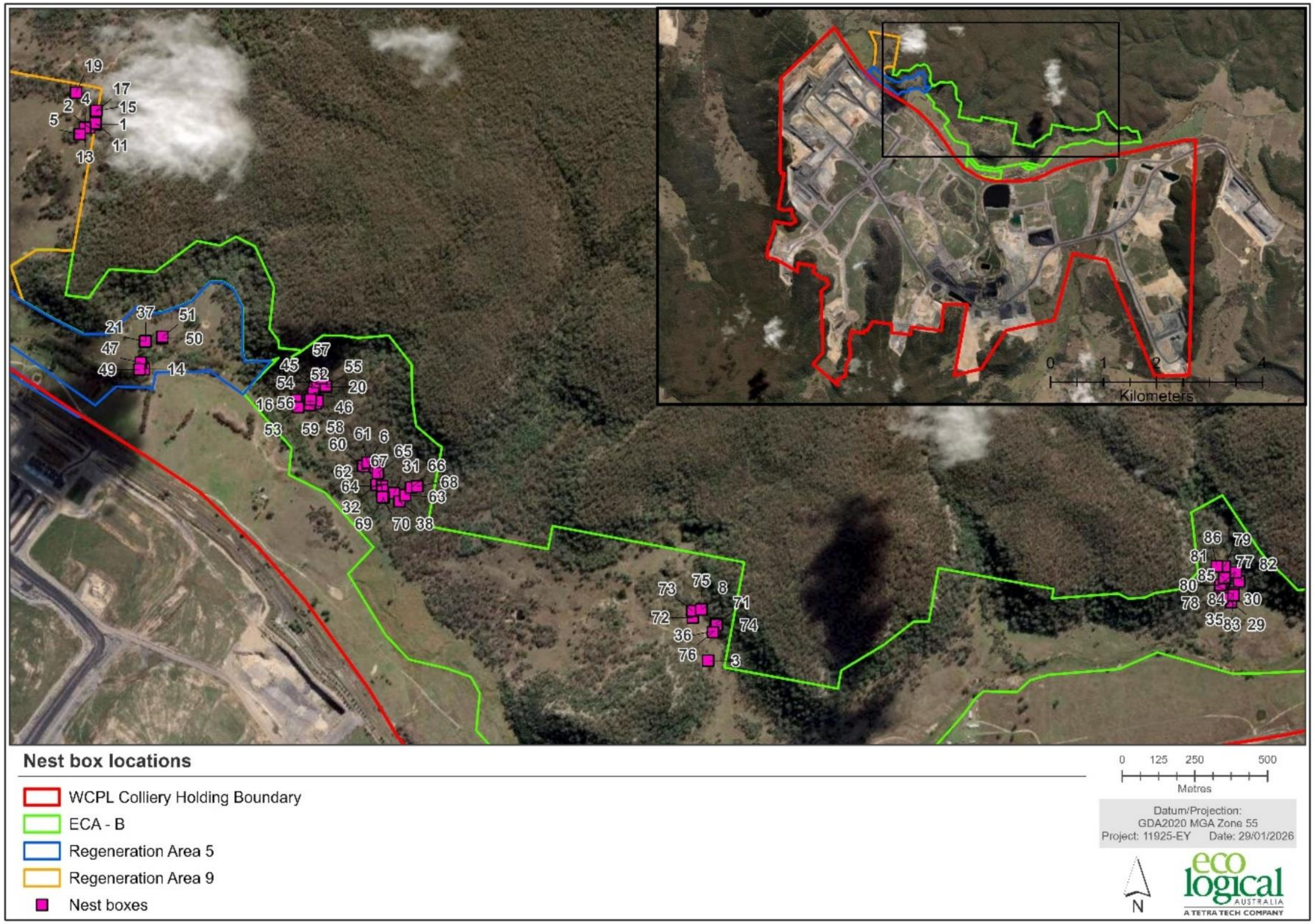

Figure 1: Nest box locations

2. Methods

Sixty-six nest boxes were inspected using a 12-meter-high pole and wireless hollow scope to investigate fauna presence or signs of use, as well as the overall condition of the nest box and any maintenance issues.

The condition of nest boxes was divided into three categories:

- Fit for use
- In need of repair; or
- Unserviceable.

Nest box usage was determined by the presence of indicators such as nesting material, feathers, droppings and signs of chewings, scratchings or a combination of the these. An assessment of whether nest boxes had been recently used was also made based on the nature and condition of the signs of use, including nest structure, age of droppings and the colour and condition of nesting material (e.g. leaves) in the nest box.

3. Results

The results of the nest box inspections are summarized in Table 1 and detailed observations are provided in Appendix A. A total of 18 nest boxes demonstrated signs of use; three contained fauna (*Trichosurus vulpecula*; common brush-tailed possum) present at the time of inspection, and a further 16 contained nesting material and/or exhibited signs of use, including chewings, scratchings around the entrance, and feathers.

Table 1: January 2026 Nest Box Monitoring Results

Installation Area	Condition			Fauna present (%)	Signs of use		
	Fit (%)	Repair (%)	Unserviceable (%)		Nest / nesting material (%)	Chewing present (%)	Other (e.g. feathers, scats, scratches) (%)
ECA-B	44 (65.67%)	6 (8.95%)	1 (1.49%)	1	77	1	83.3
Regen 5	7 (10.44%)	0	0	0	23.1	0	17
Regen 9	8 (11.94%)	1 (1.49%)	0	0	0	0	0

Seven nest boxes were identified as needing repairs (Plate 1):

- Nest box 31 has fallen down the trunk of the tree from its original position, however, is still positioned in a lower fork in the tree, though appears potentially unstable
- Nest box 68 has fallen completely off the tree and onto the ground
- The side of nest box 65 is partially open
- Nest box 60 has broken apart and is lying on the ground
- The side of nest box 52 is partially open
- Side door on nest box 54 needs to be closed and re-screwed
- Nest box 5 has fallen forward on the tree, is potentially unstable and its tie-wire requires tightening.

Locations of the nest boxes requiring repair are shown below in Figure 2.

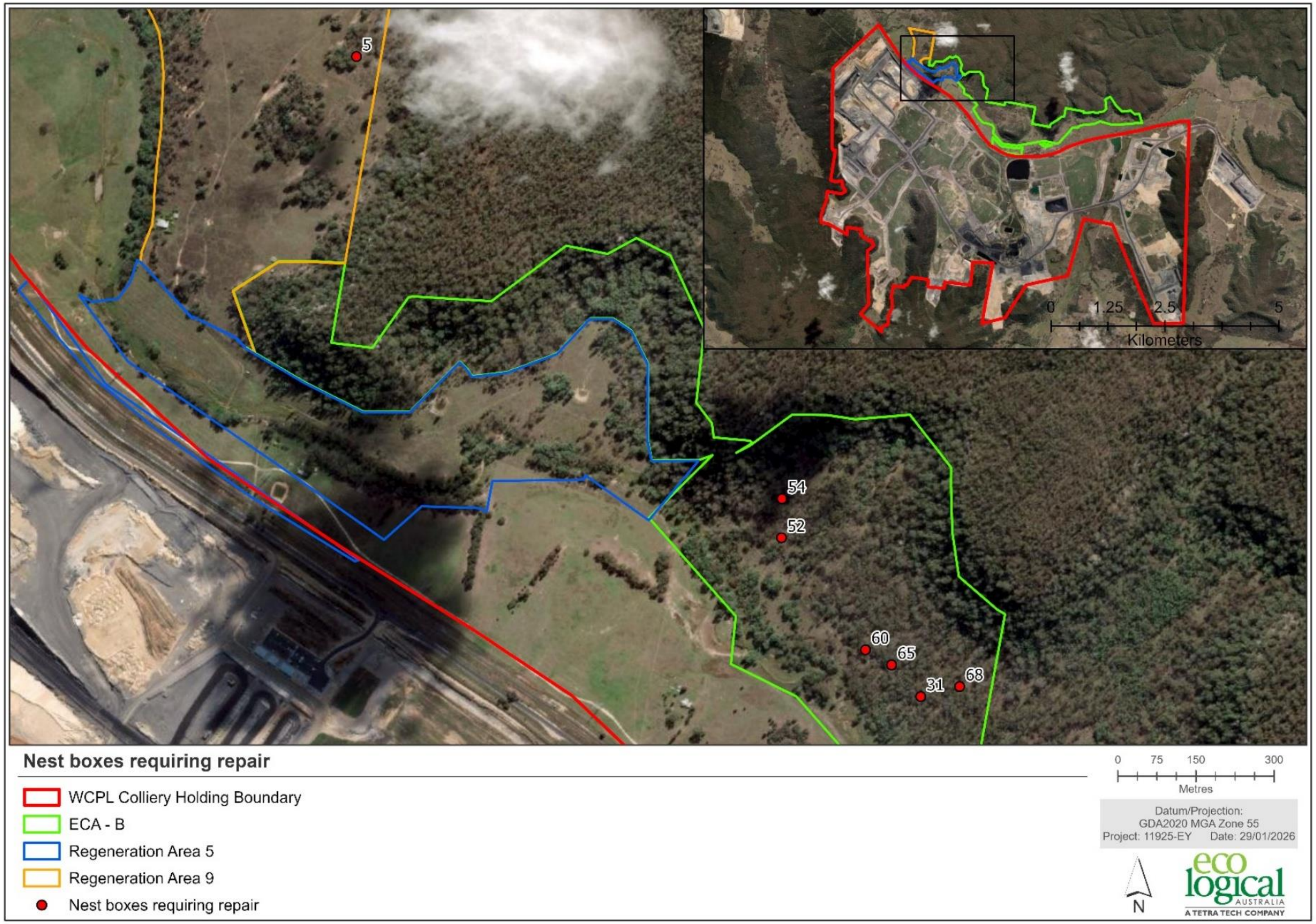

Figure 2: Nest boxes requiring repair

Nest box 31

Nest box 68

Nest box 65

Nest box 60

Nest box 52

Nest box 5

Plate 1: Nest boxes requiring repair

4. Conclusion

Nest box inspections demonstrated they predominantly remain fit for use, with a few requiring repairs, and one nest box is unserviceable. Three nest boxes contained resident fauna (common brush-tailed possum) at the time of survey and additional nest boxes showed signs of use and evidence of providing habitat for fauna.

Repairs and maintenance as per the suggestions above is recommended, as well as the continuation of annual inspections.

Appendix A Nest Box Monitoring Observations

Area	Nest Box ID	Northing	Easting	Condition	Fauna present
ECA-B	6	6421056.474	770052.41	fit	None
ECA-B	8	6420552.504	771196.7183	fit	None
ECA-B	16	6421271.608	769802.1848	fit	None
ECA-B	29	6420577.623	773016.9377	fit	None
ECA-B	30	6420652.623	772993.4273	fit	None
ECA-B	31	6420952.539	770137.1832	Repair	None
ECA-B	32	6420980.895	770077.1523	fit	None
ECA-B	35	6420610.344	773025.9292	fit	None
ECA-B	38	6420923.937	770156.6803	fit	None
ECA-B	45	6421316.767	769864.8454	fit	None
ECA-B	46	6421298.226	769860.9561	fit	None
ECA-B	53	6421247.594	769807.8571	fit	None
ECA-B	54	6421332.506	769873.9378	Repair	None
ECA-B	55	6421319.956	769903.2913	fit	Common brush-tailed possum
ECA-B	56	6421269.77	769874.992	fit	Common brush-tailed possum
ECA-B	58	6421255.728	769848.1316	fit	None
ECA-B	59	6421273.546	769850.0222	fit	Common brush-tailed possum
ECA-B	60	6421044.956	770030.801	Unserviceable	None
ECA-B	61	6421057.077	770046.4884	fit	None
ECA-B	63	6420945.626	770175.64	fit	None
ECA-B	64	6420976.491	770096.5439	fit	None
ECA-B	65	6421020.824	770082.2747	Repair	None
ECA-B	67	6420963.381	770097.0409	fit	None
ECA-B	69	6420936.365	770102.9146	fit	None
ECA-B	70	6420938.838	770097.6086	fit	None
ECA-B	71	6420504.514	771243.6811	fit	None
ECA-B	72	6420525.161	771165.1642	fit	N/A
ECA-B	73	6420547.716	771164.263	fit	None
ECA-B	74	6420499.873	771247.0433	fit	None
ECA-B	76	6420474.461	771234.4846	fit	None
ECA-B	77	6420637.314	772980.8546	fit	None
ECA-B	78	6420590.412	772987.313	Repair	None
ECA-B	79	6420700.536	772994.7248	fit	None
ECA-B	80	6420636.566	772979.7976	fit	None
ECA-B	81	6420660.163	772993.7257	fit	None
ECA-B	82	6420649.464	773044.5191	fit	None
ECA-B	83	6420601.161	773024.8323	fit	None
ECA-B	84	6420679.638	773032.8012	fit	None
ECA-B	85	6420602.26	773025.2391	fit	None
ECA-B	86	6420701.023	772968.5365	fit	None
ECA-B	3	6420377.1	771218	fit	None
ECA-B	36	6420479.7	771241.9	fit	None
ECA-B	75	6420553.5	771194.5	fit	None

Area	Nest Box ID	Northing	Easting	Condition	Fauna present
ECA-B	66	6420971.4	770196.8	fit	None
ECA-B	68	6420975.7	770217.6	Repair	
ECA-B	62	6421040.9	770073.1	fit	None
ECA-B	16	6421271.6	769802.2	fit	
ECA-B	52	6421260.3	769868.1	fit	None
ECA-B	57	6421346.3	769887.8	fit	None
ECA-B	20	6421317.5	769902.5	fit	None
regen 5	37	6421473.8	769283	fit	None
regen 5	21	-	-	fit	None
regen 5	47	6420547.7	771164.3	fit	None
regen 5	49	6421377.2	769262.2	fit	None
regen 5	14	6421378.3	769277.5	fit	None
regen 5	50	6421484	769339.6	fit	None
regen 5	51	6421489.4	769340.7	fit	None
regen 9	17	6422265.7	769113.8	fit	None
regen 9	15	6422264.1	769110.8	fit	None
regen 9	1	6422219.4	769111.2	fit	None
regen 9	11	6422222.6	769111.1	fit	None
regen 9	2	6422207.4	769089.1	fit	None
regen 9	4	6422207.7	769075.4	fit	None
regen 9	13	6422207.9	769074.7	fit	None
regen 9	5	6422184.9	769056.5	Repair	None
regen 9	19	6422327.5	769043.7	fit	None

2025 Biodiversity Monitoring

Rehabilitation Monitoring Report

Wilpinjong Coal Pty Ltd

Document Tracking

Project Name:	2025 Biodiversity Monitoring: Rehabilitation Monitoring Report
Project Number:	600-25MUD10787
Project Manager:	Natalie De Losa

Version	Prepared by	Reviewed by	Approved by	Status	Date
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Abbreviations

Abbreviation	Description
BC Act	Biodiversity Conservation Act 2016
BMP	Biodiversity Management Plan
BOA	Biodiversity Offset Areas
BVT	BioMetric Vegetation Type
CPHR	Conservation Programs, Heritage and Regulation Group
EC	Exotic Plant Cover
ECA	Enhancement and Conservation Area
ELA	Eco Logical Australia
EPBC Act	Environment Protection and Biodiversity Act 1999
FL	Fallen Logs
LFA	Landscape Function Analysis
LOI	Landscape Organisation Index
NGCG	Native Ground Stratum Cover (Grasses)
NGCO	Native Ground Stratum Cover (Other)
NGCS	Native Ground Stratum Cover (Shrubs)
NMS	Native Midstorey Cover
NOC	Native Overstorey Cover
NSR	Native Species Richness
NTH	Number of Trees with Hollows
OT	Overstorey Regeneration
PA	Project Approval
SSA	Soil Surface Assessment
SVS	Site Value Score
TARP	Trigger Action Response Plan
WCM	Wilpinjong Coal Mine
WCPL	Wilpinjong Coal Pty Ltd
WEP	Wilpinjong Extension Project

Executive Summary

Eco Logical Australia (ELA) was engaged by Wilpinjong Coal Pty Ltd (WCPL) to undertake the 2025 annual biodiversity monitoring consistent with the requirements of Development Consent SSD-6764 (as modified) and the methods outlined in the revised Wilpinjong Coal Biodiversity Management Plan Version 8 (BMP) (WCPL 2024). The primary objectives of the 2025 monitoring program is to evaluate rehabilitation progress against WCPL's approved performance criteria, assess landscape stability and monitor biodiversity indicators, including native and introduced fauna species, within rehabilitation and local reference sites.

Local reference sites were established in 2019 and 2020 in areas that conform to WCPL's rehabilitation target BioMetric Vegetation Types (BVTs), in accordance with Condition 36 of the Development Consent SSD-6764. Reference Sites were monitored in accordance with the three-year rotation outlined in the BMP. It should be noted that all monitoring for the 2025 period was completed in spring.

Additions to the rehabilitation monitoring program in 2025 included the establishment of plots throughout rehabilitation areas which had recently achieved ecosystem and land use establishment in accordance with the approved WEP BVTs, and rehabilitation which had been transitioned from agricultural rehabilitation (a component of the pre-WEP biodiversity completion criteria) to native woodland rehabilitation, also in accordance with the approved WEP BVTs.

Vegetation monitoring

Floristic monitoring was undertaken in accordance with the BioMetric plot method prescribed in the BMP at both rehabilitation and local reference sites.

Of the 19 rehabilitation sites monitored in 2025, three sites were in areas less than four years post-establishment and 16 are 4+ years since initial ecosystem establishment. Ten sites less than 10 years old have been assessed against the BVT Performance Criteria and six sites over 10 years old have been assessed against the BVT Completion Criteria. All monitored sites exceeded the Site Value Score (SVS) performance Criteria benchmark for both Performance and Completion Criteria. Exotic cover remained within acceptable limits, however, none of the sites have yet met the Performance Criteria for native overstory cover (NOC). Newly established sites showed positive initial results, indicating that early-stage rehabilitation is progressing towards ecosystem establishment.

Landscape Function Analysis

Landscape Function Analysis (LFA) monitoring was also undertaken at the rehabilitation sites greater than four years old. The results showed that all rehabilitation sites monitored recorded LFA scores above 50, confirming the stability of the sites, and as such ongoing monitoring at these sites is no longer required. However, if there is a notable visible decline in LFA parameters observed during future monitoring, reinstating LFA methods at select sites will be recommended in accordance with the WCPL BMP.

Fauna monitoring

Fauna monitoring was undertaken at both rehabilitation and local reference sites, identifying a range of bird, microbat, mammal and reptile species, including a number of species listed as threatened under the NSW *Biodiversity Conservation Act* (BC Act) 2016 and/or the Commonwealth *Environment Protection and Biodiversity Act* (EPBC Act) 1999. Pest species were also observed, highlighting the need for continued management to mitigate their impacts on rehabilitation.

Recommendations

- Maintain ongoing rehabilitation monitoring to track progress toward Completion Criteria.
- Monitor weed and pest species presence to prevent competition with native vegetation.
- Discontinue LFA monitoring at sites that have achieved LFA criteria, but continue visual erosion assessments during floristic monitoring. Significant erosion and land stability issues will continue to be monitored through visual assessments.
- Continue microbat monitoring and explore the potential for infra-red camera monitoring for ground fauna as the rehabilitation matures.
- Review WCPL rehabilitation objectives to determine if target BVT composition and structure rehabilitation objectives and completion criteria are required.
- Consider potential infill plantings at monitoring sites where canopy cover is below the Performance Criteria benchmark.
- Consider a review of rehabilitation objectives to determine if the current monitoring methodology accurately assesses the target BVT composition in accordance with required WCPL rehabilitation objectives. Specific monitoring against the BVT assemblages may assist with further guiding rehabilitation actions to achieve target BVT completion criteria.

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1. Introduction

Eco Logical Australia (ELA) was engaged by Wilpinjong Coal Pty Ltd (WCPL) to undertake annual biodiversity monitoring in 2025 in accordance with the requirements of Development Consent SSD-6764 (as modified) and the methods outlined in the revised Wilpinjong Coal Biodiversity Management Plan Version 8 (BMP; WCPL 2024). The primary objectives of the 2025 monitoring program are to evaluate the Wilpinjong Coal Mine rehabilitation progress against WCPL's approved rehabilitation performance criteria, assess landscape stability and monitor biodiversity indicators, including native and introduced fauna species.

Background

WCPL is a wholly owned subsidiary of Peabody Energy Australia Pty Ltd (Peabody). WCPL operates the Wilpinjong Coal Mine (WCM), located in the western coalfields of NSW approximately 48 km north-east of Mudgee, within the Mid-Western Regional Council Local Government Area.

The Wilpinjong Coal Mine originally operated under Project Approval (PA) 05-0021, granted under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* on 1 February 2006. A series of modifications to PA 05-0021 were approved until it was superseded by Development Consent SSD-6764 (as modified), granted on 24 April 2017 for the Wilpinjong Extension Project (WEP).

A Biodiversity Offset Strategy was developed by WCPL to offset impacts from mining on threatened species, populations or communities listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) and /or the Commonwealth *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act) in accordance with SSD-6764. The strategy comprised more than 4,500 ha of Management Domains:

- Biodiversity Offset Areas (BOAs)
- Enhancement and Conservation Areas (ECAs)
- Regeneration Areas
- Rehabilitation Areas.

In 2023, the BOAs were relinquished to the NSW National Parks and Wildlife Service to be managed as part of National Parks estate. Following relinquishment of the BOAs, the biodiversity monitoring program was redesigned to centre on monitoring the WCPL rehabilitation areas.

In accordance with Condition 36 of Development Consent SSD-6764, WCPL must demonstrate that rehabilitation meets performance and completion criteria to generate ecosystems credits to offset impacts from the WEP. These criteria apply to the following prescribed target BioMetric Vegetation Types (BVTs):

- HU547 – Fuzzy Box Woodland
- HU981 – Rough Barked Apple Woodland / HU732 – Yellow box Grassy Woodland
- HU824 – White Box-Black Cypress Pine Shrubby Woodland.

Additionally, Condition 36 and 37 of the Development Consent SSD-6764 require WCPL to meet criteria for species credit obligations associated with the critically endangered *Anthochaera Phrygia* (Regent Honeyeater). This includes demonstrating adequate habitat within the following target BVTs:

- HU697 – Mugga Ironbark-Black Cypress Pine Open Forest
- HU732 – Yellow Box Grassy Woodland
- HU825 – Narrow-leaved Ironbark-Black Cypress Pine Grass Woodland.

2. Methodology

Rehabilitation monitoring is undertaken in accordance with the BMP, focusing on vegetation assessment, landscape stability and fauna habitat and presence. Monitoring data is compared against benchmark performance and completion criteria to determine progress toward completion. Data is also collected at local reference sites for comparison.

2.1. Plot-based monitoring

Based on the WCPL rehabilitation monitoring review undertaken by ELA in 2024, rehabilitation areas are stratified based on:

- the age of rehabilitation areas since establishment
- the same final land use and target vegetation community (i.e. target BVT).

The minimum density of vegetation monitoring plots established within each stratified rehabilitation area is based on the NSW Biodiversity Assessment Method (BAM; DPIE 2020):

- <2 ha – 1 site
- >3-5 ha – 2 sites
- >5-20 ha – 3 sites
- >20-50 ha – 4 sites
- >50-100 ha – 5 sites
- >100-250 ha – 6 sites
- >250-1000 ha – 7 sites (more may be required to capture variable vegetation condition).

Under this stratification a total of 40 vegetation monitoring plots have been established, listed below in Table 2-1 and shown in Figure 2-1, with coordinate locations included in Appendix A**Error! Reference source not found.**. Monitoring of pasture rehabilitation areas has not been included as there are currently no monitoring requirements or completion criteria associated with pasture rehabilitation.

Table 2-1: Rehabilitation stratification and established monitoring plots

Stratification	Area (ha)	Minimum plots required	Monitoring plots
Post-2019, HU697	26.80	4	2021_1, 2021_2, 2023_7, R31
Post-2019, HU732	45.9	4	2021_5, 2021_7, 2023_1, 2023_4
Post-2019, HU824	187.9	6	2021_6, 2021_8, 2023_5, R23, R29, R36, R37
Pre-2019, Generic woodland	121.7	6	R6, R9, R24, R25, R34, R39
Pre-2019, HU697	14.5	3	R16, R20, R30*
Pre-2019, HU732	170.3	6	2021_3, 2021_4, R17, R18, R19, R22, R28, R35
Pre-2019, HU824	295.8	7	R14, R15, R21, R26, R27, R32, R33, R38

*R30 was removed from the monitoring rotation as the area was cleared prior to 2025 monitoring and will need to be re-established at a later date.

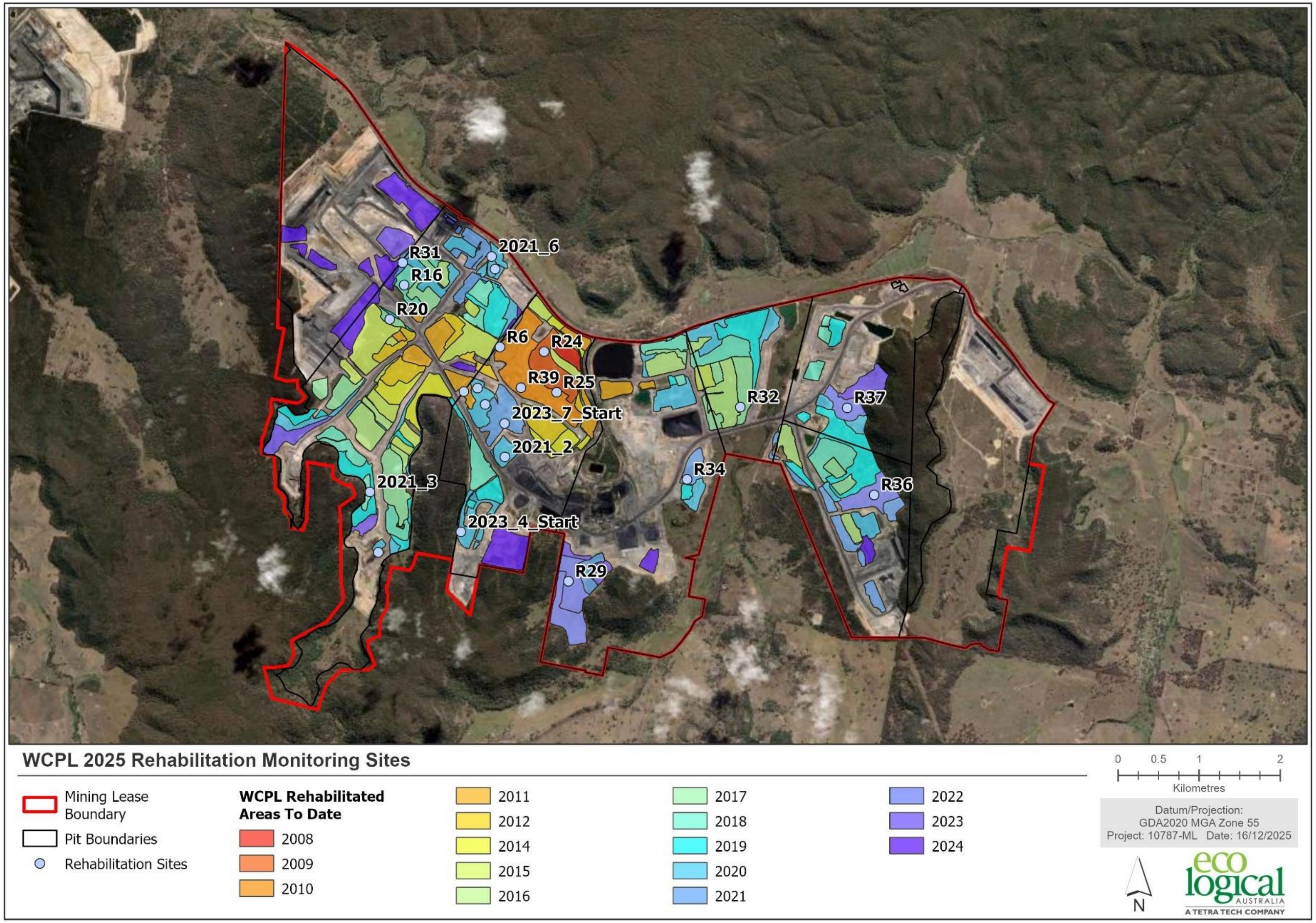

Figure 2-1: WCPL Rehabilitation monitoring sites

Two monitoring methodologies are undertaken in accordance with the BMP based on the age of rehabilitation since establishment.

Initial Establishment Monitoring (IEM)

Initial Establishment Monitoring (IEM) is a rapid style assessment for rehabilitated areas which are less than four years post-establishment. The key aim of IEM is to determine:

- germination success
- landform stability
- early threats to the rehabilitation.

Year 1 monitoring involves a walkover inspection, while Years 2 and 3 include the establishment of a 20 x 20 m quadrat (plot) for rapid assessment. The IEM monitoring parameters are further detailed in Appendix B.

Long-Term Monitoring (LTM)

The more detailed Long-Term Monitoring (LTM) program is for rehabilitation areas greater than four years post-establishment. The key objective is to evaluate progress of rehabilitation towards fulfilling the biometric performance and completion criteria prescribed in the BMP.

LTM monitoring is consistent with the BioMetric monitoring method as per the BMP and is undertaken at permanent BioMetric plots, comprising a 20m x 20m plot nested within a 20m x 50m plot (Figure 2-2).

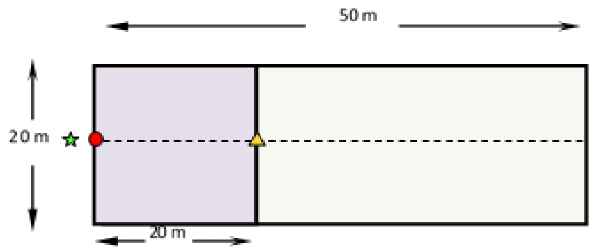

Figure 2-2: Site design (photo monitoring points)

Within each plot the following data is collected:

- Native species richness (NSR), cover and abundance within the 20m x 20m plot
- Identification of all vascular plant species to species level where possible within the 20m x 20m plot.
- Native overstorey cover (NOC) and native mid-storey cover (NMS) at 5m intervals along 50m transect (10 points)
- Native ground cover (grass, shrub, other) and exotic cover (EC) at 1m intervals along 50m transect (50 points)
- Habitat features including number of trees with hollows (NTH), length of logs (FL) and proportion of overstorey regeneration within the 20m x 50m plot.

2.2. Landscape stability

Landscape Function Analysis (LFA) monitoring follows the techniques detailed by Tongway and Hindley (2004) and the BMP (WCPL 2024), using the 50m transect method to measure stability, infiltration and nutrient cycling. Stability measured resistance to erosion, infiltration assessed soil water absorption, and nutrient cycling evaluated organic matter decomposition and recycling efficiency. LFA attributes are assessed to monitor the Landscape Organisation Index (LOI) and Soil Surface Assessment (SSA). LFA scores are produced from the SSA, derived from indices for Stability, Soil Infiltration and Nutrient Cycling providing insights into resource accumulation verses loss across the landscape.

2.2.1. Landscape Organisation Index (LOI)

The LOI characterises and maps the spatial patterns of resource loss or accumulation at a site. It calculates the proportion of the transect occupied by stable patches which are landscape elements that provide long-term stability and accumulate resources (i.e. trees, shrubs, grassy tussocks, ground cover, and logs). Patches are areas of resource loss or gain, as a result of movement downslope, and are defined by soil surface elements including perennial vegetation cover, litter or large woody debris, or rocks, which help retain soil and resources are a site. A LOI value close to 100% (1.0) implies a transect can retain resources, which is an important characteristic of a self-sustaining ecosystem. Bare soil does not contribute to LOI.

According to the LFA method, stable patches obstruct or divert water flow and/or collect/filter out material from runoff and accumulate resources. Inter-patches are areas where resources (such as water, soil material and litter) can be mobilised and freely transported either down slope by water or down-wind when aeolian processes are active.

The following data is recorded for each stable patch/inter-patch along each LFA transect:

- Distance (m) from the start of the transect
- Patch width (cm)
- Patch/inter-patch identification.

The following patch types are defined and monitored across all LFA monitoring sites and monitoring periods:

- Bare soil
- Litter (including annual plants)
- Rock (>5 cm diameter)
- Logs (>10cm diameter)
- Ground cover (perennial)
- Shrub/tree
- Cryptogram
- Any combination of the above (e.g. ground cover – litter patch).

2.2.2. Soil Surface Assessment (SSA)

The SSA provides a more detailed analysis of the transect by providing indices for Stability, Soil Infiltration and Nutrient Cycling for the whole of the landscape (transect), scored between 0 – 100.

Table 6-5 in the BMP (WCPL, 2024) outlines the Soil Surface Condition Indicators (SSCIs) that contribute to each of these three indices which are summarised in Table 2-2 below. Each patch/inter-patch type identified during the LOI assessment was subject to an SSA. A subset of up to five occurrences of each patch/inter-patch type are monitored, and data relating to 11 Soil Surface Condition Indicators (SSCIs) is collected along the 50 m transect. The sum of the three LFA indices provides the LFA score for each site.

Table 2-2: Soil Surface Condition Indicators used to determine the overall Soil Surface Analysis*

SSCI	Description
Rain splash protection	Percentage cover of perennial vegetation to a height of 0.5 m. plus rocks > 2 cm and woody material > 1 cm in diameter or other long-lived, immoveable objects.
Perennial vegetation cover	Percentage perennial vegetation cover.
Litter	Percentage cover of annual grasses and ephemeral herbage (both standing and detached) as well as detached leaves, stems, twigs, fruit, dung, etc.
Cryptogam cover	Percentage cover of algae, fungi, lichens, mosses, liverworts and fruiting bodies of mycorrhizas.
Crust brokenness	Categorises soil crusts from 0-4 where 0 refers to 'no crust present' and 4 refers to an 'intact and smooth' soil crust.
Soil erosion type and severity	Categorises the aerial extent and severity of various erosion types from 'Insignificant' to 'Severe'.
Deposited materials	Categorises the extent and depth of deposited alluvial material
Soil surface roughness	Categorises the depth of surface depressions from 'smooth' to 'deep' depressions.
Surface nature (resistance to disturbance)	Categorises the soils capacity to resist disturbance based on the soils 'hardness' or 'brittleness'.
Slake Test	Categorises the soils stability when exposed to water
Texture	Categorises the soils water infiltration capacity from 'very slow' to 'high'

*Table 6-5 BMP: WCPL, 2024

Baseline Data for the Slake Test and Texture SSCIs was used for the LFA analysis and was not assessed in the field in 2025. All other parameters were assigned a score in the field. Data was entered into the LFA calculation spreadsheets and used to calculate Soil Stability, Soil Infiltration and Nutrient Cycling indices.

2.3. Fauna Monitoring

Terrestrial fauna monitoring followed the methods prescribed within the BMP (WCPL 2024), summarised in Table 2-3. The locations of fauna monitoring sites are shown in **Error! Reference source not found.** below.

Table 2-3: Fauna monitoring methods summary

Target Species	Methodology	Total Survey Effort
Birds	Bird survey consisting of 10 minutes recording all birds seen/heard within 50 m radius of central plot point, and further 10 minutes recording all birds seen/heard within balance of a 2-ha plot. Call playback for the Critically Endangered Regent Honeyeater was played during surveying.	40 total minutes per site (20 minutes per survey, per person, per site).
Ground fauna (amphibians, mammals, reptiles)	Rocks and logs including augmented habitat features were searched for reptiles.	Searches were conducted during spring bird surveys.

Target Species	Methodology	Total Survey Effort
Bats	Automated ultrasonic acoustic recording to identify all bat species occurring.	Recording for one night (6pm – 6am), at ten local reference sites and five rehabilitation sites.
Mammals	Opportunistic collection of scats and observations of tree scratching's, animal tracks and paw prints.	Opportunistic
All	Any sightings of fauna recorded whilst moving throughout WCPL owned land and located using a GPS.	Opportunistic

2.4. Local reference sites

WCPL maintains 15 reference sites identified and established by ELA ecologists in 2021 to align with the target rehabilitation vegetation communities (Appendix A1:). Reference site monitoring methods are consistent with the rehabilitation monitoring methods summarised above.

The BMP prescribes a three-year rotational schedule for reference site monitoring spread across two seasons – autumn and spring. ELA maintains a dataset of reference site monitoring results to provide a point of comparison for rehabilitation monitoring as per the performance criteria in the BMP.

Following the transition of WCPL's biodiversity monitoring program from offset areas to rehabilitation areas, rehabilitation monitoring is now conducted only in spring and therefore autumn monitoring data from reference sites is not directly comparable. ELA's 2024 monitoring report made the recommendation to only monitoring reference sites in spring going forward. Consistent with the recommendations, 10 reference sites were monitored in spring 2025, with five sites per spring on three year rotation to be implemented from 2026.

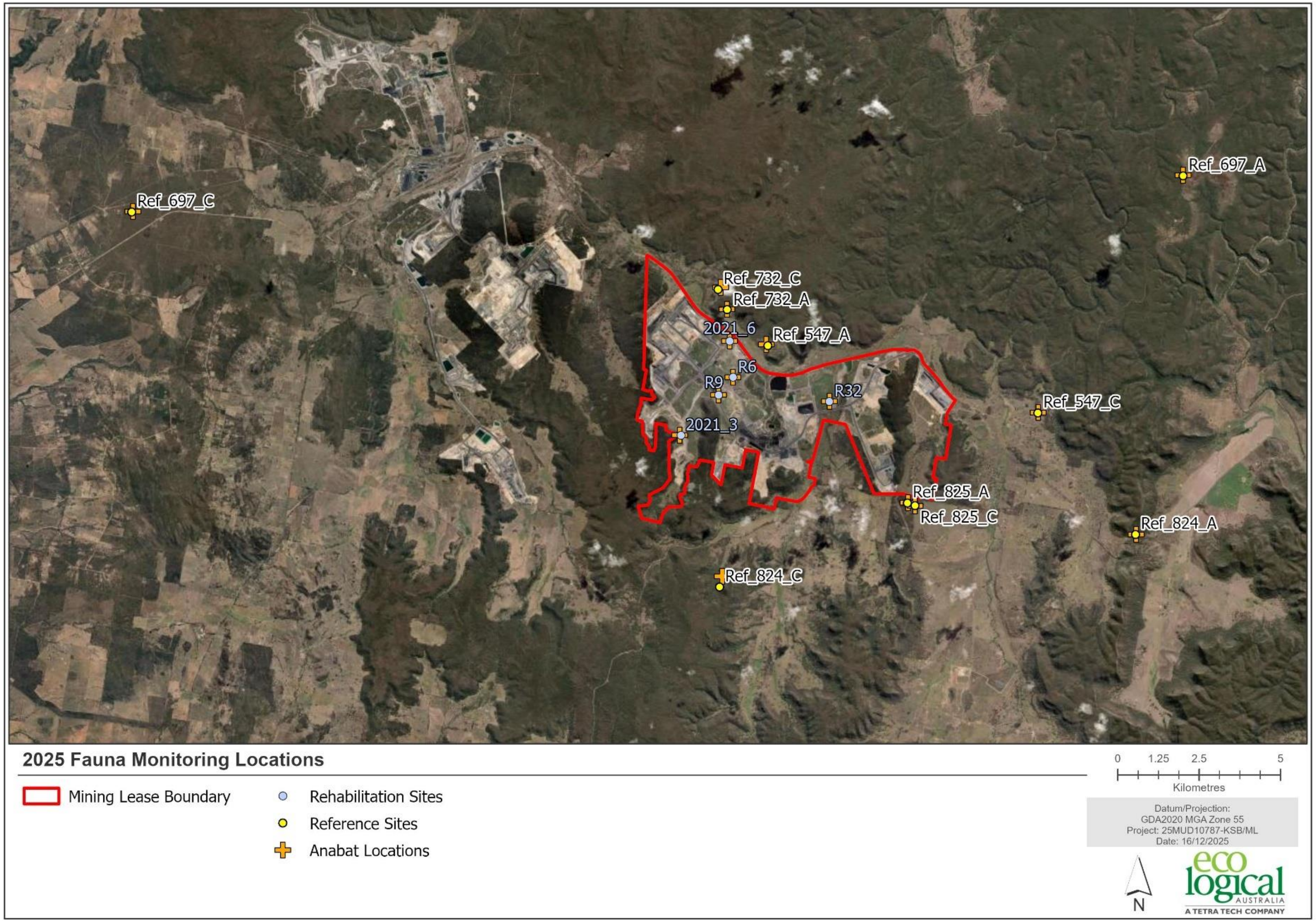

Figure 2-3: 2025 Fauna monitoring sites

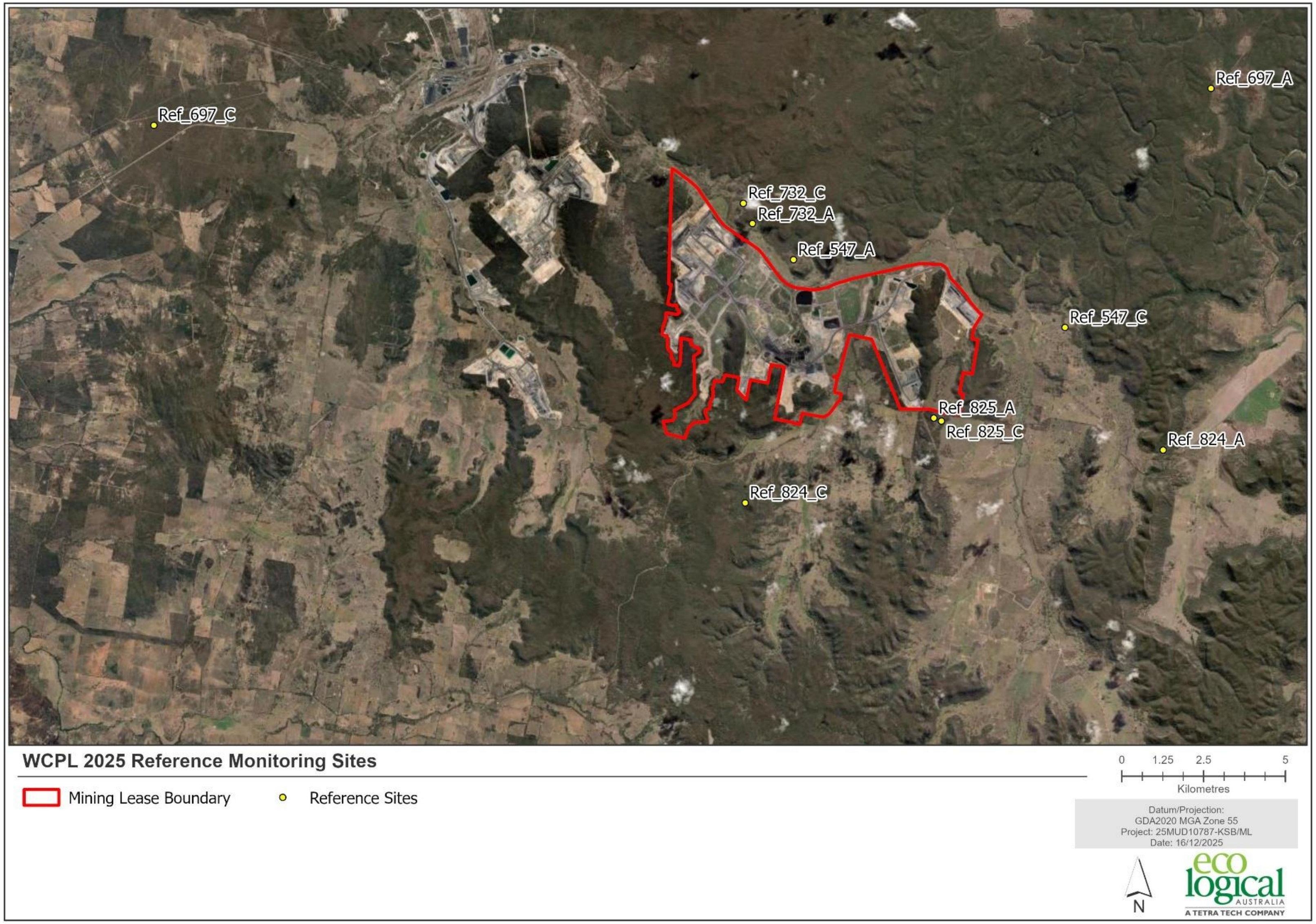

Figure 2-4: 2025 local reference sites

2.5. Monitoring schedule

The required monitoring frequency for each method is presented in Table 2-4.

Table 2-4: Monitoring frequency summary

Monitoring Phase	Methods and Analysis	Frequency / Timing
Annual Rehabilitation Walkover Inspection	Rapid style assessment to identify any areas of rehabilitation failure or maintenance requirements.	Annually in spring
Initial Establishment Monitoring - IEM	Detailed in Appendix B	For areas less than four years post-rehabilitation establishment. < 1 year: walkover inspection >2 years to <4 years: Annual monitoring in spring Monitoring consistently in the same season (spring).
Long-Term Monitoring - LTM Rehabilitation sites	Detailed in Appendix B	For areas four years and above post-rehabilitation establishment >4 years to <10 years: Monitor every second year >10 years: Monitor every third year Monitoring consistently in the same season (spring)
Landscape Function Analysis (LFA) (or alternative method)	Section 9.2 and 9.6 of the BMP	Concurrently with LTM sites or as otherwise agreed with WCPL
Fauna	Section 9.4 of the BMP	Fauna monitoring in rehabilitation areas commences after five years of establishment, therefore five selected long term established rehabilitation sites were monitored in spring 2025.
Local reference sites	Consistent with LTM methods and fauna	Per the BMP, 15 local reference sites are monitored on the three yearly cycle, with five sites monitored in each autumn and spring. Consistent with the recommendations of the 2024 monitoring report, 10 reference sites were monitored in spring 2025, with five sites per spring on a three year rotation to be implemented from 2026.

Based on the monitoring frequency presented above and building on the monitoring program completed in 2024, the full rehabilitation site monitoring schedule is presented below in Appendix C with the Local reference site monitoring schedule presented in Appendix C1:.

3. Results and discussion

Monitoring was undertaken in October and November 2025 by ELA Ecologists Natalie De Losa, Ellie Young and Dr Cheryl O'Dwyer. Weather conditions throughout the monitoring period were generally warmer than average temperatures, with below average rainfall throughout the monitoring period (Appendix C).

3.1. IEM monitoring

Year 3 IEM monitoring was conducted at three sites, R29, R36 and R37 in accordance with the Year 2 – 3 methods detailed in Appendix B. Bare ground and weed cover were proportionally higher at one site, R29, whilst weed cover was higher at R36 in proportion to native species. Whilst bare ground was proportionally dominant at R37, weed cover was lower compared to native species. IEM monitoring results are presented below in Table 3-1.

Table 3-1: IEM monitoring results

Site	Erosion	Bare ground	Weed cover	Proportion native species	Tree stem density	General notes
R29	-	30%	60%	8%	-	Groundcover includes 5% litter cover
R36	-	15%	60%	15%	-	Groundcover includes 10% litter cover
R37	-	30%	15%	25%	-	Groundcover includes 15% litter cover and large woody debris

*Listed as 'native species richness' in methods, to be amended for future monitoring

IEM results provide an indication of germination, landform stability and early threats to rehabilitation. Increased weed cover in proportion to native species and areas of bare ground present potential threats to rehabilitation success. Ongoing focus on weed control is recommended. These three sites will transition to LTM monitoring in 2026 which will provide greater detail on performance.

3.2. LTM monitoring

Sixteen LTM plots were monitored in 2025. Five of the LTM plots were established and monitored for the first time in 2025, in rehabilitation areas that had been reworked from targeted agricultural landscape rehabilitation to generic woodland vegetation; and rehabilitation that was seeded in 2021 to target HU697.

Six of the sites monitoring in 2025 are in rehabilitation areas that were established in 2009 – 2011. These areas were deigned to meet a 'generic woodland' vegetation community and therefore do not correspond to a specific BVT.

During spring ten local reference sites were monitored. Whilst Table 9-1 of the BMP (WCPL 2024) proposes a three yearly rotation including both autumn and spring monitoring of five local reference sites per season, in 2025 all ten local reference sites were monitored in spring. Whilst this is a departure from the BMP, as all rehabilitation monitoring is now undertaken in spring, autumn reference site data would not be comparable. Therefore all reference site monitoring will be conducted in spring going forward, on a three year rotational schedule (Appendix C1:).

A total of 322 plant species were recorded across all rehabilitation sites and local reference sites monitored during spring 2025, consisting of 218 native species, 95 exotic species and nine species that could not be identified as either native or exotic due to lack of plant material. A complete list of flora species recorded during the 2025 monitoring period is included in Appendix E.

3.2.1. Assessment against approved Performance Criteria and Completion Criteria

A Site Value Score (SVS) was calculated for sites monitored in areas of rehabilitation with a target BVT, using the BioMetric Tool (NSW Department Environment Climate Change and Water, DECCW 2011) which combines the quality and quantity of native vegetation by measuring ten condition variables within a plot compared to the pre-European benchmarks for the BVT.

The SVS and contributing scores are assessed against Interim Performance Criteria (for rehabilitation areas less than 10 years post establishment) and Completion Criteria (for rehabilitation areas greater than 10 years post establishment) benchmarks for the target vegetation communities (BVT), in accordance with the criteria detailed in the BMP (and included in Appendix F).

Evaluation of each monitoring parameter against the Interim Performance Criteria and Completion Criteria is undertaken to determine if the results activate the WCPL Interim Performance Criteria Trigger Action Response Plan (TARP) detailed in Tables 10-1 (Performance) and 10-2 (Completion) of the BMP.

3.2.1.1. Assessment against Performance Criteria

All sites monitored in 2025 within areas of rehabilitation with a target BVT are less than 10 years post-establishment, and are therefore assessed against Interim Performance Criteria for the target BVT, presented in Table 3-2 below.

A colour coding system has been applied to all site attribute results:

- GREEN indicates site attributes that have met the relevant Performance Criteria (indicating that no additional management intervention is required)
- RED indicates site attributes that have not met the relevant Performance Criteria, triggering actions under the TARP.

Table 3-2: Assessment against WCPL Rehabilitation BioMetric Interim Performance Criteria Benchmarks for Rehabilitation Sites within their respective BVT

BVT	Site	Site attributes (% cover)										
		SVS	NSR	NOC	NMC	NGCG	NGCS	NGCO	EC	NTH (Count)	OR	FL (M)
HU697	Performance Criteria Benchmark	7	5.5-12.5	2.13-46	1-100	0.5-24	1-10	0-40	<90%	NA	NA	4.65
	R31	44	16	0	2	10	0	4	54	0	0	0
	2021_1	42	23	0	1.8	34	0	0	50	0	0	0
	2021_2	44	23	0	3	16	0	0	28	0	0	0
	2023_7	45	37	0	8.4	46	4	20	24	0	0	0
	R16	29	7	0	0	12	0	4	34	0	0	52
	R20	21	7	0	0	0	0	0	62	0	0	0
HU732	Performance Criteria Benchmark	7	4.25-11.25	1.88-56	0.5-100	0.25-100	0-10	0.25-76	<90%	NA	NA	3.13
	2021_5	44	14	0	0	10	0	0	42	0	0	0
	2021_7	48	25	0	0	14	0	4	60	0	0	0
	2023_1	48	36	0.1	0.1	14	0	4	6	0	0	0
	2023_4	61	27	24	5.1	4	2	4	24	0	0	35

SVS = Site Value Score, NSR = Native Plant Species Richness, NOC = Native Overstorey Cover, NMC = Native Midstorey Cover, NGCG = Native Ground Stratum Cover (grasses), NGCS = Native Ground Stratum Cover (shrubs), NGCO = Native Ground Stratum Cover (other), EC = Exotic Plant Cover, NTH = Number of Trees with Hollows, OR = Overstorey Regeneration and FL = Length of Fallen Logs

All sites met the Performance Criteria benchmark SVS score. However, results for individual monitoring parameters were variable:

- Most sites exceeded the native species richness criteria range. Whilst this is not typically a detrimental factor, it does indicate that multiple native species are present which are not associated with the specific BVT. This was also reflected at the local BVT reference sites, further discussed in Section 3.2.1.3 below.
- Only one site achieved the native overstory cover criteria. This is not unexpected for areas of relatively new rehabilitation and would be expected to improve over time as overstory cover species mature. However, further investigation may be required to evaluate the success of overstory species establishment specific to the target BVT species list.
- Native midstory cover results were variable, with half of the sites not yet achieving the performance criteria. Similar to overstory cover, this would be expected to improve over time as the vegetation matures. Dominance from groundcover species, especially exotic species, may impact success of midstory species establishment. Further discussed in Section 3.2.1.3 below, the local reference sites measured low midstory cover.
- Most sites achieved the native groundcover grasses criteria. Two sites exceeded, which, similar to the native species richness criteria, is not of great concern but does indicate that multiple native species are present which are not associated with the specific BVT. One site, R20, did not achieve the native groundcover grasses criteria, due to almost total dominance from exotic groundcover species including *Lolium rigidum* (annual ryegrass) and *Plantago lanceolata* (ribwort plantain).
- Only one of the HU697 target BVT sites met the native groundcover shrubs criteria. Dominance from groundcover species, especially exotic species, may impact success of shrub species establishment. All of the HU732 sites met the criteria, noting that it is zero (0) for that BVT benchmark. Low shrub cover was also measured at the local reference sites.
- One HU732 site did not meet the native groundcover other criteria, again noting that the range is zero (0) for the HU697 benchmark and 0.25 for the HU732.
- Exotic cover was high as all sites, although all still were under the performance criteria of less than 90% exotic cover. Exotic species recorded were mostly groundcover species.
- Hollow-bearing trees and overstory regeneration was not present at any of the sites, however as the criteria for these parameters is either nil or reflective of the presence of overstory species, all sites achieved the criteria.
- The fallen logs criteria was only met at two sites, and is reflective of the placement of logs in proximity to the monitoring plot. Spreading out the distribution of logs and large woody debris at a later date would counter this.

3.2.1.2. Assessment against Completion Criteria

The six generic woodland sites in areas of rehabilitation greater than 10 year post-establishment do not relate to a specific BVT and therefore cannot be accurately evaluated against a relevant Completion Criteria. However, to provide some measure of success of the rehabilitation in these areas, monitoring results have been compared against each of WCPLs five target BVT Completion Criteria to provide an indication of success, shown in Table 3-3 below, and consideration against the WCPL Completion Criteria (Post 10 years) TARP (Table 10-2 of the BMP). A SVS was not calculated as a specific BVT benchmark was not assigned.

Table 3-3: Assessment against WCPL Rehabilitation BioMetric Completion Criteria Benchmarks for 'Generic woodland' rehabilitation greater than 10 years post-establishment

		Site attributes (% cover)										
		SVS	NSR	NOC	NMC	NGCG	NGCS	NGCO	EC	NTH (Count)	OR	FL (M)
BVT	HU547	17	7.5-22.5	3.75-52	1.25-100	1-100	0.5-20	0.5-68	<45%	NA	0.25%	9.56
	HU732		8.5-31	2.25-56	0.5-20	0.5-100	0.5-20	0.5-76				6.25
	HU697		11-25	4.25-46	2.5-100	1-24	1.25-20	0-40				9.5
	HU824		13.5-30.5	3.18-61	2.5-100	0-36	1.25-20	0.5-76				16.5
	HU825		13.5-26	4.13-54	2.75-100	0-104	1.25-20	0-68				14.5
Generic Woodland[1]	R6	-	20	6	7.9	42	0	6	6	0	30	0
	R9		19	3.2	1.5	46	0	6	18	0	20	8
	R24		30	11.8	2.5	4	2	2	8	0	40	0
	R25		21	0	2	20	12	2	8	0	0	0
	R34		17	0.1	0.1	30	0	12	36	0	10	0
	R39		26	0.4	5.6	10	0	6	12	0	10	0

SVS = Site Value Score, NSR = Native Plant Species Richness, NOC = Native Overstorey Cover, NMC = Native Midstorey Cover, NGCG = Native Ground Stratum Cover (grasses), NGCS = Native Ground Stratum Cover (shrubs), NGCO = Native Ground Stratum Cover (other), EC = Exotic Plant Cover, NTH = Number of Trees with Hollows, OR = Overstorey Regeneration and FL = Length of Fallen Logs

[1] 'Generic Woodland' does not conform to a specified BVT within the BMP and therefore does not have relevant performance criteria to compare against.

Whilst assessment against the BVT specific completion criteria is not directly relevant for the generic woodland sites, it does provide a measure of general success and may also be useful to guide future management activities to transition these areas to the target BVTs. Of note from the assessment includes:

- Overstory cover is low or lacking at most sites.
- Midstory and shrub cover are low at all sites.
- Overstory regeneration is low at all sites, reflective of the low overstory cover.
- Fallen logs are low at all sites.

3.2.1.3. Local Reference Site assessment against Completion Criteria

Ten local reference sites in the target BVTs were monitored in 2025 and have been compared against the relevant BVT Completion Criteria, presented below Table 3-4. This comparison is useful to provide local context to the rehabilitation monitoring results by providing data from the natural environment. Of note from the reference site monitoring results:

- Native species richness was high at almost all sites, indicating that the functional BVT contains more native species than the benchmark criteria range.
- Native grasses were also higher than the Completion Criteria range at reference site HU 824 A.
- Mid-story and shrub cover were both low at most sites, indicating that the benchmark range for these parameters may not be reflective of the natural environmental. Most rehabilitation sites scored low for these parameters.
- Exotic cover is low at all sites, well below the 45% cover benchmark range. This indicates that exotic species and weed incursion from land disturbance (including previous agricultural activities) is prevalent in the rehabilitation, but is not affecting the local reference sites.
- Fallen logs is high at all sites, demonstrating the prevalence of this feature in the natural environment.

Table 3-4: 2025 Reference Site BioMetric Data

Vegetation Community	Site	Site attributes (% cover)										
		SVS	NSR	NOC	NMC	NGCG	NGCS	NGCO	EC	NTH	OR	FL (m)
HU547	Completion criteria benchmark	17	7.5-22.5	3.75-52	1.25-100	1-100	0.5-20	0.5-68	<45%	NA	0.25%	9.56
	547 A	49	45	11.1	0.9	18	0	24	20	1	0.4	37
	547 C	42	21	19.7	0.5	44	0	20	0	3	0.8	39
HU697	Completion criteria benchmark	17	11-25	4.25-46	2.5-100	1-24	1.25-20	0-40	<45%	NA	0.25%	9.5
	697 A	63	55	12.8	10.1	28	2	16	0	1	0.5	25
	697 C	58	29	10.7	20.8	4	10	0	0	0	0.4	15
HU732	Completion criteria benchmark	17	8.5-31	2.25-56	0.5-20	0.5-100	0.5-20	0.5-76	<45%	NA	0.25%	6.25
	732 A	41	58	9.8	0	44	0	24	8	0	0.4	21
	732 C	59	32	14.8	1.3	30	0	28	0	1	0.6	26
HU824	Completion criteria benchmark	17	13.5-30.5	3.18-61	2.5-100	0-36	1.25-20	0.5-76	<45%	NA	0.25%	16.5
	824 A	61	35	8.8	25.6	40	8	12	0	4	0.3	93
	824 C	61	50	23.7	14.2	20	8	0	0	4	1	24
HU825	Completion criteria benchmark	17	13.5-26	4.13-54	2.75-100	0-104	1.25-20	0-68	<45%	NA	0.25%	14.5
	825 A	58	62	12.6	16.9	20	6	24	0	0	0.5	-
	825 C	52	50	9.7	30	38	20	18	2	0	0.4	-

SVS = Site Value Score, NSR = Native Plant Species Richness, NOC = Native Overstorey Cover, NMC = Native Mid storey Cover, NGCG = Native Ground Stratum Cover (grasses), NGCS = Native Ground Stratum Cover (shrubs), NGCO = Native Ground Stratum Cover (other), EC = Exotic Plant Cover, NTH = Number of Trees with Hollows, OR = Overstorey Regeneration (percentage of over-story species that are naturally regenerating) and FL = Length of Fallen Logs

3.3. Landscape Function Analysis

Landscape Organisation Index (LOI) is an output from the LFA. The LOI is a function of the proportion of a transect occupied by patches. Patches are areas of resource loss or gain, as a result of movement downslope, and are defined by soil surface elements including perennial vegetation cover, litter or large woody debris, or rocks, which help retain soil and resources are a site. A LOI value close to 100% (1.0) implies a transect can retain resources, which is an important characteristic of a self-sustaining ecosystem. Bare soil does not contribute to LOI.

As per Section 6.2 of the BMP, a self-sustaining ecosystem is deemed to have been achieved when SSA scores of 50 or more are recorded (the LFA Completion Criteria, expected to be achieved by Year 10 of the management cycle). Incremental improvement toward that target is expected with each year of monitoring.

LFA monitoring was undertaken at the 16 LTM sites in 2025, with the results presented below in Table 3-5.

Table 3-5: Rehabilitation LFA monitoring results

Site	Landscape Organisation Index (%)	Soil Surface Assessment			LFA Score (sum of stability, infiltration and nutrient cycling)
		Stability	Infiltration	Nutrient cycling	
R31	1.00	46.4	25.1	17.9	89.4
2021_1	1.00	49.7	40.4	26.8	116.9
2021_2	1.00	42.9	19.8	10.2	72.9
2023_7	1.00	47.4	25.3	14.6	87.3
R16	1.00	42.9	25.1	15.5	83.5
R20	1.00	42.3	23.4	14.1	79.8
2021_5	1.00	45.8	22.4	14.1	82.4
2021_7	1.00	46.9	23.3	12.8	83
2023_1	1.00	45	24.4	16.4	85.8
2023_4	1.00	52.4	23	14.9	90.3
R6	1.00	75.8	33.7	21.8	131.3
R9	1.00	53.1	28.6	23.1	104.8
R24	1.00	51.2	28.8	24.2	104.3
R25	1.00	79.8	27.1	22.4	129.3
R34	1.00	48.7	25.9	11.7	86.3
R39	1.00	47.2	23.3	16.3	86.8

All sites monitored achieved the target LFA score of 50 or more to be deemed a self-sustaining stable landform in accordance with the BMP. No further analysis is required and LFA monitoring is no longer required at these sites.

3.4. Fauna Monitoring

Fauna monitoring was undertaken at five sites within the rehabilitation areas in 2025, and 10 reference sites. A range of mammals, reptiles and birds were recorded across all sites, with birds as the dominant group consistent with previous years. All fauna species recorded are included in Appendix G.

Within the five rehabilitation fauna sites, bird species richness and diversity ranged, from seven species at R9 7 to 18 recorded at 2021_3. Monitoring was only undertaken in spring 2025 therefore presents a reduced overall species richness from 2024, when monitoring was conducted in three seasons, however the species richness in the spring period has increased since 2024 (Table 3-6). This result indicates that rehabilitation areas are increasingly supporting foraging habitat for a range of bird species.

Table 3-6: Bird species richness

Season	Number of bird species recorded				
	R6	R9	2021_3	2021_6	R32
Spring 2024	10	12	13	6	8
Spring 2025	12	7	18	15	8

Table 3-7 outlines the nectivorous bird species (i.e. feed on nectar) recorded on rehabilitation sites in 2025. These species serve as surrogates to assess whether the rehabilitation areas and local reference sites can support the critically endangered Regent Honeyeater (*Anthochaera phrygia*) as per section 6.3 of the BMP (2021).

While the Noisy Miner (*Manorina melanocephala*) shares similar habitat and dietary requirements with the Regent Honeyeater, it is a dominant species that outcompetes the Regent Honeyeater in the wild.

The '*Aggressive exclusion of birds from woodland and forest habitat by over-abundant Noisy Miner*' is listed as a key threatening process under both the NSW BC Act and EPBC Act.

Table 3-7: Nectivorous species recorded at Rehabilitation Sites

Scientific name	Common Name
Caligavis chrysops	Yellow-faced Honeyeater
Lichenostomus penicillatus	White-plumed Honeyeater
Acanthagenys rufogularis	Spiny-cheeked Honeyeater
Lichenostomus leucotis	White-eared Honeyeater
Acanthorhynchus tenuirostris	Eastern Spinebill
Philemon corniculatus	Noisy Friarbird
Dicaeum hirundinaceum	Mistletoebird
Manorina melanocephala	Noisy Miner
Anthochaera carunculate	Red Wattlebird

3.4.1. Microbat Monitoring

Microbats were monitored during spring 2024 at five rehabilitation sites and 10 reference sites. A summary of the results is provided in **Error! Reference source not found.**, with the full ultrasonic analysis report attached as Appendix H.

Nine microbat species could be positively (definite) identified based on the call profiles, with these species recorded within both the rehabilitation and the reference sites. One further species was probable at site R6. A further 14 species complex records were identified, where species breakdown was not possible due to overlapping call profiles.

The microbat monitoring report confirms that the rehabilitation areas continue to experience a high usage by microbat species, consistent with the reference sites. Ongoing success and maturation of the rehabilitation will further contribute to the provision of foraging habitat for these species.

3.4.2. Ground Fauna Monitoring

Two native mammals were recorded within rehabilitation areas, Red-necked wallaby and Eastern grey kangaroo. One reptile species *Pogona barbata* (Bearded dragon) was recorded at R25. Fiver further reptile species were recorded at the reference sites.

Three pest species were recorded on the rehabilitation sites in 2025, *Sus scrofa (*Feral pig), *Lepus euroaeus* (Brown hare) and *Dama dama* (Fallow deer). These three species are consistent with the 2024 monitoring.

As outlined in the BMP (WCPL 2024), '*Control of feral fauna populations is considered essential to the success of any revegetation/regeneration works as these species have the potential to damage establishing vegetation through grazing and/or tramping*'. Existing management plans targeting Feral Pigs should continue to ensure populations remain low. Fallow Deer, which were recorded in 2023 in a herd of 10 at R9, were again observed in 2024, with a herd of 3 individuals within R22 and R29. This species poses a significant threat to shrubs and trees, requiring ongoing monitoring and management.

4. Assessment against contingency plans and response

The monitoring results recorded in 2025 have been assessed against the relevant criteria in the BMP to determine if the BMP TARPs are triggered, and the resulting required actions.

4.1. Rehabilitation site performance against Performance Criteria

All monitored rehabilitation sites less than 10 years old are assessed against the Performance Criteria (Section 3.2.1.1 above) to determine if the Performance Criteria Tarp is triggered per Table 10-1 of the BMP.

4.1.1. Trigger

All sites exceeded the SVS benchmark of 7. A range of individual parameters did not meet the Performance Criteria, including an exceedance of the native species richness, and not meeting the minimum for overstory cover, midstory and shrubs (Section 3.2.1.1 above).

4.1.2. Action

The actions in the TARP have been considered for these parameters. Comparison against the reference site data has been undertaken which indicates that the species richness, midstory and shrub parameters are generally consistent with the natural environment.

4.1.3. Response

The TARP responses relate directly to achieving overall SVS, which all sites currently do.

4.1.4. Plan / recommendations

A detailed analysis of each parameter is included above in Section 3.2.1.1. Key items are included below.

4.1.4.1. Overstorey Cover

No site met the Performance Criteria for native overstorey cover. The lack of overstory species cover is generally associated with the age of the rehabilitation is expected to increase over time as vegetation matures. Overstorey cover could be increased through infill plantings of canopy cover species.

4.1.4.2. Fallen logs

Multiple sites did not meet the criteria for fallen logs. Piles of logs are evident through the rehabilitation and would be expected to become more widely distributed over time.

4.2. Rehabilitation site performance against Completion Criteria

The six generic woodland sites in areas of rehabilitation greater than 10 year post-establishment do not relate to a specific BVT and therefore cannot be accurately evaluated against a relevant Completion Criteria. However, to provide some measure of success of the rehabilitation in these areas, monitoring results have been compared against each of WCPLs five target BVT Completion Criteria to provide an indication of success, detailed in Section 3.2.1.2 above. A SVS was not calculated as a specific BVT benchmark was not assigned, therefore consideration against the WCPL Completion Criteria (Post 10 years) TARP (Table 10-2 of the BMP) is not possible as all response relates to the SVS.

4.3. Landscape Function Analysis (LFA)

All monitored sites exceeded the LFA score of 50, meaning LFA monitoring is no longer required at these sites (as per Section 6.2 of the WCPL BMP). Assessment against the LFA TARP is not required as all sites have already achieved target.

Future reinstatement of LFA monitoring at sites which have exceeded an LFA score of 50 may be recommended if vegetation cover declines, soil stability decreases, or erosion is observed.

4.4. Key Recommendations

- Maintain ongoing rehabilitation monitoring to track progress toward Completion Criteria.
- Monitor weed and pest species presence to prevent competition with native vegetation.
- Discontinue LFA monitoring at sites that have achieved LFA criteria, but continue visual erosion assessments during floristic monitoring. Significant erosion and land stability issues will continue to be monitored through visual assessments.
- Continue microbat monitoring and explore the potential for infra-red camera monitoring for ground fauna as the rehabilitation matures.
- Review WCPL rehabilitation objectives to determine if target BVT composition and structure rehabilitation objectives and completion criteria are required.
- Consider potential infill plantings at monitoring sites where canopy cover is below the Performance Criteria benchmark.
- Consider a review of rehabilitation objectives to determine if the current monitoring methodology accurately assesses the target BVT composition in accordance with required WCPL rehabilitation objectives. Specific monitoring against the BVT assemblages may assist with further guiding rehabilitation actions to achieve target BVT completion criteria.

5. References

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Appendix A Rehabilitation monitoring sites

Site	Vegetation Class/BVT	Easting	Northing
R6	Generic Woodland	769566	6419516
R9	Generic Woodland	769120	6418969
2021_1	HU 697	769385	6418808
2021_2	HU 697	769629	6418160
2021_3	HU732	767926	6417731
2021_4	HU732	767571	6418373
2021_6	HU 824	769464	6420638
2021_5	HU 732	769504	6420477
2021_7	HU 824	769290	6419007
2021_8	HU 824	769565	6418209
2023_1	HU 732	768064	6416986
2023_4	HU 732	769083	6417235
2023_5	HU 824	774128	6417400
2023_7	HU 697	769623	6418575
R14	HU697	768884	6420462
R15	HU697	768675	6420146
R16	HU697	768389	6420288
R17	HU732	767090	6418544
R18	HU732	767876	6418828
R19	HU732	768171	6419172
R20	HU697	768198	6419860
R21	HU697	769466	6419915
R22	HU732	768971	6419800
R23	HU697	769708	6419896
R24	Generic Woodland	770112	6419471
R25	Generic Woodland	770266	6418956
R26	HU697	769319	6417949
R27	HU697	769566	6419516
R28	HU732	768178	6417988
R29	HU697	770411	6416627
~~R30~~	~~HU697~~	~~769566~~	~~6419516~~*
R31	HU697	768372	6420539
R32	HU824	772527	6418768
R33	HU824	771674	6419463
R34	HU824	771871	6417883
R35	HU824	768248	6420826
R36	HU824	774188	6417700
R37	HU824	773835	6418770
R38	HU824	773781	6418154
R39	Generic Woodland	769820	6419030

* Site R30 was removed from the monitoring rotation as the area had been cleared prior to monitoring.

A1: Reference sites

Site	Easting	Northing	Vegetation Community
Ref 547_A	770637	6420489	BVT 547 – Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW Southwestern Slopes Bioregion
Ref 547_B	770151	6420878	
Ref 547_C	778934	6418422	
Ref 697_A	783397	6425717	BVT 697 – Mugga Ironbark – Black Cypress Pine shrub/grass open forest of the upper Hunter Valley, mainly Sydney Basin Bioregion
Ref 697_B	747549	6410089	
Ref 697_C	751096	6424600	
Ref 732_A	769389	6421602	BVT 732 – Yellow Box grassy woodland on lower hillslopes and valley flats in the southern NSW Brigalow Belt South Bioregion
Ref 732_B	771183	6415608	
Ref 732_C	769183	6422270	
Ref 824_A	781933	6414689	BVT 824 – White Box – Black Cypress Pine shrubby woodland of the Western Slopes
Ref 824_B	779295	6419440	
Ref 824_C	769159	6413074	
Ref 825_A	774926	6415657	BVT 825 – Narrow-leaved Ironbark – Black Cypress Pine shrub – grass woodland upper Hunter and north Wollemi
Ref 825_B	774805	6415400	
Ref 825_C	775163	6415574	

Appendix B IEM and LTM methodology

Initial Establishment Monitoring (IEM) for Native Vegetation		
Rehabilitation age	≤ 3 years old	
Monitoring site dimensions	20m x 20m	
Monitoring Attribute	Data Collection Method	Deliverable
General	Year 1: Walkover only	Year 1: Year 1 areas to be covered by the annual rehabilitation walkover inspection, and any relevant observations included in the Annual Management Actions Report
General	Years 2-3: Plot established, photo reference points taken and general monitoring Plot information recorded.	Years 2-3: Rapid assessment plots to be established with wooden pegs at each corner, labelled with site name on durable tag. Photo reference points are to be taken from each of the four sides of the plot, equidistant from the two closest corner points, facing the opposite side of the plot. Within the 20m x 20m plot, note general comments such as rocks present, presence/absence of topsoil, significant weed infestations, evidence of fire or drought and other factors likely to influence rehabilitation development.
Erosion	Note presence and maximum depth of erosion gullies or rills within the 20m x 20m plot. Note whether erosion gullies or rills are active or stable.	Presence of erosion in the following categories, with reference to maximum observed depth: ● Minor sheet erosion or rills (<100 mm) ● Sheet erosion or rills (100 mm -<300 mm) ● Rills (300 mm - <500 mm) ● Gullies (500 mm -<1m) ● Major gully (≥1m)
Bare ground	Visually estimate the proportion of the 20m x 20m site containing bare ground (i.e. the proportion of the ground where vegetation, litter, logs and rocks (>5cm diameter) are absent.	Total bare ground as a percentage (%).
Weed cover	Rapid Assessment: within the 20m x 20m site note presence of “high threat exotic” weed species (as defined in BAM), "Priority Weeds" for the LLS region (as identified in relevant Regional Strategic Weed Management Plan) and other exotics that occur in high density/abundance and require management. Estimate foliage cover of each species recorded.	Total weed cover (High Threat Exotic, Priority Weeds’ and ‘Other Exotics’) to be provided as a percentage (%).
Proportion native species (previously labelled ‘native species richness’)	Rapid Assessment (approx. 15 minutes): within the 20m x 20m site record native species present and note whether they are “dominant”, “common” or “uncommon”.	Determine the proportion (%) of all flora species recorded in the rapid assessment that are native.
Tree stem density	Record number of tree stems in the 20m x 20m site (tree’ species	Determine tree stem density as stems/ha.

Initial Establishment Monitoring (IEM) for Native Vegetation	
	consistent with BAM definition)

Long Term Monitoring (LTM) for Native Vegetation		
Rehabilitation age	≥ 4 years old	
Monitoring site dimensions	20m x 50m (extension of the 20m x 20m site used for IEM)	
Monitoring Attribute	Data Collection Method	Deliverable
General	Sites established, photo reference points taken and general monitoring site information recorded. Monitoring to be undertaken in accordance with the BioMetric assessment method.	As a minimum, start and end points of 50m transect to be established with star pickets (min 135cm length), corners of 20m x 20m site marked with wooden pegs, and transect start labelled with site name on durable tag. As a minimum photo reference points taken from the start and end points of the 50m transect. Within the 20m x 50m site general comments such as rocks present, presence/ absence of topsoil, significant weed infestations, evidence of fire or drought and other factors likely to influence rehabilitation development
Within 20m x 20m quadrat	Species name	A list of all vascular plant species observed
	Cover	An assessment of projected foliage cover (pfc) for all vascular plant species (1 – 5% and then increments of 5%)
	Abundance	An assessment of abundance (density) for each vascular plant species in intervals of 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1000, 2000 etc.
	Reproductive status	An assessment of the reproductive status (i.e. presence of flowers, flower buds or fruits) of midstorey and overstorey species^
Along 50m transect	Ground cover	Litter, rock, bare soil, cryptogram, exotic, native grass, native shrub (<1m) and native other groundcover is recorded at every 1m along the 50m transect. Record presence and foliage cover of each High Threat Exotic weed species (i.e. consistent with Biodiversity Assessment Methodology)
	Midstorey and overstorey cover	Midstorey and overstorey cover is recorded at every 5m along the 50m transect
Within 20m x 50m site	Regeneration	Proportion of overstorey species that are regenerating
	Large woody debris	Total length of large woody debris >10cm diameter
	Trees with hollows	Total number of trees with hollows
	Structure	Structural assessment identifying the dominant species (maximum three) for each vegetation stratum along with heights and projected foliage cover.
Erosion	Note presence and maximum depth of erosion gullies or rills within the 20m x 50m site. Note whether erosion gullies or rills are active or stable.	Presence of erosion in the following categories, with reference to maximum observed depth: • Minor sheet erosion or rills (<100 mm) • Minor sheet erosion or rills (100 mm -<300 mm) • Rills (300 mm - <500 mm) • Gullies (500 mm -<1m) • Gully (≥1m)

Appendix C Rehabilitation monitoring schedule

Site	Year Ecosystem Established	Age (yrs) 2025	Vegetation Community	Rehabilitation area stratification	Monitored in 2024	2025	2026	2027	2028	Fauna
R31	2021	4	HU697	Post-2019, HU697	IEM	LTM, LFA		LTM, LFA		
2021_1	2020	5	HU697	Post-2019, HU697		LTM, LFA		LTM, LFA		
2021_2	2020	5	HU697	Post-2019, HU697		LTM, LFA		LTM, LFA		
2023_7	2021	4	HU697	Post-2019, HU697		LTM, LFA		LTM, LFA		
2021_5	2020	5	HU732	Post-2019, HU732		LTM, LFA		LTM, LFA		
2021_7	2020	5	HU732	Post-2019, HU732		LTM, LFA		LTM, LFA		
2023_1	2020	5	HU732	Post-2019, HU732		LTM, LFA		LTM, LFA		
2023_4	2020	5	HU732	Post-2019, HU732		LTM, LFA		LTM, LFA		
R23	2020	5	HU824	Post-2019, HU824	LTM, LFA		LTM, LFA		LTM, LFA	
R29	2022	3	HU824	Post-2019, HU824	IEM	IEM	LTM, LFA		LTM, LFA	
R36	2022	3	HU824	Post-2019, HU824	IEM	IEM	LTM, LFA		LTM, LFA	
R37	2022	3	HU824	Post-2019, HU824	IEM	IEM	LTM, LFA		LTM, LFA	
2021_6	2020	5	HU824	Post-2019, HU824	LTM, LFA		LTM, LFA		LTM, LFA	✓
2021_8	2020	5	HU824	Post-2019, HU824	LTM, LFA		LTM, LFA		LTM, LFA	
2023_5	2020	5	HU824	Post-2019, HU824	LTM, LFA		LTM, LFA		LTM, LFA	
R6	2010	15	Generic Woodland	Pre-2019, Generic woodland		LTM, LFA			LTM, LFA	✓
R9	2011	14	Generic Woodland	Pre-2019, Generic woodland		LTM, LFA			LTM, LFA	✓
R24	2009	16	Generic Woodland	Pre-2019, Generic woodland		LTM, LFA			LTM, LFA	
R25	2010	15	Generic Woodland	Pre-2019, Generic woodland		LTM, LFA			LTM, LFA	
R34	2011	14	Generic Woodland	Pre-2019, Generic woodland		LTM, LFA			LTM, LFA	

Site	Year Ecosystem Established	Age (yrs) 2025	Vegetation Community	Rehabilitation area stratification	Monitored in 2024	2025	2026	2027	2028	Fauna
R39	2010	15	Generic Woodland	Pre-2019, Generic woodland		LTM, LFA			LTM, LFA	
R16	2018	7	HU697	Pre-2019, HU697		LTM, LFA		LTM, LFA		
R20	2017	8	HU697	Pre-2019, HU697		LTM, LFA		LTM, LFA		
R30*	2017	8	HU687	Pre-2019, HU697		LTM, LFA*		LTM, LFA		
R17	2019	6	HU732	Pre-2019, HU732	LTM, LFA		LTM, LFA		LTM, LFA	
R18	2016	9	HU732	Pre-2019, HU732	LTM, LFA		LTM, LFA		LTM, LFA	
R19	2012	13	HU732	Pre-2019, HU732	LTM, LFA			LTM, LFA		
R22	2012	13	HU732	Pre-2019, HU732	LTM, LFA			LTM, LFA		
R28	2017	8	HU732	Pre-2019, HU732	LTM, LFA			LTM, LFA		
R35	2018	7	HU732	Pre-2019, HU732	LTM, LFA		LTM, LFA		LTM, LFA	
2021_3	2018	7	HU732	Pre-2019, HU732	LTM, LFA		LTM, LFA		LTM, LFA	✓
2021_4	2018	7	HU732	Pre-2019, HU732	LTM, LFA		LTM, LFA		LTM, LFA	
R14	2018	7	HU824	Pre-2019, HU824	LTM, LFA		LTM, LFA		LTM, LFA	
R15	2017	8	HU824	Pre-2019, HU824	LTM, LFA		LTM, LFA		LTM, LFA	
R21	2019	6	HU824	Pre-2019, HU824	LTM, LFA		LTM, LFA		LTM, LFA	
R26	2018	7	HU824	Pre-2019, HU824	LTM, LFA		LTM, LFA		LTM, LFA	
R27	2014	11	HU824	Pre-2019, HU824	LTM, LFA			LTM, LFA		
R32	2016	9	HU824	Pre-2019, HU824	LTM, LFA		LTM, LFA		LTM, LFA	✓
R33	2016	9	HU824	Pre-2019, HU824	LTM, LFA		LTM, LFA		LTM, LFA	
R38	2018	7	HU824	Pre-2019, HU824	LTM, LFA		LTM, LFA		LTM, LFA	
					Monitored in 2024	2025	2026	2027	2028	Fauna 2025
				Total rehabilitation sites	24	20	18	15	24	5

*R30 was removed from the monitoring rotation as the area was cleared prior to 2025 monitoring and will need to be re-established at a later date.

C1: Reference sites

Sites	Spring 2021	Autumn 2022	Spring 2022	Autumn 2023	Spring 2023	Autumn 2024	Spring 2024	Spring 2025	Spring 2026	Spring 2027	Spring 2028
Ref 547_A			LTM, fauna, LFA			LTM, fauna, LFA		LTM, fauna			LTM, fauna
Ref 547_B	LTM, fauna, LFA			LTM, fauna, LFA			LTM, fauna, LFA		LTM, fauna		
Ref 547_C		LTM, fauna, LFA			LTM, fauna, LFA			LTM, fauna		LTM, fauna	
Ref 697_A			LTM, fauna, LFA			LTM, fauna, LFA		LTM, fauna			LTM, fauna
Ref 697_B	LTM, fauna, LFA			LTM, fauna, LFA			LTM, fauna, LFA		LTM, fauna		
Ref 697_C		LTM, fauna, LFA			LTM, fauna, LFA			LTM, fauna		LTM, fauna	
Ref 732_A			LTM, fauna, LFA			LTM, fauna, LFA		LTM, fauna			LTM, fauna
Ref 732_B	LTM, fauna, LFA			LTM, fauna, LFA			LTM, fauna, LFA		LTM, fauna		
Ref 732_C		LTM, fauna, LFA			LTM, fauna, LFA			LTM, fauna		LTM, fauna	
Ref 824_A			LTM, fauna, LFA			LTM, fauna, LFA		LTM, fauna			LTM, fauna
Ref 824_B	LTM, fauna, LFA			LTM, fauna, LFA			LTM, fauna, LFA		LTM, fauna		
Ref 824_C		LTM, fauna, LFA			LTM, fauna, LFA			LTM, fauna		LTM, fauna	
Ref 825_A			LTM, fauna, LFA			LTM, fauna, LFA		LTM, fauna			LTM, fauna
Ref 825_B	LTM, fauna, LFA			LTM, fauna, LFA			LTM, fauna, LFA		LTM, fauna		
Ref 825_C		LTM, fauna, LFA			LTM, fauna, LFA			LTM, fauna			

Appendix D Weather conditions

2025 Monthly mean and historical average weather conditions

Month	2025 Averages (WCPL)			Historical Averages		
	Mean min. temp (°C)	Mean max. temp (°C)	Total Rainfall (mm)	Mean min. temp (°C)	Mean max. temp (°C)	Total Rainfall (mm)
January	17.3	30.9	111.8	16.9	31.2	67.6
February	17	30.3	41.2	16.4	30.0	62.0
March	17.6	28.5	64.4	13.8	27.5	55.1
April	10.2	24.5	12.8	9.9	23.5	39.2
May	8.6	19.4	99	6.3	19.1	37.8
June	1.8	15.9	26.4	3.7	15.5	43.8
July	3.0	15.0	64.8	2.6	14.8	43.2
August	4.2	16.7	38.2	3.4	16.5	41.1
September	5.2	22.1	53.8	6.1	19.8	41.8
October	10.3	26.6	35.2	9.3	23.7	51.9
November	12.3	28.9	29.8	12.3	26.8	57.4

Source: 2025 data from the WCPL Weather Station Sentinex 34 provided 19 December 2025, historical data from the BoM weather stations at Gulgong Post Office (temp) and Wollar-Barigan St weather station (rainfall) (BOM 2025).

Appendix E Flora species list

Species	Native / Exotic	Family
Acacia buxifolia	Native	Fabaceae (Mimosaceae)
Acacia dealbata	Native	Fabaceae (Mimosaceae)
Acacia decora	Native	Fabaceae (Mimosaceae)
Acacia doratoxylon	Native	Fabaceae (Mimosaceae)
Acacia gladiiformis	Native	Fabaceae (Mimosaceae)
Acacia hakeoides	Native	Fabaceae (Mimosaceae)
Acacia implexa	Native	Fabaceae (Mimosaceae)
Acacia ixiophylla	Native	Fabaceae (Mimosaceae)
Acacia linearifolia	Native	Fabaceae (Mimosaceae)
Acacia rubida	Native	Fabaceae (Mimosaceae)
Acacia sp.	Native	Fabaceae (Mimosaceae)
Acacia spectabilis	Native	Fabaceae (Mimosaceae)
Acacia triptera	Native	Fabaceae (Mimosaceae)
Acacia verniciflua	Native	Fabaceae (Mimosaceae)
Acaena sp.	Native	Rosaceae
Acrotriche rigida	Native	Ericaceae (Epacridoideae)
Ailanthus altissima	Exotic	Simaroubaceae
Aira elegantissima	Exotic	Poaceae
Allocasuarina diminuta	Native	Casuarinaceae
Allocasuarina gymnanthera	Native	Casuarinaceae
Allocasuarina verticillata	Native	Casuarinaceae
Amyema miquelli	Native	Loranthaceae
Amyema quandang var. quandang	Native	Loranthaceae
Amyema sp.	Native	Loranthaceae
Angophora floribunda	Native	Myrtaceae
Anthosachne scabra	Native	Poaceae
Arctotheca calendula	Exotic	Asteraceae
Aristida ramosa	Native	Poaceae
Aristida vagans	Native	Poaceae
Arthropodium fimbriatum	Native	Asparagaceae
Arthropodium minus	Native	Asparagaceae
Arundinella nepalensis	Native	Poaceae
Asparagus officinalis	Exotic	Asparagaceae
Asperula conferta	Native	Rubiaceae
Astroloma humifusum	Native	Ericaceae (Epacridoideae)
Austrostipa aristiglumis	Native	Poaceae
Austrostipa densiflora	Native	Poaceae
Austrostipa scabra	Native	Poaceae
Austrostipa sp.	Native	Poaceae
Austrostipa verticillata	Native	Poaceae
Avena fatua	Exotic	Poaceae
Bidens sp.	Exotic	Asteraceae
Bossiaea prostrata	Native	Fabaceae (Faboideae)
Bothriochloa macra	Native	Poaceae
Brachychiton populneus	Native	Malvaceae
Briza minor	Exotic	Poaceae
Bromus catharticus	Exotic	Poaceae
Bromus diandrus	Exotic	Poaceae
Bromus hordeaceus	Exotic	Poaceae
Bromus molliformis	Exotic	Poaceae
Bursaria spinosa	Native	Pittosporaceae
Caladenia eremaea	Native	Orchidaceae
Caladenia fuscata	Native	Orchidaceae
Caladenia sp.	Native	Orchidaceae

Species	Native / Exotic	Family
Callistemon pinifolius	Native	Myrtaceae
Callitris endlicheri	Native	Cupressaceae
Calocephalus sp.	Native	Asteraceae
Calotis cuneifolia	Native	Asteraceae
Calotis lappulacea	Native	Asteraceae
Calytrix tetragona	Native	Myrtaceae
Capsella bursa-pastoris	Exotic	Brassicaceae
Carduus tenuiflorus	Exotic	Asteraceae
Carex appressa	Native	Cyperaceae
Carex breviculmis	Native	Cyperaceae
Carex inversa	Native	Cyperaceae
Carthamus lanatus	Exotic	Asteraceae
Cassinia quinquefaria	Native	Asteraceae
Cassinia sifton	Native	Asteraceae
Cassytha glabella	Native	Lauraceae
Centaurea melitensis	Exotic	Asteraceae
Centaurium tenuiflorum	Exotic	Gentianaceae
Cerastium glomeratum	Exotic	Caryophyllaceae
Cerastium vulgare	Exotic	Caryophyllaceae
Cheilanthes sieberi	Native	Pteridaceae
Chloris gayana	Exotic	Poaceae
Chloris truncata	Native	Poaceae
Chloris virgata	Exotic	Poaceae
Chondrilla juncea	Exotic	Asteraceae
Chrysocephalum apiculatum	Native	Asteraceae
Cineraria lyratiformis	Exotic	Asteraceae
Cirsium vulgare	Exotic	Asteraceae
Clematis aristata	Native	Ranunculaceae
Convolvulus angustissimus	Native	Concolculaceae
Convolvulus erubescens	Native	Concolculaceae
Conyza bonariensis	Exotic	Asteraceae
Conyza sp.	Exotic	Asteraceae
Cotula australis	Native	Asteraceae
Crassula seibriana	Native	Crassulaceae
Crassula sieberiana	Native	Crassulaceae
Cryptandra armata	Native	Rhamnaceae
Cyclospermum leptophyllum	Exotic	Apiaceae
Cymbonotus lawsonianus	Native	Asteraceae
Cymbopogon refractus	Native	Poaceae
Cynodon dactylon	Native	Poaceae
Cynoglossum australe	Native	Boraginaceae
Cyperaceae sp.	Native/exotic	Cyperaceae
Cyperus gracilis	Native	Cyperaceae
Daucus carota	Exotic	Apiaceae
Daucus glochidiatus	Native	Apiaceae
Dianella caerulea	Native	Asphodelaceae
Dianella revoluta	Native	Phormiaceae
Dianella sp.	Native	Phormiaceae
Dichelachne micrantha	Native	Poaceae
Dichondra repens	Native	Convolvulaceae
Digitaria breviglumis	Native	Poaceae
Digitaria diffusa	Native	Poaceae
Digitaria eriantha	Exotic	Poaceae
Digitaria parviflora	Native	Poaceae
Digitaria sp.	Native/exotic	Poaceae
Dodonaea boroniifolia	Native	Sapindaceae
Dodonaea viscosa	Native	Sapindaceae

Species	Native / Exotic	Family
Dodonaea boroniifolia	Native	Sapindaceae
Drosera peltata	Native	Droseraceae
Dysphania pumilio	Native	Amaranthaceae
Echinopogon caespitosus	Native	Poaceae
Echinopogon intermedius	Native	Poaceae
Echium plantagineum	Exotic	Boraginaceae
Echium vulgare	Exotic	Boraginaceae
Einadia hastata	Native	Chenopodiaceae
Einadia nutans	Native	Chenopodiaceae
Einadia polygonoides	Native	Chenopodiaceae
Eleusine sp.	Exotic	Poaceae
Enchylaena tomentosa	Native	Amaranthaceae
Entolasia stricta	Native	Poaceae
Eragrostis curvula	Exotic	Poaceae
Eragrostis leptostachya	Native	Poaceae
Erodium cicutarium	Exotic	Geraniaceae
Erodium crinitum	Native	Geraniaceae
Eucalyptus albens	Native	Myrtaceae
Eucalyptus blakelyi	Native	Myrtaceae
Eucalyptus bridgesiana	Native	Myrtaceae
Eucalyptus conica	Native	Myrtaceae
Eucalyptus crebra	Native	Myrtaceae
Eucalyptus dealbata	Native	Myrtaceae
Eucalyptus fibrosa	Native	Myrtaceae
Eucalyptus melliodora	Native	Myrtaceae
Eucalyptus microcarpa	Native	Myrtaceae
Eucalyptus moluccana	Native	Myrtaceae
Eucalyptus sideroxylon	Native	Myrtaceae
Eucalyptus sp. 1	Native	Myrtaceae
Eucalyptus sp. 2	Native	Myrtaceae
Euchiton japonicus	Native	Asteraceae
Euchiton sphaericus	Native	Asteraceae
Euphorbia sp.	Native/exotic	Euphorbiaceae
Euphorbia drummondii	Native	Euphorbiaceae
Exocarpos sp.	Native	Santalaceae
Exocarpos strictus	Native	Santalaceae
Facelis retusa	Exotic	Asteraceae
Fimbristylis dichotoma	Native	Cyperaceae
Fimbristylis sp.	Native	Cyperaceae
Gahnia aspera	Native	Cyperaceae
Gahnia sieberiana	Native	Cyperaceae
Galium australe	native	Rubiaceae
Galium leiocarpum	Native	Rubiaceae
Galium sp.	Native/exotic	Rubiaceae
Gamochaeta americana	Exotic	Asteraceae
Gamochaeta calviceps	Exotic	Asteraceae
Gamochaeta purpurea	Exotic	Asteraceae
Geranium molle	Exotic	Geraniaceae
Geranium solanderi	Native	Geraniaceae
Glossodia major	Native	Orchidaceae
Glycine clandestina	Native	Fabaceae (Faboideae)
Glycine tabacina	Native	Fabaceae (Faboideae)
Gomphocarpus fruticosus	Exotic	Apocynaceae
Gompholobium huegelii	Native	Fabaceae (Faboideae)
Gonocarpus tetragynus	Native	Haloragaceae
Goodenia hederacea	Native	Goodeniaceae
Goodenia ovata	Native	Goodeniaceae

Species	Native / Exotic	Family
Goodenia paniculata	Native	Goodeniaceae
Grona varians	Native	Fabaceae (Faboideae)
Hakea dactyloides	Native	Proteaceae
Haloragis heterophylla	Native	Haloragaceae
Hardenbergia violacea	Native	Fabaceae (Faboideae)
Heliotropium amplexicaule	Exotic	Boraginaceae
Hibbertia acicularis	Native	Dilleniaceae
Hibbertia circumdans	Native	Dilleniaceae
Hibbertia obtusifolia	Native	Dilleniaceae
Hibbertia riparia	Native	Dilleniaceae
Hirschfeldia incana	Exotic	Brassicaceae
Hydrocotyle laxiflora	Native	Araliaceae
Hyparrhenia hirta	Exotic	Poaceae
Hypericum gramineum	Exotic	Hypericaceae
Hypericum perforatum	Exotic	Hypericaceae
Hypochaeris glabra	Exotic	Asteraceae
Hypochaeris radicata	Exotic	Asteraceae
Indigofera adesmiifolia	native	Fabaceae (Faboideae)
Juncus bufonius	Native	Juncaceae
Juncus capitatus	Native	Juncaceae
Juncus homalocaulis	Native	Juncaceae
Juncus sp.	Native/exotic	Juncaceae
Juncus subsecundus	Native	Juncaceae
Juncus tenuis	Native	Juncaceae
Juncus usitatus	Native	Juncaceae
Juncus filiformis	Exotic	Juncaceae
Lachnagrostis filiformis	Native	Poaceae
Lactuca saligna	Exotic	Asteraceae
Laxmannia gracilis	Native	Anthericaceae
Lepidium africanum	Exotic	Brassicaceae
Lepidium bonariense	Exotic	Brassicaceae
Lepidium sp.	Native/exotic	Brassicaceae
Lepidosperma laterale	Native	Cyperaceae
Leucopogon muticus	Native	Ericaceae (Epacridoideae)
Liliaceae sp.	Native/exotic	Liliaceae
Linum catharticum	Exotic	Linaceae
Linum marginale	Exotic	Linaceae
Lissanthe strigosa	Native	Ericaceae (Epacridoideae)
Lolium perenne	Exotic	Poaceae
Lolium rigidum	Exotic	Poaceae
Lomandra confertifolia	Native	Lomandraceae
Lomandra filiformis	Native	Lomandraceae
Lomandra glauca	Native	Lomandraceae
Lomandra longifolia	Native	Lomandraceae
Lomandra multiflora	Native	Lomandraceae
Lomandra sp.	Native	Lomandraceae
Luzula densiflora	Native	Juncaceae
Lysimachia arvensis	Exotic	Primulaceae
Lysimachia foemina	Exotic	Primulaceae
Lythrum hyssopifolia	Native	Lythraceae
Maireana decalvans	Native	Chenopodiaceae
Medicago polymorpha	Exotic	Fabaceae (Faboideae)
Medicago sp.	Exotic	Fabaceae (Faboideae)
Melaleuca sp.	Native	Myrtaceae
Melichrus erubescens	Native	Ericaceae (Epacridoideae)
Melichrus urceolatus	Native	Ericaceae (Epacridoideae)
Mentha satureioides	Native	Lamiaceae

Species	Native / Exotic	Family
Microlaena stipoides	Native	Poaceae
Microtis parviflora	Native	Orchidaceae
Modiola caroliniana	Exotic	Malvaceae
Myoporum montanum	Native	Scrophulariaceae
Myoporum sp.	Native	Scrophulariaceae
Notelaea microcarpa	Native	Oleaceae
Olearia elliptica	Native	Asteraceae
Opercularia diphylla	Native	Rubiaceae
Opercularia hispida	Native	Rubiaceae
Ornithopus compressus	Exotic	Fabaceae (Faboideae)
Oxalis perennans	Native	Oxalidaceae
Oxytes brachypoda	Native	Fabaceae (Faboideae)
Panicum effusum	Native	Poaceae
Parentucellia latifolia	Exotic	Orobanchaceae
Paronychia brasiliana	Exotic	Carophyllaceae
Paspalum dilatatum	Exotic	Poaceae
Persoonia linearis	Native	Proteaceae
Petrorharghia dubia	Exotic	Carophyllaceae
Phyllanthus hirtellus	Native	Phyllanthaceae
Pimelea sp.	Native	Thymelaeaceae
Plantago debilis	Native	Plantaginaceae
Plantago gaudichaudii	Native	Plantaginaceae
Plantago lanceolata	Exotic	Plantaginaceae
Poa sieberiana	Native	Poaceae
Pomax umbellata	Native	Rubiaceae
Poranthera microphylla	Native	Phyllanthaceae
Pterostylis sp.	Native	Orchidaceae
Pultenaea microphylla	Native	Fabaceae (Faboideae)
Pultenaea sp.	Native	Fabaceae (Faboideae)
Ranunculus pumilio	Native	Ranunculaceae
Ranunculus sp.	Native/exotic	Ranunculaceae
Rapistrum rugosum	Exotic	Brassicaceae
Rosa rubiginosa	Exotic	Rosaceae
Rumex acetosella	Exotic	Polygonaceae
Rumex brownii	Native	Polygonaceae
Rytidosperma caespitosum	Native	Poaceae
Rytidosperma pallidum	Native	Poaceae
Rytidosperma racemosum	Native	Poaceae
Rytidosperma sp.	Native	Poaceae
Salvia verbenaca	Exotic	Lamiaceae
Schoenus apogon	Native	Cyperaceae
Scutellaria humilis	Native	Lamiaceae
Senecio madagascariensis	Exotic	Asteraceae
Senecio quadridentatus	Native	Asteraceae
Senecio sp.	Native/exotic	Asteraceae
Setaria parviflora	Exotic	Poaceae
Sida corrugata	Native	Malvaceae
Sida cunninghamii	Native	Malvaceae
Sida rhombifolia	Exotic	Malvaceae
Sigesbeckia orientalis	Native	Asteraceae
Silene gallica	Exotic	Caryophyllaceae
Sisymbrium officinale	Exotic	Brassicaceae
Sisyrinchium micranthum	Exotic	Iridaceae
Sisyrinchium rosulatum	Exotic	Iridaceae
Solanum brownii	Native	Solanaceae
Solanum campanulatum	Native	Solanaceae
Solanum cinereum	Exotic	Solanaceae

Species	Native / Exotic	Family
Solanum nigrum	Exotic	Solanaceae
Solanum prinophyllum	Native	Solanaceae
Solenogyne bellioides	Native	Asteraceae
Solenogyne dominii	Native	Asteraceae
Solenogyne sp.	Native	Asteraceae
Soliva sessilis	Exotic	Asteraceae
Sonchus asper	Exotic	Asteraceae
Sonchus oleraceus	Exotic	Asteraceae
Sporobolus creber	Native	Poaceae
Stackhousia monogyna	Native	Stackhousiaceae
Stackhousia viminea	Native	Stackhousiaceae
Stellaria media	Exotic	Carophyllaceae
Stuartina muelleri	Native	Asteraceae
Swainsona galegifolia	Native	Fabaceae (Faboideae)
Taraxacum officinale	Exotic	Asteraceae
Templetonia stenophylla	Native	Fabaceae (Faboideae)
Themeda triandra	Native	Poaceae
Thysanotus patersonii	Native	Anthericaceae
Trifolium angustifolium	Exotic	Fabaceae (Faboideae)
Trifolium arvense	Exotic	Fabaceae (Faboideae)
Trifolium campestre	Exotic	Fabaceae (Faboideae)
Trifolium dubium	Exotic	Fabaceae (Faboideae)
Trifolium glomeratum	Exotic	Fabaceae (Faboideae)
Trifolium repens	Exotic	Fabaceae (Faboideae)
Trifolium sp.	Exotic	Fabaceae (Faboideae)
Trifolium subterraneum	Exotic	Fabaceae (Faboideae)
Trifolium vesiculosum	Exotic	Fabaceae (Faboideae)
Triptilodiscus pygmaeus	Native	Asteraceae
Urtica incisa	Native	Urticaceae
Verbena bonariensis	Exotic	Verbenaceae
Veronica plebeia	Native	Plantaginaceae
Vittadinia cuneata	Native	Asteraceae
Vittadinia muelleri	Native	Asteraceae
Vulpia bromoides	Exotic	Poaceae
Vulpia sp.	Exotic	Poaceae
Wahlenbergia communis	Native	Campanulanceae
Wahlenbergia gracilis	Native	Campanulanceae
Wahlenbergia sp.	Native	Campanulanceae
Wahlenbergia stricta	Native	Campanulanceae
Wurmbea dioica	Native	Colchiaceae

Appendix F BioMetric performance and completion criteria (rehabilitation monitoring)

Table 6-4 Biometric Performance & Completion Criteria

Attribute (WCPL2021)	BVT	Native Plant Species Richness MIN-MAX (No. species)		Native Over Storey Cover MIN-MAX (%)[8]		Native Mid – Storey Cover MIN-MAX (%)		Native Ground Cover Grass MIN-MAX (%)		Native Ground Cover Shrubs MIN-MAX (%)		Native Ground Cover Other MIN-MAX (%)		Number of Trees with Hollows	Total Length Fallen Logs (m)	
Local Reference Site BVT Data (WCPL, 2021)	HU547	15-45		15-26		0-6		4-58		0-2		2-34		0	38.22	
	HU732	17-62		9-28		0-0.2		2-50		0-2		2-38		0	25	
	HU697	22-50		17-23		1-13		4-12		0-14		0-20		0	38	
	HU824	27-61		12.7-30.5		0.7-13.7		0-18		0-8		2-38		3	83.39	
	HU825	27-52		16.5-27		0.4-7		0-52		0-12		0-34		1	58	
Completion Criteria Allowable Future Attribute Score Increases Relative to Benchmark (After OEH, 2014b, 2015)		**1**		**1**		**1**		**1**		**1**		**1**		**0**	**0.5**	
		>50%		**>25<200%**		**>25<200%**		**>25<200%**		**>25<200%**		**>25<200%**		**N/A**	**>25%**	
WCPL Criteria	**BVT**	**Comp.**	**Perf.**	**Comp.**	**Perf.**	**Comp.**	**Perf.**	**Comp.**	**Perf.**	**Comp.**	**Perf.**	**Comp.**	**Perf.**		**Comp.**	**Perf.**
	HU547	7.5-22.5	3.75-11.25	3.75-52	1.88-52	1.25-100	1-100	1-100	0.5-100	0.5-20	0-10	0.5-68	0.25-68	NIL	9.56	4.78
	HU732	8.5-31	4.25-11.25	2.25-56	1.88-56	0.5-20	0-20	0.5-100	0.25-100	0.5-20	0-10	0.5-76	0.25-76		6.25	3.13
	HU697	11-25	5.50-12.5	4.25-46	2.13-46	2.5-100	1-100	1-24	0.5-24	1.25-20	1-10	0-40	0-40		9.5	4.75
	HU824	13.5-30.5	6.75-15.25	3.18-61	1.59-61	2.5-100	1-100	0-36	0-36	1.25-20	1-10	0.5-76	0.25-76		16.5	8
	HU825	13.5-26	6.75-13	4.13-54	2.06-54	2.75-100	1-100	0-104	0-104	1.25-60	1-30	0-68	0-68		14.5	7.25

Attribute (OEH, 2017)	Exotic Plant Cover (% of total cover)		Regeneration[7] (% of over-storey species that are naturally regenerating)		Overall Site Value Score (OEH, 2015) (average of plots in vegetation zone)	
Completion Criteria Allowable Future Attribute Score Increases Relative to Benchmark (After OEH, 2014b, 2015)	**1**		**0.5**		**16.93**	
	<45%		**25%**			
WCPL Criteria	**Comp.**	**Perf.**	**Comp.**	**Perf.**	**Comp.**	**Perf.**
All relevant BVTs	<45%	<90%	To be determined based on number of OS species	No regeneration	17	7

[8] Relevant Regent Honeyeater habitat criteria, in concurrence with the presence/absence monitoring for mistletoe and surrogate nectivore bird species
Comp. = Completion Criteria
Perf. = Performance Criteria at 10 years after landform establishment

Appendix G Fauna species list

Common Name	Scientific Name	BC Act	EPBC Act
Aves			
Australian King Parrot	*Alisterus scapularis*		
Australian Magpie	*Gymnorhina tibicen*		
Australian Pipit	*Anthus novaeseelandiae*		
Australian Raven	*Corvus coronoides*		
Australian Wood Duck	*Chenonetta jubata*		
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*		
Brown Quail	*Synoicus ypsilophora*		
Brown Thornbill	*Acanthiza pusilla*		
Brown treecreeper (sub-species)	*Climacteris picumnus*	Vulnerable	Vulnerable
Brown-headed Honeyeater	*Melithreptus brevirostris*		
Buff-rumped Thornbill	*Acanthiza reguloides*		
Double-barred Finch	*Stizoptera bichenovii*		
Dusky Woodswallow	*Artamus cyanopterus*		
Eastern Koel	*Eudynamys orientalis*		
Eastern Rosella	*Platycercus eximius*		
Eastern Spinebill	*Acanthorhynchus tenuirostris*		
Eastern Yellow Robin	*Eopsaltria australis*		
Emu	*Dromaius novaehollandiae*		
Fan-Tailed Cuckoo	*Cacomantis flabelliformis*		
Galah	*Eolophus roseicapilla*		
Golden Whistler	*Pachycephala pectoralis*		
Grey Fantail	*Rhipidura albiscapa*		
Grey Strike-thrush	*Colluricincla harmonica*		
Horsfield's Bronze-Cuckoo	*Chalcites basalis*		
Jacky Winter	*Microeca fascinans*		
Laughing Kookaburra	*Dacelo novaeguineae*		
Lewin's Honeyeater	*Meliphaga lewinii*		
Magpie-lark	*Grallina cyanoleuca*		
Masked Lapwing	*Vanellus miles*		
Mistletoebird	*Dicaeum hirundinaceum*		
Musk Lorikeet	*Glossopsitta concinna*		
Noisy Friarbird	*Philemon corniculatus*		
Noisy Miner	*Manorina melanocephala*		
Olive-backed Oriole	*Oriolus sagittatus*		
Pacific Black Duck	*Anas superciliosa*		
Painted Honeyeater	*Grantiella picta*		
Pied Butcherbird	*Cracticus nigrogularis*		
Pied Currawong	*Strepera graculina*		
Red Wattlebird	*Anthochaera carunculata*		
Red-browed Finch	*Neochmia temporalis*		

Common Name	Scientific Name	BC Act	EPBC Act
Rufous Songlark	*Cincloramphus mathewsi*		
Rufous Whistler	*Pachycephala rufiventris*		
Sacred Kingfisher	*Todiramphus sanctus*		
Scarlet Robin	*Petroica boodang*		
Speckled Warbler	*Pyrrholaemus sagittatus*		
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*		
Spotted Pardalote	*Pardalotus punctatus*		
Striated Pardalote	*Pardalotus striatus*		
Striated Thornbill	*Acanthiza lineata*		
Sulphur-Crested Cockatoo	*Cacatua galerita*		
Superb Fairy wren	*Malurus cyaneus*		
Superb Lyrebird	*Menura novaehollandiae*		
Wedge-tailed Eagle	*Aquila audax*		
Weebill	*Smicrornis brevirostris*		
Welcome Swallow	*Hirundo neoxena*		
White-browed Scrubwren	*Sericornis frontalis*		
White-browed Treecreeper	*Climacteris affinis*		
White-eared Honeyeater	*Nesoptilotis leucotis*		
White-plumed honeyeater	*Ptilotula penicillata*		
White-throated Gerygone	*Gerygone olivacea*		
White-throated Treecreeper	*Cormobates leucophaea*		
White-winged Chough	*Corcorax melanorhamphos*		
White-Winged Triller	*Lalage sueurii*		
Willie Wagtail	*Rhipidura leucophrys*		
Yellow Thornbill	*Acanthiza nana*		
Yellow-faced Honeyeater	*Caligavis chrysops*		
Yellow-tufted Honeyeater	*Lichenostomus melanops*		
Mammalia			
Red-necked Wallaby	*Notamacropus rofogriseus*		
Eastern Grey Kangaroo	*Macropus giganteus*		
Pig	*Sus scrofa*		
European Hare	*Lepus europaeus*		
European Rabbit	*Oryctolagus cuniculus*		
Reptilia			
Barking Gecko	*Underwoodisaurus milii*		
Eastern Striped Skink	*Ctenous robutus*		
Common Garden Skink	*Lampropholis guichenoti*		
Lace Monitor	*Varanus varius*		
Bearded Dragon	*Pogona barbata*		

Appendix H Microbat ultrasonic analysis report

2025 Channel Stability Monitoring Report

Wilpinjong Coal Mine

Wilpinjong Coal Pty Ltd

eco logical AUSTRALIA
A TETRA TECH COMPANY

Document Tracking

Project Name:	2025 Channel Stability Monitoring Report
Project Number:	600-25MUD10787
Project Manager:	Natalie De Losa

Version	Prepared by	Reviewed by	Approved by	Status	Date
V1	Edward Moar	Kalya Abbey	Kalya Abbey	Final	06/01/2026

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Abbreviations

Abbreviation	Description
ARI	Average Recurrence Interval
BEHI	Bank Erosion Hazard Index
BoM	Bureau of Meteorology
CSM	Channel Stability Monitoring
EIS	Environmental Impact Statement
ELA	Eco Logical Australia
EY	Exceedances per Year
IFD	Intensity-Frequency-Duration
LHB	Left Hand Bank
ML	Mining Lease
RHB	Right Hand Bank
SWMP	Surface Water Management Plan
WCM	Wilpinjong Coal Mine
WCPL	Wilpinjong Coal Pty Ltd

Executive Summary

Channel stability monitoring (CSM) was completed by Eco Logical Australia (ELA) on behalf of Wilpinjong Coal Pty Ltd (WCPL) between 3 November and 7 November 2025, with an additional survey date in December to round off the sites that weren't completed in the initial survey dates. The CSM program aims to provide quantitative and qualitative measures of channel stability along Wilpinjong and Cumbo Creeks. Monitoring was undertaken across a total of 59 permanent monitoring locations, including 49 on Wilpinjong Creek and 10 on Cumbo Creek. Consistent with previous monitoring, methods included surveying the designated reach of each monitoring site (approximately 100 m) and completing the Bank Erosion Hazard Index (BEHI) assessment, along with visual and photographic comparative assessment with data from previous years.

CSM results in 2025 were largely consistent with previous years, with seven of the 59 sites becoming moderately more unstable, while nine sites saw improvements to bank stability, including a large change (-10) in BEHI score at site CCK2 on Cumbo Creek. Otherwise, most changes were minor, with a maximum difference of ±2.5. The main reason for the large change at site CCK2 was a significant increase in stabilisation due to increased groundcover from vegetation and less mass wasting. Slight increases in bank vegetation ground cover, as well as increases in water levels and stream flow, were observed at most sites. Mass wasting was also reduced from 2024, while there were slight increases in unconsolidated material, possibly due to storm events.

Identified historical erosion points were monitored in 2025, with some sites experiencing minor erosion in 2025, however all sites remain largely stable. Overall, erosion points require ongoing monitoring, and additional revegetation and remediation works are recommended to improve channel bank stability.

The results of the 2025 CSM support conclusions made in previous monitoring and assessments that ongoing mining operations are not causing stability issues within the target creek systems. Both Wilpinjong and Cumbo Creeks are typical of ephemeral creek systems in agricultural landscapes of the surrounding region, with channel stability issues within these creeks reflecting historical disturbances and land use practices, rather than contemporary mining operations. While storm events and intermittent rainfall can contribute to sudden wasting and erosion events, these changes are not related to the alteration of creek systems from mining operations.

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1. Introduction

1.1. Background

Eco Logical Australia (ELA) was engaged by Wilpinjong Coal Pty Ltd (WCPL) to undertake annual channel stability monitoring (CSM) along Wilpinjong and Cumbo Creeks. CSM is required to satisfy Schedule 3, Condition 30 (d, iii) of the WCPL Development Consent (SSD 6764), and the CSM criteria detailed in Appendix 2 (Surface Water Management Plan (SWMP)) of the Wilpinjong Water Management Plan (WCPL 2018).

1.2. Regional Overview

Wilpinjong Coal Mine (WCM) is located in the Mid-Western Regional Council Local Government Area, approximately 45 km north-east of Mudgee. The mine is owned and operated by WCPL, a wholly owned subsidiary of Peabody Energy Australia.

WCM is located at the headwaters of the Goulburn River which is a major tributary of the Hunter River catchment. Wilpinjong Creek is the main drainage channel within the WCM. It is an intermittent creek with a narrow floodplain that has a history of cattle grazing. The northern edge of the floodplain is bordered by the sandstone escarpments of the Goulburn River National Park (NP). Wilpinjong Creek has three coal mines in its catchment, Moolarben, Ulan and Wilpinjong, with the latter positioned furthest downstream. WCPL discharges treated mine water into Wilpinjong Creek, treated by reverse osmosis, at a licensed discharge point (EPL24) directly adjacent to WCM.

Cumbo Creek flows north through land managed by WCPL, passing between Pit 3, Pit 2, Pit 7 and Pit 4, before joining Wilpinjong Creek north of the eastern pit area. Wilpinjong Creek continues to flow east, for approximately 4.5 km downstream where it joins Wollar Creek, which continues another 13 km through the Goulburn River NP before entering the Goulburn River.

1.3. Previous channel stability assessments

A baseline channel stability assessment of Wilpinjong and Cumbo Creeks was undertaken in 2005 as part of the Environmental Impact Statement (EIS) for the Wilpinjong Coal Project (WCPL 2005) to characterise the existing condition of the Wilpinjong and Cumbo Creek stream channels prior to mining. The Wilpinjong Creek survey included 49 sites and extended 12.5 km from the upstream gauging station to the confluence with Wollar Creek to the east. The Cumbo Creek survey included ten sites and extended 3 km from the southern boundary of the Mining Lease (ML) 1573 north to the confluence with Wilpinjong Creek.

The baseline surveys concluded both Wilpinjong and Cumbo Creeks have been affected by pre-mining land management practices dominated by sheep and cattle grazing. These land management practices involved the clearing of riparian vegetation on both creeks to maximise grazing areas and stock access to drinking water. The clearing of this vegetation is likely to have contributed significantly to bank instability. Disturbance from burrowing animals, both native (e.g. *Vombatus ursinus* (Common Wombats)) and introduced (e.g. *Oryctolagus cuniculus* (European Rabbit)), is also likely to have contributed to this instability.

Subsequent annual CSM has been undertaken in 2011, and 2014-2025, to assess the ongoing stability of the Wilpinjong and Cumbo Creeks during operational mining. Barnson (2017) developed a proforma to assist in the assessment of creek stability at each survey location and to enable comparisons to be made between annual survey periods. Annual CSM reports have concluded that overall riparian health is poor, with erosion and bank stability issues present, typical of historically cleared agricultural catchments. Data collected by annual CSM to date has indicated that mining activities are not contributing to further channel stability issues in Wilpinjong and Cumbo Creeks.

1.4. Objectives

This report details the findings from the 2025 CSM program and includes a comparison of the regeneration progress of both Wilpinjong and Cumbo Creeks against previous monitoring conducted since 2011.

The CSM program aims to provide qualitative measures of stream bed and bank erosion and channel instability along Wilpinjong and Cumbo Creeks.

The key objectives of the 2025 CSM program are to:

- Evaluate erosional or depositional features of the creek banks
- Record the details of permanent monitoring sites with written descriptions and photographs
- Assess the stability of Wilpinjong and Cumbo Creeks using a rapid assessment methodology
- Compare visual channel stability at each of the permanent monitoring sites against previous monitoring records.

2. Methodology

2.1. Field Survey – Channel stability monitoring and comparative assessment

The field survey was conducted by ELA ecologists Edward Moar, Natalie De Losa, and Cheryl O'Dwyer between 7 and 11 November 2025, with an additional date in December to finish off non-accessible sites in the initial survey(s).

A total of 59 permanent monitoring locations were surveyed (49 on Wilpinjong Creek and 10 on Cumbo Creek; Figure 2-1**Error! Reference source not found.**). Consistent with previous monitoring, surveys involved surveying the designated reach of each site (approximately 100 m) and completing the Bank Erosion Hazard Index (BEHI) assessment. BEHI assessment involves scoring a site on eight quantitative categories outlined below and in Appendix A.

The eight BEHI indicators of channel stability that were used to evaluate erosion at each site include:

- Bank Height (m)
- Bank Angle (°)
- Percentage of Bank Height with a Bank Angle greater than 80°
- Evidence of Mass Wasting (% of Bank)
- Unconsolidated Material (% of Bank)
- Streambank Protection (% of Streambank covered in plant roots, vegetation, logs, branches, rocks, etc.)
- Established Beneficial Riparian Woody – Vegetation Cover
- Stream Curvature Descriptor

The BEHI indicators produce an activity rating that classifies each location from 'Highly Unstable', indicating the drainage line is experiencing severe ongoing erosion, to 'Highly Stable', indicating the drainage line is highly stable in function and form. This rating system enables any deterioration or improvement in bank stability to be detected over time. The classification system is detailed below in Table 2-1.

Table 2-1: BEHI score ratings for each rating class

Rating	BEHI Score
Highly Stable	0-25
Moderately Stable	26-35
Stable	36-45
Unstable	46-55
Moderately Unstable	56-65
Highly Unstable	66-85

Field notes and photographs were taken to allow qualitative assessment through comparisons between monitoring periods. This process included written site descriptions using the previous monitoring report (ELA 2024) to make comparisons in situ, as well as taking upstream and downstream photographs at each of the permanent monitoring sites. Site descriptions are provided in Appendix C and copies of site photos are provided in Appendix D. Comparisons of the monitoring site photographs (2011-2025) has been made by referring to previous reports prepared by Barnson (2017) and ELA (2020-2024).

Previously established erosion points along Wilpinjong Creek were also assessed (Figure 2-2

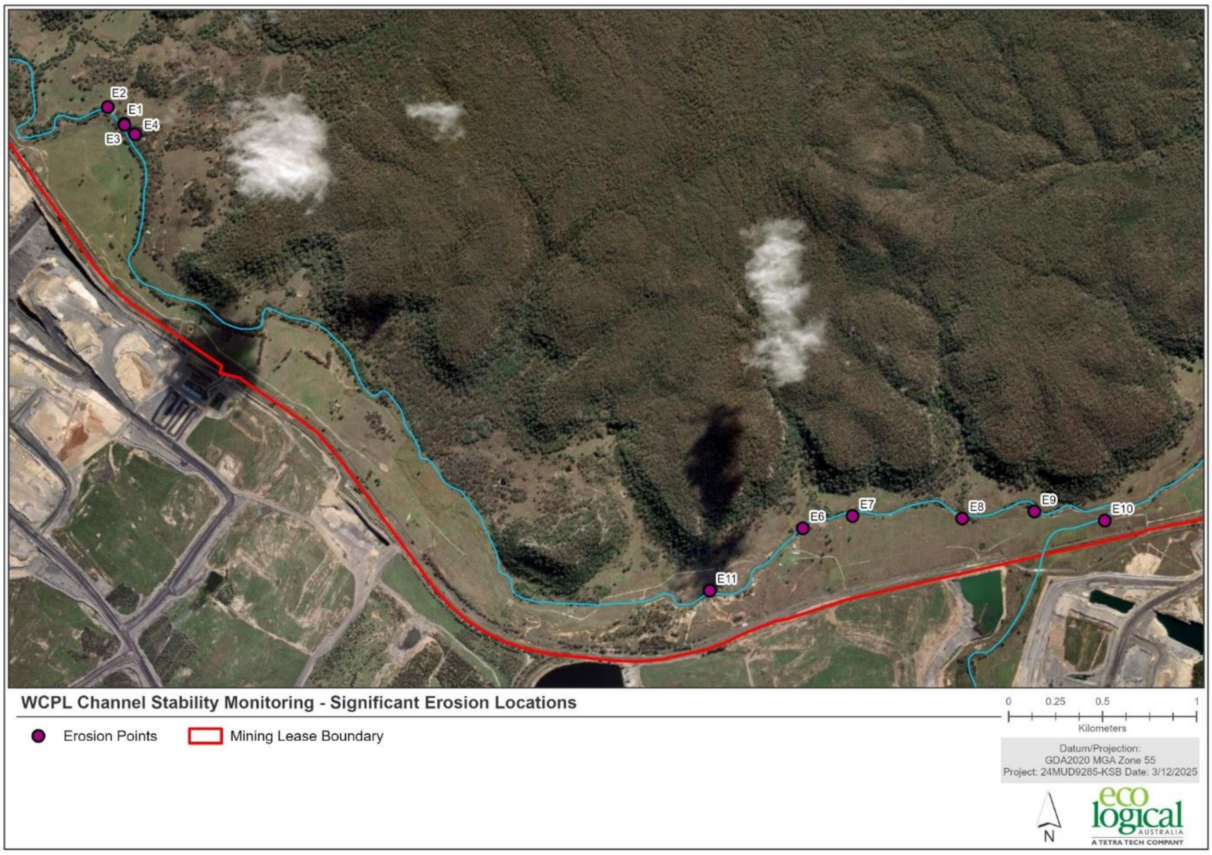

Figure 2-2:). These are in areas with moderate to severe erosion and are monitored to determine the presence and extent of on-going erosion. Management issues and threatened species were recorded opportunistically throughout the surveys, to highlight areas where management intervention is recommended.

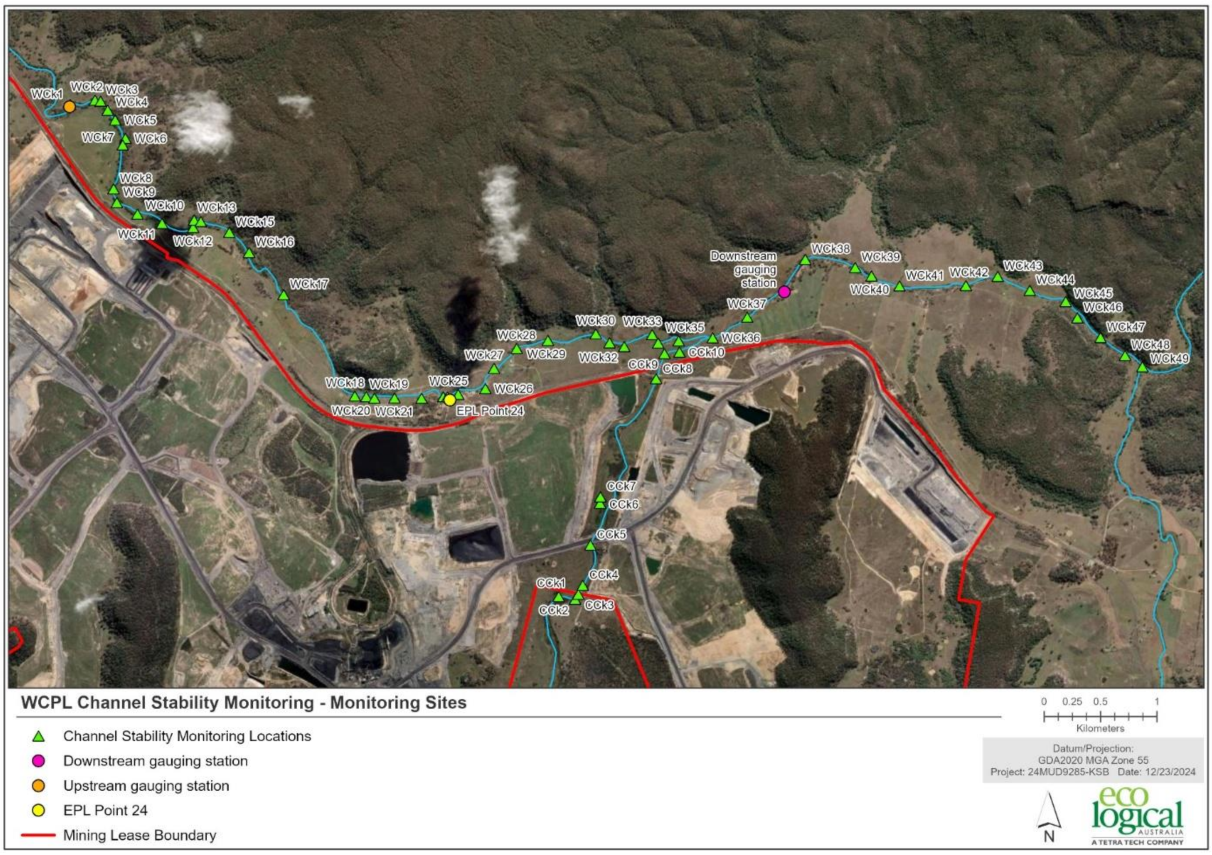

Figure 2-1: Channel Stability monitoring locations along Wilpinjong Creek and Cumbo Creek

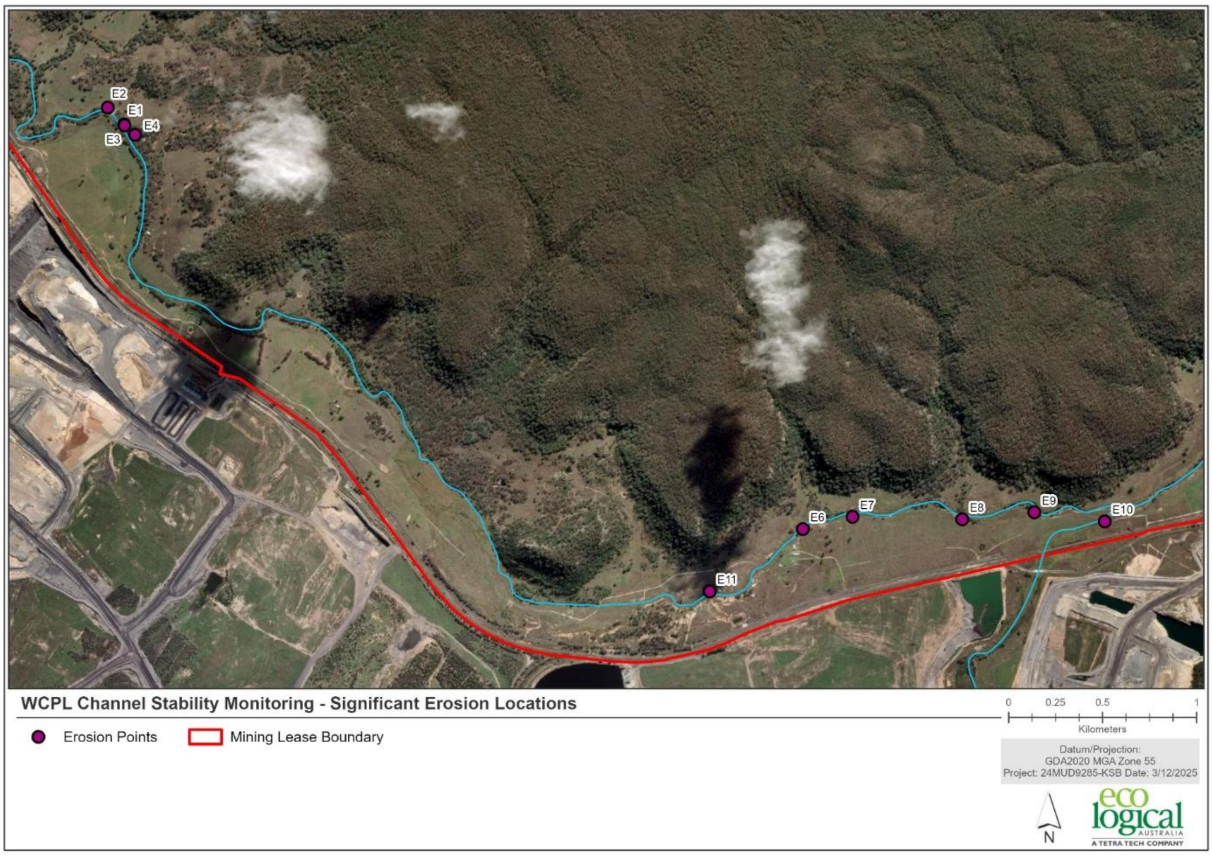

Figure 2-2: Significant erosion locations along Wilpinjong Creek

2.2. Rainfall and Flood Analysis

Previous WCPL CSM reports have included an analysis of rainfall Intensity-Frequency-Duration (IFD) and exceedance likelihood, with its effect on erosion (Barnson 2017). Rainfall data is included in Appendix F and shows that 2025 experienced drier weather and less rainfall than 2024, and below average. Flow data for Wilpinjong and Cumbo Creeks is shown below in **Figure 2-3**, **Figure 2-4**, and **Figure 2-5**, which demonstrates a continued reduced flow throughout 2025 compared to years prior to 2023, potentially due to reduced discharge. Due to this above average annual rainfall and low flow, coupled with an absence of significant or increased erosion events across the monitoring sites, it was determined that IFD and exceedance analysis would be of negligible benefit and therefore it has not been undertaken for the purposes of this report. This analysis was again not included in the 2025 BEHI and overall data analysis as well.

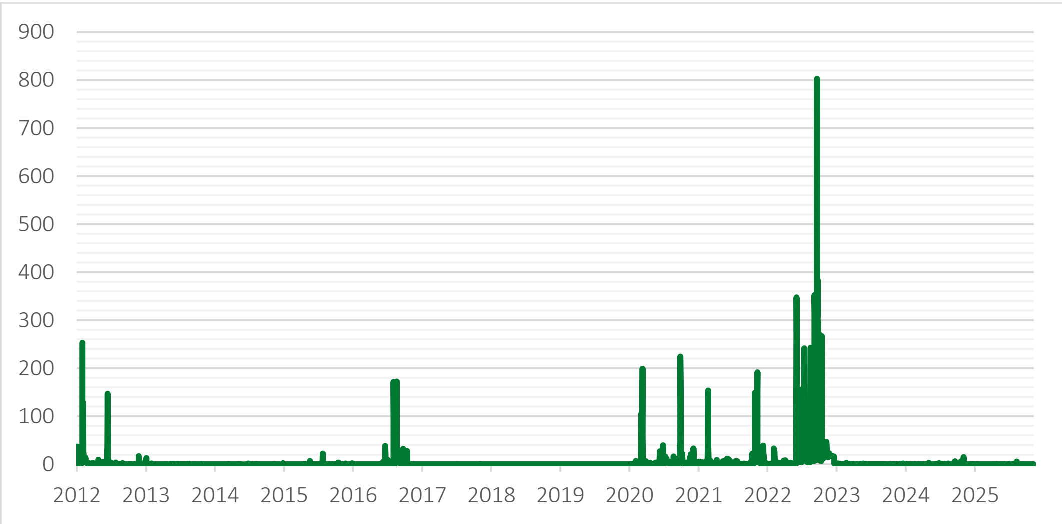

Figure 2-3: Wilpinjong Creek stream flow upstream of the WCPL mine discharge point EPL 24

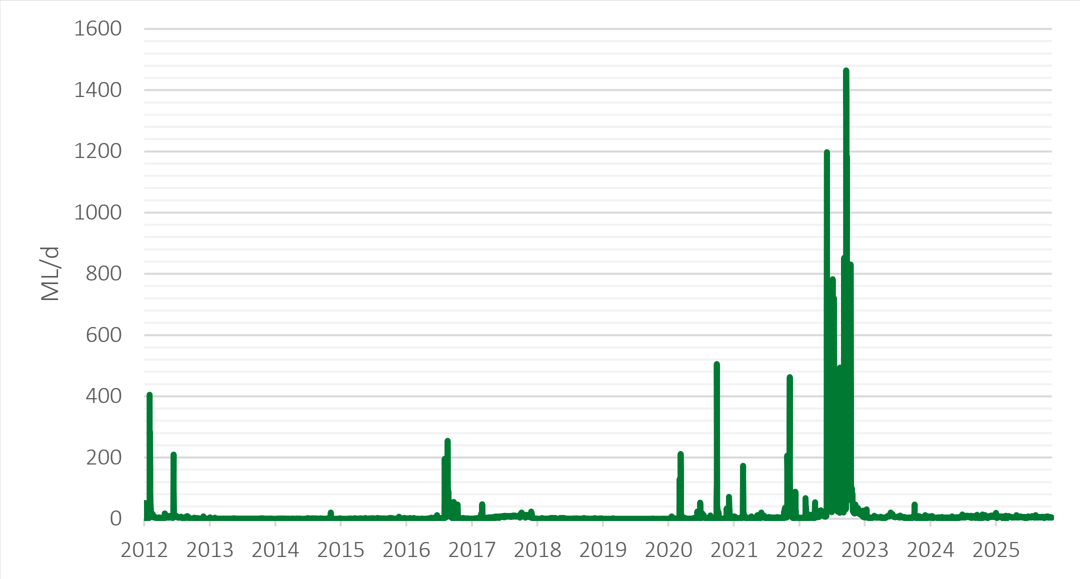

Figure 2-4: Wilpinjong Creek stream flow downstream of the WCPL mine discharge point EPL 24

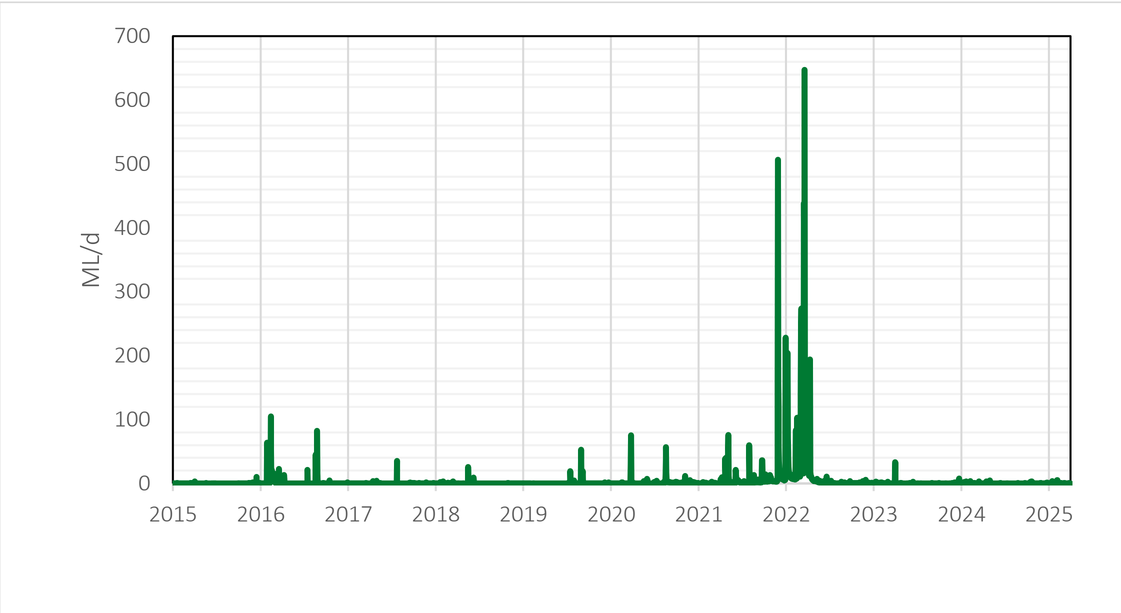

Figure 2-5: Cumbo creek stream flow downstream of the WCPL mine discharge point EPL 24

3. Results

3.1. Channel Stability Monitoring

The results of the BEHI assessments completed at sites along Wilpinjong Creek and Cumbo Creek are presented below in Appendix A and Appendix B. Site descriptions and comparison notes can be found in Appendix CA range of priority weed species listed within the Central Tablelands Regional Strategic Weed Management Plan 2023-2027 (LLS 2023) were recorded, as well as priority pest animal species listed within the Central Tablelands Regional Strategic Pest Animal Management Plan 2018-2023 (LLS 2018), the locations of which are shown in

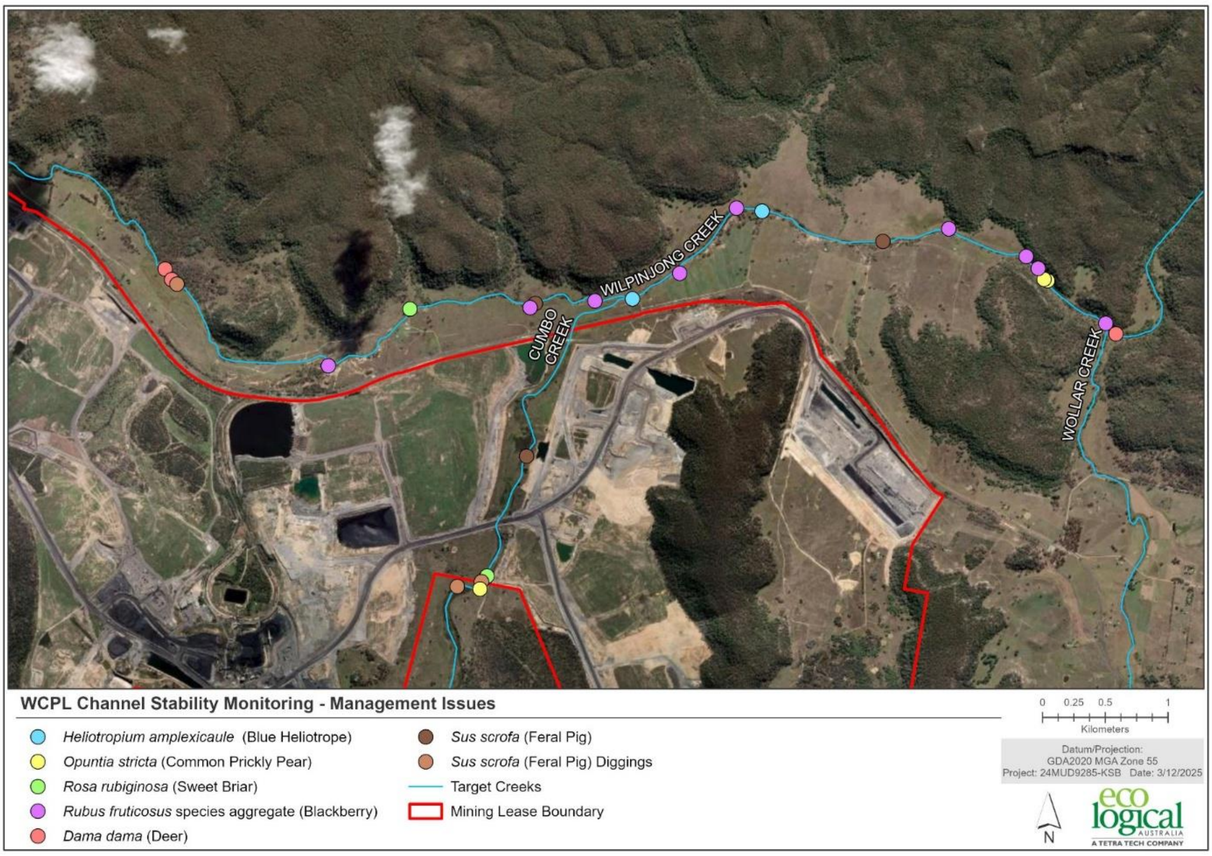

Figure 3-1.

Figure 3-1: Weed species and feral species along Wilpinjong and Cumbo Creek

4. Discussion and Recommendations

Of the 49 sites surveyed along Wilpinjong Creek, 35 sites recorded scores in the stable range, whilst 14 sites recorded scores in the unstable range. The lowest scoring sites (all Moderately Unstable) were WCk26, WCk27, Wck32 and WCk42. Both WCk27 and WCk42 have scored Moderately Unstable since 2018 and 2017 respectively, whereas WC4 experienced some erosion to degrade to an unstable rating for 2024 and 2025 due to some minor erosion. These sites were typified by mass sediment wasting, high cover of unconsolidated material, less than 50% streambank protection and limited to no riparian woodland. WCk28 has experienced decline from 2024 scores, from Stable to Unstable, due to additional mass wasting.

The western section of Wilpinjong Creek (incorporating WCk1 to WCk16) contains good areas of natural regeneration, with overall moderate to good riparian woodland vegetation and habitat present. There was some regeneration of *Eucalyptus* sp. recorded along the banks which has the potential to provide increased bank stability in the future. Overall groundcover increased slightly, although upstream sites WCk1 to WCk3 had cattle present grazing and other sites exhibited evidence of grazing pressure in 2024. In stream vegetation cover of *Phragmites australis* (Common Reed) remained consistent despite significantly reduced water levels.

The middle section of Wilpinjong Creek (incorporating sites WCk17 to WCk44) is characterised by cleared adjacent paddocks and narrow, scattered riparian woodland (where present). Widespread historic clearing in this section of the creek has a pronounced influence on the channel stability scores, with unstable BEHI scores consistently recorded. There was a slight increase in groundcover at some sites, however this was not reflected in the overall score. A high cover of *Phragmites australis* within the channel was recorded at the majority of sites.

The eastern section of Wilpinjong Creek (incorporating sites WCk45 to WCk49) is characterised by a relatively steep and narrow valley, which has resulted in a straight channel with an overall high bank height. All sites within this section are Stable, with most sites in a Moderately Stable condition, due to the high groundcover and presence of woody vegetation on the banks which is assisting in stabilising the steep bank form erosion and the reduced grazing pressures compared to sites further upstream.

Of the ten sites surveyed along Cumbo Creek, all were in the Stable range, with nine out of ten sites Highly Stable. Cumbo Creek is characterised by a shallow meandering channel with low stable banks. The adjacent paddocks have been historically cleared with only very sparse riparian vegetation woodland remaining. Despite the lack of woody riparian vegetation, the creek remains in a stable condition, primarily due to high groundcover and are absent of grazing pressures. Groundcover species can assist in providing mid and upper bank sections with greater protection from scour, as they slow water flow close to the bank (Abernathy and Rutherford 1999).

4.1. Multi-year comparisons

Following on from the baseline channel stability assessment of Wilpinjong and Cumbo Creeks undertaken in 2005 as part of the WCPL EIS (WCPL 2005), annual monitoring has been undertaken during 2011, and 2014 – 2025. Annual monitoring since 2011 shows that the channel stability has remained relatively constant, both upstream and downstream of WCM. The following sections compare 2025 results to the results of previous monitoring years detailed above.

4.2. Site stability scores

Site channel stability data in the form of BEHI scores are available from 2016 – 2025 for direct comparison. Site stability ratings (based on BEHI scores) for Wilpinjong Creek and Cumbo Creek sites are presented in Appendix E. Differences in ratings were only noted as 'Improved' or 'Declined'. If no differences were observed the ratings were determined to be unchanged, indicating a consistent stability rating for that site. For Wilpinjong Creek, ratings improved at one site and remained unchanged at 48 sites. For Cumbo Creek, ratings remained unchanged at all sites.

Most sites remained consistent with previous years, with any score changes generally no more than ±2.5 of 2024 scores. Wck10, 11 and 12 all slightly decreased in stability from last year but not enough to move it between a different score tier.

The mostly consistent results from 2016 to 2025 at Cumbo Creek reflects the overall stable nature of this creek, with most sites classified as Highly Stable – with the one outlier at CCK2 being due to major rilling/erosion events according photo (Section 4.4)

4.3. Photographic comparisons

Photographic comparisons of sites across 2022-2025 monitoring are included in Appendix D. Photos taken from 2011 and 2014 – 2021 monitoring were also compared, however are not included in this report due to size. Previous reports can be referred to for photo comparisons with earlier years.

Comparisons indicate that there has been little observable change in the overall morphology of the stream channel and banks, with little evidence of any significant ongoing erosional features. The only notable feature is the level of groundcover on the banks has either remained consistent or increased slightly compared to 2024. This is largely due to an increased in rainfall in 2024 and the first half of 2025 (Appendix F) compared to 2023 and a return to above average rainfall consistent with 2020 to 2022 rainfall, and livestock grazing pressure at sites within Wilpinjong Creek remaining consistent, and despite lower rainfall in the second half of 2025, this increased vegetation and slowing of mass wasting resulted in consistent BEHI scores. In stream cover of *Phragmites australis* (Common Reed) and other macrophytes was largely maintained in 2025. Vegetation bank composition remained similar in 2025, with dominant groundcover species including a mixture of native and exotic species, such as *Aristida ramosa* (Purple wiregrass), *Sporobolus creber* (Western Rat-tail Grass), *Paspalum dilatatum* (Paspalum), and *Plantago lanceolata* (Lamb's Tongues).

Water levels were also slightly lower within Wilpinjong Creek and Cumbo Creek in 2025 compared to 2024. Most CSM sites upstream of WCPL water discharge location had water confined to pools/ponds at the time of monitoring. Downstream of the WCPL discharge point water levels were very low and slow flowing. There was no water flow within Cumbo Creek, with only isolated pools observed throughout its reach during monitoring.

Overall, decreases in vegetation cover and water levels visible in site photos observed both upstream and downstream of the WCPL water discharge location can be attributed to the below average rainfall recorded during 2025, when compared to photo evidence from Appendix D.

4.4. Erosion points

Error! Reference source not found. provides photos of the significant erosion points along Wilpinjong and Cumbo Creeks. These sites were identified as having moderate to severe historical erosion and the potential for continued erosion during times of downstream and lateral flow. Progression of erosion was minimal and only observed at seven of the 2025 monitoring points, with all sites stable at the time of monitoring. Sites E1, E3, E4, E7, and E9 showed evidence of ongoing mass wasting. Both Sites E7 and E9 displayed riling and undercutting, with further mass wasting observed. Sites E2, E6, E8, E10, and E11 all displayed evidence of erosion; however, they had largely stabilised over the previous years and showed no signs of obvious erosion progression at the time of monitoring.

Table 4-1: Significant erosion points and suggested remediation works

Erosion Point	Image	Notes/ suggested works
E1 (768557, 6422438)		Continuation of mass wasting, there appears to be some change to the left bank at the top with more erosion present.
E2 (768469, 6422527)		Rills formed on exposed bare soil with mass wasting also evident. However, since 2024 data there doesn't appear to be any major erosion. Evidence of revegetation and mulching.
E3 (768558, 6422432)		Evidence of continued mass wasting at top of bank and around tree roots. Reshaping and contouring of bank to ease water flowing the erosion and revegetation. From the 2024 photo comparatively there appears to be far less veg ground cover.

Erosion Point	Image	Notes/ suggested works
E4 (768614, 6422382)		Due to the formation of the banks and surrounding rock formations, mass wasting has continued as an overall erosion event. Reshaping and contouring of the bank would be beneficial to ease erosion to this corridor, as well as veg cover change.
E6 (772166, 6420287)		Erosion appears stable on the steep banks with no further mass wasting or undercutting observed at the time of monitoring. Reshaping and contouring of bank to ease water flowing through the erosion and revegetation.
E7 (772431, 6420352)		Undercutting and riling evident. A small amount of mass wasting has occurred over the past year. Reshaping of bank to ease water flowing through the erosion and revegetation. Wasting continuing in 2025 with less vegetation present and more wasting occurring from the bank top.

Erosion Point	Image	Notes/ suggested works
E8 (773014, 6420339)		Road continues to be stable with no further erosion evident. Continue to monitor rill.
E9 (773397, 6420376)		Erosion has continued to progress with evidence of undercutting and mass wasting. Tree roots on bank edge exposed. Reshaping and contouring of bank and revegetation.
E10 (773772, 6420328)		Erosion has continued to remain stable over the past 2 years now. Not active at time of monitoring. Revegetation and mulching (Section 4.3)

Erosion Point	Image	Notes/ suggested works
E11 (771670, 6419956)		Undercutting, Rilling and runoff of soil apparent. No evidence of further erosion at the time of monitoring. Reshaping of bank revegetation and mulching (Section 4.3)

4.5. Revegetation, remediation and recommendations

Revegetation work is recommended to target most of the erosion points, except for E8. The establishment of riparian vegetation can assist in stabilising banks and slow surface runoff (Abernathy and Rutherford 1999). Sites E1, E3, E4, E6 and E9 have very steep and exposed banks, which without intervention will continue to erode. This erosion can range from minor activity to gully retreat, bank collapse, and further root exposure. As these banks become higher, and the bank angle becomes greater, which will lead to further erosion. Therefore, it is recommended that these banks are initially reshaped to reduce the overall bank angle, before undertaking revegetation works.

Meanwhile, with site E2 showing evidence of rill erosion, the application of a native groundcover seed mix and mulch to the bank sides (including hydro-mulch) is recommended to assist stabilisation until vegetation establishes, along with the installation of coarse-rock, large-woody debris, coir logs and/or hay bale check dams to reduce water flow in designated erosion points. Seeding and mulching is also recommended for sites E10, and E11. Temporary fencing works in all areas will also assist in excluding native and introduced fauna from revegetation and remediation areas, it is recommended that the existing fencing around sites E1 to E4 be assessed and reinstated where required.

Previous revegetation works were undertaken in 2019 by WCPL on a 1.6 km section of Wilpinjong Creek, approximately between sites WCk25 and WCk27 (see **Error! Reference source not found.**), and in 2020 along approximately 1.9 km of Cumbo Creek and 1 km of Wilpinjong Creek using tube stock of native species. Cumbo Creek is currently stable and continues to remain stable, it is recommended that the ongoing success of the revegetation works be determined though survival assessments, which could also help to inform future revegetation works planned for both the two channels and the mine rehabilitation.

Livestock (cattle) access to the riparian zone continues to impact on the overall stability and riparian health of Wilpinjong Creek. The impact of livestock was apparent in the far-western section of Wilpinjong Creek (incorporating sites WCk1 to WCk4), with heavy grazing observed of riparian and instream vegetation at each of these four sites. The generally preceding wetter conditions in the lead up to 2024 monitoring likely exacerbated the impact of stock grazing in this section on Wilpinjong Creek for last years scores, remaining stable for 2025. Excluding stock from the riparian zone in these areas, is recommended to improve creek stability and health and assist natural regeneration.

The results of ongoing monitoring provide evidence that the channels along both Wilpinjong and Cumbo Creek and relatively stable and have remained consistently stable throughout recent years of drought and flooding. Given the consistent results produced through monitoring, it is recommended that the annually monitoring be changed to biennial or triennial monitoring, and in response to extreme rainfall years. This recommendation would require a change to the WCPL SWMP, so that monitoring is consistent with the SWMP. It is recommended that WCPL considered altering the requirements for channel stability monitoring in the 2025 management plan review and update period upon submission of the Annual Review.

5. Conclusion

The channel stability of both Wilpinjong and Cumbo Creeks is characteristic of ephemeral systems in agricultural landscapes, and consistent with other creeks in the surrounding region. Both creek systems exhibit characteristic channel stability issues associated with agricultural landscapes including:

- Historically cleared and degraded riparian vegetation and the presence of exotic species, including Regional Priority Weeds such as *Rubus fruticosus* species aggregate (Blackberry), *Rosa rubiginosa* (Sweet Brier) and *Hypericum perforatum* (St John's Wort).
- Lateral gully-erosion at several locations, due to an increase in runoff velocity occurring perpendicular to the creek line from adjacent cleared paddocks.
- Continued livestock access contributing to bank instability, reducing in-stream and riparian vegetation and hampering natural regeneration.
- Introduced and native fauna (e.g. European Rabbit and Common Wombat) burrowing within the riparian zone.

There was little evidence of erosion progression at the CSM sites, whilst there being increased rainfall and resulting water flowing through the channels, there was also increased riparian and instream vegetation cover due to the wetter conditions that has the potential to increase stability for future monitoring periods. Minor erosion was observed at approximately half of the erosion monitoring points; however, they were all largely stable and not active during the monitoring period of increased rainfall. Flow both upstream and downstream of the WCM was relatively reduced in 2025 with many sites previously featuring ponding and channelisation now bare and dry.

Erosion and bank stability issues within the Wilpinjong and Cumbo Creeks are the result of historic agricultural practices within the riparian zone, including widespread clearing and direct and ongoing stock access to the bank and channel. The stability of the bank and channel has remained relatively consistent throughout recent years of drought and flooding. There is no evidence that mining activities are adversely impacting the channel stability of the target creeks surrounding the WCM. It is recommended that WCPL consider transitioning the annual monitoring to biennial or triennial monitoring.

6. References

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Wilpinjong Coal Pty Limited 2018. Wilpinjong Coal Water Management Plan (Appendix 2 – Surface Water Management Plan) WI-ENV-MNP-0006.

Appendix A BEHI Assessment Scoring

Indicator	Measure	Score
1. Bank Height (m)	0 - 1.5	0
	1.5-3	2.5
	3-4.5	5
	4.5-6	7.5
	6+	10
2. Bank Angle (°)	0-20	0
	21-60	2
	61-80	4
	81-90	6
	91-120	8
	> 120	10
3. Percentage of Bank Height with a Bank Angle Greater than 80°	0-10	0
	11 to 25	2.5
	26-50	5
	51-75	7.5
	76-100	10
4. Evidence of Mass Wasting (% of Bank)	0-10	0
	11 to 25	2.5
	26-50	5
	51-75	7.5
	76-100	10
5. Unconsolidated Material (% of Bank)	0-10	0
	11 to 25	2.5
	26-50	5
	51-75	7.5
	76-100	10
6. Streambank Protection (% of Streambank covered by plant roots, vegetation, logs, branches, rocks, etc.)	0-10	15
	11 to 25	12.5
	26-50	10
	51-70	7.5
	70-90	2.5
	90-100	0
7. Established Beneficial Riparian Woody – Vegetation Cover	0-10	15
	11 to 25	12.5
	26-50	10
	51-70	7.5
	70-90	2.5
	90-100	0
8. Stream Curvature Descriptor	Meander	5
	Shallow Curve	2.5
	Straight	0
Site Ratings (totals)	Highly Stable	0-25
	Mod Stable	26-35

Indicator	Measure	Score
	Stable	36-45
	Unstable	46-55
	Mod Unstable	56-65
	Highly Unstable	66-85

Appendix B 2025 BEHI data

2025 BEHI data for Wilpinjong Creek

Site	Bank (L/R)	Bank Height (m)	Bank Face Length	BEHI Indicator 1	2	3	4	5	6	7	8	Total	Rating
WCk1	L	4	10	5	2	5	2.5	2.5	7.5	10	5	39.5	Stable
WCk2	R	3.5	9	5	2	5	2.5	2.5	7.5	10	0	34.5	Mod Stable
WCk3	L	3	12	5	2	2.5	7.5	5	10	12.5	5	49.5	Unstable
WCk4	L	4	8	5	2	7.5	5	7.5	10	12.5	0	49.5	Unstable
WCk5	L	3	9	5	2	2.5	5	5	2.5	7.5	0	29.5	Mod Stable
WCk6	L	4.5	6	5	2	2.5	0	2.5	7.5	10	2.5	32	Mod Stable
WCk7	L	2.5	6	2.5	2	2.5	0	2.5	2.5	7.5	0	19.5	Highly Stable
WCk8	L	5	12	7.5	2	0	0	0	2.5	15	2.5	29.5	Mod Stable
WCk9	R	2	9	2.5	2	7.5	5	2.5	10	15	2.5	47	Unstable
WCk10	R	1.5	15	2.5	0	0	0	0	2.5	15	2.5	22.5	Highly Stable
WCk11	R	1.5	18	0	0	0	0	2.5	0	12.5	2.5	17.5	Highly Stable
WCk12	R	2	12	2.5	2	0	0	2.5	2.5	15	5	29.5	Mod Stable
WCk13	L	4	8	5	4	0	0	2.5	2.5	10	5	29	Mod Stable
WCk14	L	1.8	7	2.5	2	0	0	2.5	2.5	12.5	0	22	Highly Stable
WCk15	L	1.8	6	2.5	2	2.5	0	2.5	2.5	10	2.5	24.5	Highly Stable
WCk16	L	3	7	2.5	2	5	0	2.5	7.5	7.5	0	27	Mod Stable
WCk17	R	1.8	4	2.5	2	0	0	0	0	15	2.5	22	Highly Stable
WCk18	R	2.5	5	2.5	2	5	2.5	0	0	15	2.5	29.5	Mod Stable
WCk19	L	2	4	2.5	2	2.5	2.5	0	0	15	0	24.5	Highly Stable
WCk20	L	1.8	5	2.5	2	5	7.5	2.5	7.5	12.5	0	39.5	Stable
WCk21	R	1.3	5	0	2	2.5	2.5	0	2.5	15	2.5	27	Mod Stable
WCk22	R	1.6	8	2.5	2	0	7.5	2.5	12.5	12.5	2.5	42	Stable
WCk23	R	2.5	12	2.5	2	0	2.5	5	12.5	15	5	44.5	Stable
WCk24	R	1.7	10	2.5	0	2.5	0	2.5	2.5	15	2.5	27.5	Mod Stable
WCk25	L	1.7	7	2.5	2	2.5	7.5	2.5	7.5	15	2.5	42	Stable
WCk26	L	3.5	10	5	2	7.5	7.5	5	10	15	2.5	54.5	Unstable
WCk27	R	2.8	5	2.5	6	7.5	7.5	5	10	15	2.5	56	Mod Unstable
WCk28	L	2.5	5	2.5	2	7.5	7.5	2.5	10	12.5	2.5	47	Unstable
WCk29	L	3.6	8	5	2	7.5	5	5	7.5	15	2.5	49.5	Unstable
WCk30	R	2.8	12	2.5	2	0	0	2.5	2.5	12.5	2.5	24.5	Highly Stable
WCk31	R	3	6	2.5	4	5	5	5	7.5	15	2.5	46.5	Unstable
WCk32	R	3.2	7	5	4	7.5	7.5	2.5	7.5	15	2.5	51.5	Unstable
WCk33	L	3.2	6	5	4	7.5	7.5	5	10	10	5	54	Unstable
WCk34	R	2.4	6	2.5	4	5	2.5	0	0	15	5	34	Mod Stable
WCk35	R	2.2	13	2.5	2	2.5	7.5	5	10	15	2.5	47	Unstable

Site	Bank (L/R)	Bank Height (m)	Bank Face Length	BEHI Indicator								Total	Rating
				1	2	3	4	5	6	7	8		
WCk36	R	2	15	5	2	0	2.5	2.5	2.5	15	2.5	32	Mod Stable
WCk37	R	2	12	5	2	2.5	7.5	5	7.5	15	0	44.5	Stable
WCk38	L	3.1	6	5	2	2.5	0	2.5	0	10	5	27	Mod Stable
WCk39	L	3.2	7	5	4	2.5	5	7.5	7.5	15	2.5	49	Unstable
WCk40	R	3.2	14	5	2	0	7.5	7.5	12.5	15	0	49.5	Unstable
WCk41	R	2.8	8	2.5	2	2.5	0	0	0	15	0	22	Highly Stable
WCk42	R	3.8	6	5	4	7.5	5	10	12.5	12.5	2.5	59	Mod Unstable
WCk43	L	3.1	5	5	4	7.5	2.5	0	2.5	15	2.5	39	Stable
WCk44	R	1.7	3	2.5	2	2.5	0	0	2.5	15	2.5	27	Mod Stable
WCk45	L	3.5	7	5	4	2.5	2.5	0	2.5	7.5	5	29	Mod Stable
WCk46	R	2.5	5	2.5	4	5	2.5	2.5	2.5	10	2.5	31.5	Mod Stable
WCk47	R	2.5	6	2.5	2	2.5	7.5	2.5	7.5	12.5	0	37	Stable
WCk48	L	2.7	8	2.5	2	2.5	2.5	5	2.5	12.5	2.5	32	Mod Stable
WCk49	L	4	10	5	4	2.5	0	5	7.5	10	2.5	36.5	Stable

2025 BEHI data for Cumbo Creek

Site	Bank (L/R)	Bank Height (m)	Bank Face Length	BEHI Indicator								Total	Rating
				1	2	3	4	5	6	7	8		
CCk1	L	1.4	10	0	0	0	0	0	0	15	0	15	Highly Stable
CCk2	R	1	8	0	2	2.5	2.5	0	2.5	15	5	29.5	Stable
CCk3	L	0.3	2	0	0	0	0	0	2.5	15	2.5	20	Highly Stable
CCk4	R	1	13	0	0	0	0	0	0	15	2.5	17.5	Highly Stable
CCk5	R	1	8	0	0	0	0	0	0	15	2.5	17.5	Highly Stable
CCk6	R	1.8	5	2.5	2	2.5	0	0	0	15	2.5	24.5	Highly Stable
CCk7	R	0.5	2	0	2	2.5	0	0	0	15	2.5	22	Highly Stable
CCk8	L	2	15	2.5	0	0	0	0	0	15	2.5	20	Highly Stable
CCk9	L	0.7	2	0	2	2.5	0	0	0	15	2.5	22	Highly Stable
CCk10	L	0.7	4	0	2	2.5	0	0	0	15	2.5	22	Highly Stable

Appendix C Monitoring site descriptions – Wilpinjong Creek and Cumbo Creek

Site	Upstream	Downstream
Wilpinjong Creek		
WCk1	• Water level is higher than 2024 with water pooled downstream of weir • No further dieback of *Angophora floribunda* (Rough-barked Apple) since 2021 • Livestock access to creek • Groundcover on bank heavily grazed • Cattle present	• Bare soil patches, erosion stabilising • Livestock access to creek • Groundcover on bank heavily grazed • Water ponding within channel • Cattle present • Cattle tracks main site of mass wastage • Slight worse score than last year
WCk2	• Livestock access to creek • Groundcover on bank heavily grazed • Large decrease in vegetation cover within the channel due to livestock grazing, cattle present • Water ponding within channel Minimal localised erosion, currently appears stable, however has slight increase due to livestock access	• Livestock access to creek • Groundcover on bank heavily grazed • Erosion appears stable, however slight increase due to livestock access • Water ponding within channel • Cattle present • Consistent with last year's results
WCk3	• Livestock access to creek • Groundcover on bank heavily grazed • *Phragmites australis* and *Juncus* sp. present in 2022 now absent due to grazing • Water ponding within channel. • Minimal localised erosion, slight progression • Cattle present	• Livestock access to creek • Groundcover on bank heavily grazed • *Phragmites australis* and *Juncus* sp. present in 2022 now absent due to grazing • Some progression of erosion and mass wasting • Water ponding within channel • Cattle present • Mass wasting progressing from 2024 scores, with less consolidated material. • Not enough vegetation to stabilise progression of erosion.
WCk4	• Livestock access to creek • Groundcover on bank and within channel heavily grazed • *Phragmites australis* now absent from channel • No water within channel • Active erosion on left hand bank (LHB) continues, with evidence of undercutting and mass wasting	• LHB steep with exposed roots • Vegetation cover on both banks is good • LHB erosion active still active, with undercutting and mass wasting • Vegetation in channel is high, dominated by Phragmites australis and Juncus sp. • No water within channel • Erosion still progressing. Affecting the angle of the near bank.
WCk5	• *Phragmites australis* present in channel, high cover • LHB erosion active with mass wasting evident. Some bare soil patches on bank from erosion • Vegetation on banks is in good condition • *Eucalyptus blakelyi* (Blakely's Red Gum) regeneration in channel • No water within channel • Erosion stable on LHB, however slight progression	• Vegetation in channel is high, dominated by Phragmites australis • Woody vegetation cover is good on both banks • Bank vegetation cover good, with mixed grasses including *Themeda triandra* • Minor localised erosion on LHB from animal tracks, however, appears largely stable • Erosion continues to increase; metrics with 2024 otherwise consistent.
WCk6	• *Phragmites australis* in channel, high cover	• Vegetation in channel is high, dominated by *Phragmites australis*

Site	Upstream	Downstream
	• Good vegetation on both banks bank • Eucalypt regeneration on LHB • Water ponding within channel • Small *Rubus fruticosus* species aggregate (Blackberry) on LHB	• Woody vegetation cover is good on both banks • Large *Rubus fruticosus* species aggregate on RHB and small *Rubus fruticosus* species aggregate along LHB • Water ponding within channel • Decrease in canopy veg cover and increase in unconsolidated material.
WCk7	• *Phragmites australis* present in channel, high cover • Good vegetation cover that has increased on both banks • Regeneration of *Eucalyptus blakelyi* on banks • Large woody debris (LWD), within channel, potential litter trap during high flow events • Water ponding within channel	• Vegetation in channel is high, dominated by *Phragmites australis* • Good vegetation cover on bank increased, with groundcover on LHB contributing to stabilisation • Woody vegetation is good on both banks • Regeneration of *Angophora floribunda* and *Eucalyptus blakelyi* on both banks • Water ponding within channel • Very stable overall. Good veg cover • Overall, a decent improvement in score despite remaining within the same rating range.
WCk8	• High *Phragmites australis* cover within and edge of channel • Water ponding/pooling, no flow • Good woody vegetation cover on LHB, RHB has good groundcover	• High *Phragmites australis* cover within and edge of channel • Water ponding/pooling, no flow • Some bare patches on RHB, however no erosion • Increase in mass wasting and unconsolidated material, decrease in veg.
WCk9	• Erosion on right hand bank (RHB) has been active in past year, currently appears stable • High cover of *Phragmites australis* in channel • Debris washed up into trees from previous high flow events	• High cover of *Phragmites australis* in channel • Good vegetation cover on upper and lower bank • RHB is steep, with mid bank bare due to erosion • Erosion on RHB has been active within the past year, currently appears stable. • Continuation of mass wasting from previous years.
WCk10	• High cover of *Phragmites australis* in channel and on bank • Water ponding within channel Eucalyptus regeneration on RHB • Good vegetation cover on RHB	• Good vegetation cover on both banks • High woody vegetation cover on RHB • High cover of *Phragmites australis* in channel • Debris from high flow events washed up onto trees on RHB • Water ponding within channel • Channel dry, Causeway pipe appears to have been dislodged. Otherwise, stable.
WCk11	• High vegetation cover in channel and on banks with *Phragmites australis, Arundinella nepalensis* (Reedgrass), and *Austrostipa verticillata* (Slender bamboo grass) present • *Cyperaceae* sp. in channel • High woody vegetation cover on LHB • Young *E. camaldulensis* and *E. blakelyi* on RHB • No water within channel	• High cover of *Phragmites australis* in channel • High vegetation cover on both banks • Regeneration of *Eucalyptus blakelyi* in channel • No water in channel • Slight decrease in canopy cover.
WCk12	• Young *Allocasuarina* species on LHB • Good vegetation cover on both banks increased since 2024 • High *Phragmites australis* cover in channel • No water within channel	• High cover of *Phragmites australis* in channel • High woody vegetation cover on both banks • Increased high vegetation cover on both banks, RHB dominated by *Lomandra confertifolia* • Regeneration of *Angophora floribunda* and *Eucalyptus blakelyi* on RHB

Site	Upstream	Downstream
		• No water within channel • Reduced woody cover from 2024 results.
WCk13	• Good vegetation cover on banks, high cover of *Phragmites australis* within and on the edge of the channel • Debris washed up from high flow events in channel an on LHB • Water ponding within channel • Eucalypt regeneration present on both banks	• Regeneration of *Eucalyptus blakelyi* on both banks • Good vegetation cover on both banks • Water ponding within channel • *Less vegetation than last year on this bank*
WCk14	• Debris washed up against base of tree from high flow events • High cover of *Phragmites australis* within and on the edge of the channel • Good groundcover and woody vegetation cover on both banks • Regeneration of *Eucalyptus blakelyi* on RHB • Water ponding within channel	• High cover of *Phragmites australis* within and on edge of channel • High groundcover on LHB • Regeneration of *Eucalyptus blakelyi* on LHB • Water ponding within channel • Stable with 2024 results
WCk15	• High cover of *Phragmites australis* in channel • Good vegetation cover on both banks, which is stabilising LHB • Good groundcover on both banks • No water within channel	• LHB stable with good vegetation cover • High cover of *Phragmites australis* within and on edge of channel • No water within channel
WCk16	• Water ponding within channel • High cover of *Phragmites australis* on the edge of the bank • Good vegetation cover on both banks	• Water ponding within channel • *Phragmites australis* on the edge of RHB • Both banks well vegetated • LHB stable with good vegetation cover • Channel is bare, with little vegetation. • Veg continued to decrease in 2025 score • Unconsolidated material increased. Site looks less stable than 2024, and much drier.
WCk17	• Highly vegetated with *Phragmites australis* in channel and extended onto bank • Regen present on both banks	• Dense vegetation of *Phragmites australis* in channel at similar cover to 2022 monitoring, is preventing access to point • *Eucalyptus blakelyi* regeneration on RHB • LHB stable with good vegetation cover • Consistent overall with 2024 score.
WCk18	• Good vegetation cover on RHB • Good woody vegetation on LHB • *Phragmites australis* on edge of channel • Water ponding/pooling • Erosion on RHB has been active over past year, small amounts of mass wasting	• High cover of *Phragmites australis* within in channel, extending to upper bank • Good vegetation cover on banks • Water ponding/pooling • Erosion on RHB has stabilised due to increased groundcover • Water level is much lower than 2024 score – pooling and ponding reduced – but otherwise fairly consistent score.
WCk19	• High vegetation cover on bank, including *Lomandra confertifolia* (Mat-rush) and *Themeda triandra* • Minor erosion from animal tracks on LHB, currently appears stable • *Phragmites australis* within and on the edge of channel • Water ponding/pooling	• Good vegetation cover on LHB, dominated by *Lomandra confertifolia* and native grasses • High cover of *Phragmites australis* within in channel • Water ponding/pooling • Bare patches present on LHB, minor erosion has historically but appears stable • Mostly consistent with 2024 score.

Site	Upstream	Downstream
WCk20	• High cover of *Phragmites australis* in channel • Mass wasting has continued on LHB over past year, for approximately 50 m upstream from point • Good groundcover vegetation on lower bank and upper bank, dominated by *Lomandra confertifolia* • Bare soil present mid bank on LHB from erosion	• High cover of *Phragmites australis* within in channel, extending to upper bank • Good vegetation cover on LHB, dominated by *Lomandra confertifolia* and native grasses • Regeneration of *Angophora floribunda* on LHB • *Rubus fruticosus* species aggregate on RHB • No water within channel • Mass wasting still progressing, otherwise consistent with 2024 score.
WCk21	• Vegetation cover on high, dominated by *Lomandra confertifolia* • High *Phragmites australis* cover within and on the edge of the channel • Eucalypt regeneration present on RHB • Water pooling within channel	• High cover of *Phragmites australis* within in channel • *Angophora floribunda* regeneration on RHB • High groundcover on both banks, dominated by *Lomandra confertifolia*, which has helped stabilise erosion • Water pooling within channel from 2024 has reduced, way less water overall. • No water over the causeway unlike previous years. • Otherwise fairly consistent with last year.
WCk22	• Good vegetation cover on RHB • Some bare patches of ground on RHB, low bank angle, minor active erosion • No riparian tree cover on LHB with only a small riparian zone on RHB • Eucalypt regeneration present RHB • High *Phragmites australis* cover within and on edges of channel • No water in channel	• Erosion on RHB has been active over the past year but currently appears stable • Minimal vegetation cover on RHB, dominated by bare ground • No riparian tree cover on RHB • High cover of *Phragmites australis* within channel • Good vegetation cover on LHB • No water within channel • Mass wasting continued to progress, not much change from previous scores though.
WCk23	• High *Phragmites australis* cover within channel • Minor erosion on LHB, however there is good vegetation cover stabilising the bank and regeneration is occurring • Patches of bare soil on RHB, erosion is currently stable • No water in channel	• High cover of *Phragmites australis* within channel • Vegetation cover on RHB is similar to 2022 monitoring • Erosion on RHB appears to have stabilised, though bare ground present • *Rubus fruticosus* species aggregate present • Mass wasting still slowly progressing. Less unconsolidated material but no increase in vegetation on the LHB/RHB, still bare.
WCk24	• High vegetation cover on RHB • High cover of *Phragmites australis* in channel with *Juncus* sp. on edge of channel • Erosion on RHB stable • No water in channel	• High cover of *Phragmites australis* and *Typha* sp. within channel • High vegetation cover high on lower RHB • Sediment fence is gone • Increase in vegetation. Stones stabilising erosion. Site improving overall.
WCk25	• Bank well vegetated increased since 2024 • High *Phragmites australis* cover within and on the edge of the channel • Eucalypt regeneration on LHB • Low cover of *Hypericum perforatum* on LHB • Some bare patches, however no active erosion • No water within channel	• High cover of *Phragmites australis* within channel • Bare soil patches on LHB, with active erosion • Good vegetation cover on the upper banks, mainly native grasses, with increase in cover since 2024 • *Hypericum perforatum* present on lower LHB • Erosion point E11 at DS section of site. Metrics consistent to previous year except increase in

Site	Upstream	Downstream
		stream bank vegetation cover. Erosion continues,
WCk26	• Good vegetation cover on LHB • High *Phragmites australis* cover within channel and extending to upper bank • *Rubus fruticosus* species aggregate present on LHB	• LHB is steep and continues to erode, with evidence of wasting and run off • High cover of *Phragmites australis* within channel • LHB mostly bare due to erosion • Groundcover on upper LHB dying off • Mass wasting still progressing, otherwise consistent with last year.
WCk27	• High cover of *Phragmites australis* within channel • RHB continues to be an erosion risk mass wasting has not progressed since Brush-tailed Rock-wallaby • Vegetation cover on top of bank has increased since 2023 • No water within channel	• RHB is steep and continues to erode through mass wasting • High *Phragmites australis* cover within channel • Patches of bare soil on lower and mid RHB • Groundcover on upper RHB has increased since 2024 • Erosion progressing, but site otherwise consistent.
WCk28	• Mass wasting on LHB has progressed slightly • Good vegetation cover on banks, slightly less than 2024 • High cover of *Phragmites australis* in channel • Eucalypt regeneration at top of LHB	• High cover of *Phragmites australis* within channel • LHB steep with evidence of mass wasting erosion over the past year • Vegetation cover on upper LHB consistent with 2024 • Erosion on RHB currently appears stable with groundcover consistent with 2024 • Mass wasting still progressing, but otherwise consistent metrics with 2024.
WCk29	• *Angophora floribunda* regeneration on LHB • Large *Rubus fruticosus* species aggregate present on LHB • High cover of *Phragmites australis* in channel • Slight increase in erosion continued around exposed tree root on LHB	• Signs of recent erosion on LHB, mass wasting active on steep bank face, top of bank held by native grasses • Lower and mid LHB is bare • High cover of *Phragmites australis* within channel • Mass wasting slowly progressing but some more groundcover. Otherwise consistent with last year.
WCk30	• High cover of *Phragmites australis* in channel • Extensive wombat burrows on RHB, bank vegetation cover similar to 2024 • Good woody vegetation cover on both banks • Regeneration of *Angophora floribunda* on both banks • RHB dominated by *Lomandra confertifolia* • Water ponding/pooling	• High cover of *Phragmites australis* within channel • Vegetation cover is high on RHB with *Lomandra confertifolia* dominating RHB • *Rubus fruticosus* species aggregate on LHB • Regeneration of *Angophora floribunda* and *Eucalyptus blakelyi* and *Eucalyptus melliodora* on RHB • Water ponding/pooling • Increased wombat activity/burrows has led to mass wasting along the top of bank. Metrics consistent with 2024 though.
WCk31	• Erosion on RHB continues with undercutting and mass wasting, some sections stabilised by high groundcover • High cover of *Phragmites australis* in channel, increased since 2024 • Vegetation cover on banks is similar to 2024	• High cover of *Phragmites australis* within channel and extending to banks, cover has increased since 2024 • Minor erosion on RHB, some evidence of mass wasting progression at top of RHB, however largely stable • Eucalypt regeneration on RHB

Site	Upstream	Downstream
	• Water flowing in channel	• Site adjacent to causeway. Fill and boulders placed on causeway ramp are holding, erosion slowing, site largely unchanged since last year.
WCk32	• High cover of *Phragmites australis* in channel • RHB steep leading to exposed roots of Eucalypts on bank edge. Erosion is slowly progressing due to mass wasting • Bare patches mid bank on RHB, good vegetation cover on upper and lower bank • Very large *Rubus fruticosus* species aggregate at top of RHB which extends to the lower bank • Water ponding/pooled	• Erosion on RHB, largely stable but some evidence of mass wasting • High cover of *Phragmites australis* within channel • RHB dominated by native grasses • Decrease in bare ground on RHB • Very large *Rubus fruticosus* species aggregate at top of RHB which extends to the lower bank • Mass wasting progressing. Consistent though with last year. Lots of veg close to channel but bank is steep and bare. Drier.
WCk33	• Vegetation is denser than 2024 with more less ground patches, particularly on lower and mid bank • *High Lomandra confertifolia* cover on LHB • High cover of *Phragmites australis* in channel • Erosion has occurred on LHB over past year, currently appears stable in some sections but mass wasting active in some spots • Water ponding in channel	• Active erosion on LHB, exposed root system with active mass wasting around it and increases in bare soil patches • Upper LHB has good vegetation cover • Good vegetation cover on RHB, dominated by *Lomandra confertifolia, increase in cover from 2024* • Water ponding/pooling • Two trees have fallen on LHB, with one over the channel • High cover of *Phragmites australis* within channel • Consistent with previous year, some increase in mass wastage of sheer banks.
WCk34	• High *Phragmites australis* within channel • Minimal localised erosion along animal tracks on RHB • Minor erosion on RHB, high vegetation cover is stabilising bank • High *Lomandra confertifolia* cover on RHB • Water ponding/pooling	• High cover of *Phragmites australis* within channel • Minor erosion on RHB has stabilised, however there are some bare patches of ground • Good vegetation cover on LHB • High groundcover on RHB dominated by *Lomandra confertifolia* • High bank, historical mass wasting now being supported by high veg cover.
WCk35	• High cover of *Phragmites australis* within channel • RHB bare patches and active erosion continues to progress slowly, however appears stable • Good vegetation cover on LHB and top of RHB • Low flow of water in channel	• High cover of *Phragmites australis* within channel • Vegetation cover on RHB is dominated by native grasses, however there is an increase in bare ground • *Rubus fruticosus* species aggregate within channel • Erosion on RHB has been active over the past years, though has largely stabilised • Good vegetation cover on LHB • No tree cover in riparian zone on RHB • Low flow of water in channel • Slight progression on mass wasting, otherwise consistent.
WCk36	• High cover of *Phragmites australis* and *Typha* species within channel	• RHB erosion appears stable with good vegetation cover • Some bare ground on top of RHB

Site	Upstream	Downstream
	• Less bare patches and minor erosion on both banks than 2024, currently appears stable • RHB vegetation includes a mix of *Verbena bonariensis,* native grasses and *Lomandra confertifolia*	• High cover of *Phragmites australis* and *Typha* sp. within channel • No tree cover in riparian zone on either bank • Both banks dominated native grasses and *Lomandra confertifolia* • More unconsolidated material, more veg cover which is stabilising erosion from previous years
WCk37	• Decrease in groundcover and increase in bare patches on RHB • Mass wasting progressing slowly • LHB remains well vegetated with minor lateral erosion • High cover of *Phragmites australis* and *Typha* species within channel • Water pooling and flowing slowly	• Vegetation cover is still high on RHB, but slightly decreased since 2024 • Minor erosion on top of RHB, however stable due to good groundcover • High cover of *Phragmites australis* and *Typha* sp. within channel • Mass wasting ongoing slowly, less unconsolidated material and more veg on bank.
WCk38	• Increase in groundcover vegetation on banks, some bare ground persisting however no erosion • *Phragmites australis* on edge of channel on LHB • Water ponding and flowing slowly • *Rubus fruticosus* species aggregate present on LHB	• Increase in groundcover vegetation on banks, some bare ground however no erosion • Good woody vegetation cover on both banks • *Rubus fruticosus* species aggregate present on LHB • Water flowing slowly within channel • A little more unconsolidated material, otherwise consistent with last year.
WCk39	• Vegetation cover good on upper and lower LHB, however mid bank bare • *Juncus* sp. on edge of channel • Water flowing slowly within channel • Erosion progressing slowly on LHB with evidence of run off and mass wasting, currently appears stable • Regeneration of Eucalypt species on both banks, healthy and growing well • Grazing of channel and bank vegetation due to livestock	• Vegetation cover good on lower and upper LHB • Erosion on LHB recently active, some evidence of mass wasting but largely stable and vegetated • LHB steep with bare mid bank • Regeneration of Eucalypt species on both banks progressing well • *Rubus fruticosus* species aggregate present on RHB • Water flowing within channel • Grazing of channel and bank vegetation due to livestock • Slightly higher veg this year otherwise consistent with previous year
WCk40	• Vegetation cover on banks and in channel similar to 2024 • Regeneration of *Eucalyptus blakelyi* on both banks healthy and growing well • LHB erosion remains stable • RHB mostly bare ground with unconsolidated materials, some evidence of erosion but largely stable • Channel and bank vegetation cover high • Water flowing slowly	• Vegetation cover on banks and in channel similar to 2024 • Channel and bank vegetation cover high, *Juncus* sp. present • RHB mostly bare ground with unconsolidated materials, some evidence of erosion but largely stable • Regeneration occurring on both banks • Water flower slowly in narrow channel • Consistent with last year except for slightly less unconsolidated material – topsoil largely stripped from bank, rocky substrate susceptible to erosion, particularly Rilling and lateral. • Regen on both banks progressing very well.
WCk41	• RHB exposed tree roots, however vegetation cover is good and is assisting with bank stabilisation, no progression of erosion • Macrophytes and *Juncus* sp. in channel • Water ponding/pooling	• Channel and bank vegetation cover high and increased since 2024 • Macrophytes and *Juncus* sp. in channel • Erosion on RHB stable • Water pooled and moving very slowly • Consistent with last year's scores.

Site	Upstream	Downstream
	• Channel and bank vegetation cover high and increased since 2024	
WCk42	• Veg in channel and on banks similar to 2024 • Bank vegetation cover high, • High macrophyte and *Juncus* sp. cover within channel • RHB steep but appears stable, low groundcover • Water flowing in channel	• Erosion on RHB is still active, undercutting and mass wasting present, though overall less compared to previous years • LHB vegetation cover high • LHB is well vegetated with regeneration of Eucalypts present • High macrophyte and *Juncus* sp. cover within channel • Water flowing in channel • RHB eroding into bedrock, tree roots exposed - erosion as significant as seen, though still progressing. Site consistent.
WCk43	• High cover of macrophytes within channel • Good groundcover on RHB increased since 2024 • LHB steep, some progression of mass wasting but appears stable • Water flowing slowly in channel	• High vegetation cover within channel and on the lower and upper LHB increased since 203 • LHB steep, some progression of mass wasting but appears stable due to good groundcover • Water flowing slowly in channel • Small decrease in veg cover but it is continuing to stabilise historical erosion.
WCk44	• Vegetation cover on RHB similar to 2024, some bare patches • Groundcover dominated by native grass species • Mass wasting on both banks stab due to good vegetation cover • *Juncus* sp. and other macrophytes on edge of channel • LHB appears stable • Water flowing slowly in channel	• Vegetation cover on RHB consistent with 2024, dominated by *Aristida ramosa* and *Bothriochloa macra* • *Phragmites australis* and *Typha* sp. within channel • LHB exposed steep bank appears stable due to good vegetation cover, erosion caused by wombats and animal tracks • Water pooling and flowing slowly • More mass wasting and less veg due to this. Otherwise consistent.
WCk45	• Vegetation cover is similar to 2024 • Water flowing in channel • LHB stable with vegetation cover improving stability • *Eucalyptus blakelyi* and *Eucalyptus melliodora* (Yellow Box) regeneration on both banks	• Vegetation cover similar to 2024, with high vegetation cover on both banks • *Rubus fruticosus* species aggregate on LHB • Regeneration of *Eucalyptus melliodora* and *Eucalyptus blakelyi* on RHB • LHB is steep, with erosion and mass wasting active over the previous year • Goody woody vegetation cover on LHB • Some evidence of mass wasting, affecting angle of bank but nothing much more. • Otherwise consistent with 2024 scores.
WCk46	• High vegetation cover in channel and on banks • Water slowly flowing in channel • Large *Rubus fruticosus* species aggregate on LHB • Large *Angophora floribundas* on both banks with regen present	• High vegetation cover on both banks, including *Juncus* and *Cyperaceae* sp. on RHB • Good woody vegetation cover on RHB • Very slow flow of water • Fallen tree from LHB across channel, causing litter trap • LHB continues to be stabilised due to vegetation cover • RHB is steep with minor erosion but appears to have stabilised • Consistent with previous year
WCk47	• High cover of *Phragmites australis* and *Typha* species within channel	• High cover of *Phragmites australis* and *Typha* species within channel • Both banks have high cover of groundcover dominated by *Lomandra confertifolia*

Site	Upstream	Downstream
	• Erosion and mass wasting has slowly progressed on RHB, however is currently stable • Regeneration of *Eucalyptus blakelyi* and *Angophora floribunda* on both banks • LHB is steep but stable with good groundcover • RHB good groundcover on lower and upper bank, dominated by *Lomandra confertifolia*	• Both banks have good woody vegetation cover • RHB is steep, erosion and mass wasting appears stable, mid bank is bare • Water in channel flowing slowly • Mass wasting continuing to progress. Bank eroded and also now affecting angle of bank
WCk48	• Vegetation cover has increased since 2024, with good cover on both banks • High cover of *Phragmites australis* and *Typha* species within channel • Animal tracks on LHB steep and causing localised erosion • Active erosion and undercutting under tree root on LHB, currently appears stable • Water flowing in channel	• *Phragmites australis* and *Typha* species on the edge of channel • Water flowing within channel • Good vegetation cover on both banks increased since 2024 • LHB erosion currently stable and held by woody vegetation • Some bare ground on lower LHB • Erosion caused by animal tracks has stabilised • Consistent, bit more unconsolidated material
WCk49	• Vegetation cover on banks is similar to 2024 • LHB woody vegetation cover is high and stabilising bank • RHB lateral erosion is currently stable • *Rubus fruticosus* species aggregate on LHB • Water flowing in channel	• Water flowing within channel • Good vegetation cover on both banks assisting with stabilising erosion • RHB some minor erosion and bare soil due to high flow events, however groundcover still high • Good woody vegetation cover on LHB stabilising erosion • Blackberry (*rubus sp.)* on bank, consistent with last year
Cumbo Creek		
CCk1	• Vegetation cover within channel similar to 2024, dominated by *Juncus* sp. • Vegetation cover on banks is similar to 2024 and is dominated by *Plantago lanceolata* (Lamb's Tongues) and native grasses • Some regeneration of Eucalypts present • Water pooling within channel	• Vegetation cover on bank and in channel is similar to 2024 • Channel vegetation cover is high, including *Juncus* sp. and *Cyperaceae* sp. • Bank dominated by *Plantago lanceolata* (Lamb's Tongues) and a mixture of native and exotic grasses • Eucalypt regeneration on LHB is healthy and growing well • Some pooling in channel. Highly stable overall.
CCk2	• Vegetation cover on bank and channel high, dominated by *Juncus* sp and native grasses including *Aristida ramosa* • Some bare patches on RHB • Erosion and mass wasting on bank continues to stabilise • Water pooling within channel	• Good vegetation cover in channel and on LHB • Bare soil on RHB, erosion currently appears stable • Channel vegetation cover is high, including *Juncus* sp. and *Cyperaceae* sp. • Mix of native and exotic grass species dominating bank, including *Aristida ramose* • Stabilising with increased groundcover to previous scores
CCk3	• High vegetation cover on both banks, with a mix of native and exotic grasses • High cover of in stream vegetation, including *Cyperaceae* species • Water pooling within channel	• Bank vegetation cover is high • Bank dominated by *Juncus* sp. and Cyperaceae sp. and a mix of native and exotic grass species • Small amounts of *Hypericum perforatum* also present • Water pooling within channel

Site	Upstream	Downstream
		• Increased groundcover reducing unconsolidated material.
CCk4	• Good groundcover within channel and on banks • Increased ground cover form 2024 • Bank vegetation is dominated by *Plantago lanceolata* and *Sporobolus creber* (Western Rat-tail Grass) • Small amount of *Hypericum perforatum* • *Rosa rubiginosa* (Sweet Briar) in channel on RHB • Water pooling within channel	• Two large *Rosa rubiginosa* on RHB • Site remains stable with good vegetation cover which has increased since 2024 • Channel vegetation cover is high, including *Juncus* sp. and *Cyperaceae* sp. • Small amounts of *Hypericum perforatum* also present • Water pooling within channel • High veg cover remains. Dry creek bed. Some *Rosa sp.* Bushes on the bank(s) 2025.
CCk5	• High cover within channel, dominated by *Juncus* sp. • Groundcover on banks is similar to 2024, dominated by *Plantago lanceolata* and native grasses including *Sporobolus creber* and *Aristida ramosa* • Small amounts of *Hypericum perforatum* present • Water pooling within channel	• Vegetation cover is high and similar to 2024 • Vegetation cover within channel is dominated by *Juncus* sp. • Upper bank dominated by *Plantago lanceolata, Paspalum dilatatum* and *Cynodon dactylon* • Small amounts of *Hypericum perforatum* also present • Water pooling within channel • Increased steam bank protection resulting in reduced consolidated material.
CCk6	• Channel vegetation cover high • Upper banks dominated by *Lomandra filiformis* (Wattle Mat-rush) as well as *Paspalum dilatatum* and *Cynodon dactylon* and *Juncus* sp. • Water pooling within channel	• Channel is bare, with no vegetation • Vegetation cover on banks is high and is dominated by *Lomandra filiformis* (Wattle Mat-rush) as well as *Paspalum dilatatum, Bromus* sp. and *Juncus* sp. • Small water pool within channel in 2024 – completely dry in 2025 score. • Stream otherwise stable with no change other than bank length.
CCk7	• Vegetation within channel and on banks very high, dominated by *Paspalum dilatatum*, *Bromus* sp. and *Plantago lanceolata* No water within channel	• Vegetation within channel and on banks very high, dominated by *Paspalum dilatatum*, *Bromus* sp. and *Plantago lanceolata* • No water within channel (2024). • Completely dry (2025). • Stream otherwise stable with no change other than bank length.
CCk8	• High cover of *Phragmites australis* within channel • Vegetation on bank is dominated by *Paspalum dilatatum, Sporobolus creber* and *Plantago lanceolata* • Small amount of *Hypericum perforatum* present on LHB	• High vegetation cover in channel, with *Phragmites australis, Juncus* sp., and *Cyperaceae* sp. present • Good vegetation cover on banks, including *Paspalum dilatatum Bromus* sp. and *Sporobolus creber* • Small water pool within channel in 2024 – completely dry in 2025 score. • Stream otherwise stable with no change other than bank length.
CCk9	• Vegetation cover is similar to 2024, • Vegetation cover is high and dominated by *Cyperaceae* sp. within the channel and mixed native and exotic grasses on both banks	• Vegetation cover is similar to 2024 • Erosion has been stabilised by vegetation cover • Bank is dominated by mixed native and exotic grass species • Channel vegetation cover is high and dominated by *Cyperaceae* sp. and *Typha* sp. • Highly vegetated, consistent with last year

Site	Upstream	Downstream
CC10	• Vegetation cover has increased on the banks since 2024 • Vegetation cover is high and dominated by *Cyperaceae* sp. within the channel and mixed native and exotic grasses on both banks • Water pooling/ponding	• Vegetation cover has increased on the banks since 2024 • Vegetation cover is high and dominated by *Cyperaceae* sp. within the channel and mixed native and exotic grasses on both banks • LHB erosion is currently stable • Water pooling/ponding • Highly vegetated, consistent with previous year.

Appendix D Site photo comparisons

WCK 1

 Figure B – 1: 2025 upstream	 Figure B – 2: 2024 upstream	 Figure B – 3: 2023 upstream	 Figure B – 4: 2022 upstream
 Figure B – 5: 2025 downstream	 Figure B – 6: 2024 downstream	 Figure B – 7: 2023 downstream	 Figure B – 8: 2022 downstream

WCK 2


Figure B – 9: 2025 upstream


Figure B – 10: 2024 upstream


Figure B – 11: 2023 upstream


Figure B – 12: 2022 upstream


Figure B – 13: 2025 downstream


Figure B – 14: 2024 downstream


Figure B – 15: 2023 downstream


Figure B – 16: 2022 downstream

WCK 3

 Figure B – 17: 2025 upstream	 Figure B – 18: 2024 upstream	 Figure B – 19: 2023 upstream	 Figure B – 20: 2022 upstream
 Figure B – 21: 2025 downstream	 Figure B – 22: 2024 downstream	 Figure B – 23: 2023 downstream	 Figure B – 24: 2022 downstream

WCK 4

Figure B – 25: 2025 upstream

Figure B – 26: 2024 upstream

Figure B – 27: 2023 upstream

Figure B – 28: 2022 upstream

Figure B – 29: 2025 downstream

Figure B – 30: 2024 downstream

Figure B – 31: 2023 downstream

Figure B – 32: 2022 downstream

WCK 5


Figure B – 33: 2025 upstream


Figure B – 34: 2024 upstream


Figure B – 35: 2023 upstream


Figure B – 36: 2022 upstream


Figure B – 4: 2025 downstream


Figure B – 4: 2024 downstream


Figure B – 4: 2023 downstream


Figure B – 40: 2022 downstream

WCK 6


Figure B – 41: 2025 upstream


Figure B – 42: 2024 upstream


Figure B – 43: 2023 upstream


Figure B – 44: 2022 upstream


Figure B – 45: 2025 downstream


Figure B – 46: 2024 downstream


Figure B – 47: 2023 downstream


Figure B – 48: 2022 downstream

WCK 7


Figure B – 49: 2025 upstream


Figure B – 50: 2024 upstream


Figure B – 51: 2023 upstream


Figure B – 52: 2022 upstream


Figure B – 53: 2025 downstream


Figure B – 54: 2024 downstream


Figure B – 55: 2023 downstream


Figure B – 56: 2022 downstream

WCK 8


Figure B – 57: 2025 upstream


Figure B – 58: 2024 upstream


Figure B – 59: 2023 upstream


Figure B – 60: 2022 upstream


Figure B – 61: 2025 downstream


Figure B – 62: 2024 downstream


Figure B – 63: 2023 downstream


Figure B – 64: 2022 downstream

WCK 9

Figure B – 65: 2025 upstream

Figure B – 66: 2024 upstream

Figure B – 67: 2023 upstream

Figure B – 68: 2022 upstream

Figure B – 69: 2025 downstream

Figure B – 70: 2024 downstream

Figure B – 71: 2023 downstream

Figure B – 72: 2022 downstream

WCK 10


Figure B – 73: 2025 upstream


Figure B – 74: 2024 upstream


Figure B – 75: 2023 upstream


Figure B – 76: 2022 upstream


Figure B – 77: 2025 downstream


Figure B – 78: 2024 downstream


Figure B – 79: 2023 downstream


Figure B – 80: 2022 downstream

WCK 11

 Figure B – 81: 2025 upstream	 Figure B – 82: 2024 upstream	 Figure B – 83: 2023 upstream	 Figure B – 84: 2022 upstream
 Figure B – 85: 2025 downstream	 Figure B – 86: 2024 downstream	 Figure B – 87: 2023 downstream	 Figure B – 88: 2022 downstream

WCK 12

 Figure B – 89: 2025 upstream	 Figure B – 90: 2024 upstream	 Figure B – 91: 2023 upstream	 Figure B – 92: 2022 upstream
 Figure B – 93: 2025 downstream	 Figure B – 94: 2024 downstream	 Figure B – 95: 2023 downstream	 Figure B – 96: 2022 downstream

WCK 13


Figure B – 97: 2025 upstream


Figure B – 98: 2024 upstream


Figure B – 99: 2023 upstream


Figure B – 100: 2022 upstream


Figure B – 101: 2025 downstream


Figure B – 102: 2024 downstream


Figure B – 103: 2023 downstream


Figure B – 104: 2022 downstream

WCK 14


Figure B – 105: 2025 upstream


Figure B – 106: 2024 upstream


Figure B – 107: 2023 upstream


Figure B – 108: 2022 upstream


Figure B – 109: 2025 downstream


Figure B – 110: 2024 downstream


Figure B – 111: 2023 downstream


Figure B – 112: 2022 downstream

WCK 15

Figure B – 113: 2025 upstream

Figure B – 114: 2024 upstream

Figure B – 115: 2023 upstream

Figure B – 116: 2022 upstream

Figure B – 117: 2025 downstream

Figure B – 118: 2024 downstream

Figure B – 119: 2023 downstream

Figure B – 120: 2022 downstream

WCK 16

 Figure B – 121: 2025 upstream	 Figure B – 122: 2024 upstream	 Figure B – 123: 2023 upstream	 Figure B – 124: 2022 upstream
 Figure B – 125: 2025 downstream	 Figure B – 126: 2024 downstream	 Figure B – 127: 2023 downstream	 Figure B – 128: 2022 downstream

WCK 17

 Figure B – 129: 2025 upstream	 Figure B – 130: 2024 upstream	 Figure B – 131: 2023 upstream	 Figure B – 132: 2022 upstream
 Figure B – 133: 2025 downstream	 Figure B – 134: 2024 downstream	 Figure B – 135: 2023 downstream	 Figure B – 136: 2022 downstream

WCK 18


Figure B – 137: 2025 upstream


Figure B – 138: 2024 upstream


Figure B – 139: 2023 upstream


Figure B – 140: 2022 upstream


Figure B – 141: 2025 downstream


Figure B – 142: 2024 downstream


Figure B – 143: 2023 downstream


Figure B – 144: 2022 downstream

WCK 19

Figure B – 145: 2025 upstream

Figure B – 146: 2024 upstream

Figure B – 147: 2023 upstream

Figure B – 148: 2022 upstream

Figure B – 149: 2025 downstream

Figure B – 150: 2024 downstream

Figure B – 151: 2023 downstream

Figure B – 152: 2022 downstream

WCK 20

 Figure B – 153: 2025 upstream	 Figure B – 154: 2024 upstream	 Figure B – 155: 2023 upstream	 Figure B – 156: 2022 upstream
 Figure B – 157: 2025 downstream	 Figure B – 158: 2024 downstream	 Figure B – 159: 2023 downstream	 Figure B – 160: 2022 downstream

WCK 21

 Figure B – 161: 2025 upstream	 Figure B – 162: 2024 upstream	 Figure B – 163: 2023 upstream	 Figure B – 164: 2022 upstream
 Figure B – 165: 2025 downstream	 Figure B – 166: 2024 downstream	 Figure B – 167: 2023 downstream	 Figure B – 168: 2022 downstream

WCK 22


Figure B – 169: 2025 upstream


Figure B – 170: 2024 upstream


Figure B – 171: 2023 upstream (alternative angle)


Figure B – 172: 2022 upstream


Figure B – 173: 2025 downstream


Figure B – 174: 2024 downstream


Figure B – 175: 2023 downstream (alternative angle)


Figure B – 176: 2022 downstream

WCK 23

 Figure B – 177: 2025 upstream	 Figure B – 178: 2024 upstream	 Figure B – 179: 2023 upstream	 Figure B – 180: 2022 upstream
 Figure B – 181: 2025 downstream	 Figure B – 182: 2024 downstream	 Figure B – 183: 2023 downstream	 Figure B – 184: 2022 downstream

WCK 24


Figure B – 185: 2025 upstream


Figure B – 186: 2024 upstream


Figure B – 187: 2023 upstream


Figure B – 188: 2022 upstream


Figure B – 189: 2025 downstream


Figure B – 190: 2024 downstream


Figure B – 191: 2023 downstream


Figure B – 192: 2022 downstream

WCK 25

 Figure B – 193: 2025 upstream	 Figure B – 194: 2024 upstream	 Figure B – 195: 2023 upstream	 Figure B – 196: 2022 upstream
 Figure B – 197: 2025 downstream	 Figure B – 198: 2024 downstream	 Figure B – 199: 2023 downstream	 Figure B – 200: 2022 downstream

WCK 26

 Figure B – 201: 2025 upstream	 Figure B – 202: 2024 upstream	 Figure B – 203: 2023 upstream	 Figure B – 204: 2022 upstream
 Figure B – 205: 2025 downstream	 Figure B – 206: 2024 downstream	 Figure B – 207: 2023 downstream	 Figure B – 208: 2022 downstream

WCK 27

 Figure B – 209: 2025 upstream	 Figure B – 210: 2024 upstream	 Figure B – 211: 2023 upstream	 Figure B – 212: 2022 upstream
 Figure B – 213: 2025 downstream	 Figure B – 214: 2024 downstream	 Figure B – 215: 2023 downstream	 Figure B – 216: 2022 downstream

WCK 28

 Figure B – 217: 2025 upstream	 Figure B – 218: 2024 upstream	 Figure B – 219: 2023 upstream	 Figure B – 220: 2022 upstream
 Figure B – 221: 2025 downstream	 Figure B – 222: 2024 downstream	 Figure B – 223: 2023 downstream	 Figure B – 224: 2022 downstream

WCK 29

 Figure B – 225: 2025 upstream	 Figure B – 226: 2024 upstream	 Figure B –227: 2023 upstream	 Figure B – 228: 2022 upstream
 Figure B – 229: 2025 downstream	 Figure B – 230: 2024 downstream	 Figure B – 231: 2023 downstream	 Figure B – 232: 2022 downstream

WCK 30


Figure B – 233: 2025 upstream


Figure B – 234: 2024 upstream


Figure B – 235: 2023 upstream


Figure B – 236: 2022 upstream


Figure B – 237: 2025 downstream


Figure B – 238: 2024 downstream


Figure B – 239: 2023 downstream


Figure B – 240: 2022 downstream

WCK 31

 Figure B – 241: 2025 upstream	 Figure B – 242: 2024 upstream	 Figure B – 243: 2023 upstream	 Figure B – 244: 2022 upstream
 Figure B – 245: 2025 downstream	 Figure B – 246: 2024 downstream	 Figure B – 247: 2023 downstream	 Figure B – 248: 2022 downstream

WCK 32

 Figure B – 249: 2025 upstream	 Figure B – 250: 2024 upstream	 Figure B – 251: 2023 upstream	 Figure B – 252: 2022 upstream
 Figure B – 253: 2025 downstream	 Figure B – 254: 2024 downstream	 Figure B – 255: 2023 downstream	 Figure B – 256: 2022 downstream

WCK 33


Figure B – 257: 2025 upstream


Figure B – 258: 2024 upstream


Figure B – 259: 2023 upstream


Figure B – 260: 2022 upstream


Figure B – 261: 2025 downstream


Figure B – 262: 2024 downstream


Figure B – 263: 2023 downstream


Figure B – 264: 2022 downstream

WCK 34

 Figure B – 265: 2025 upstream	 Figure B – 266: 2024 upstream	 Figure B – 267: 2023 upstream	 Figure B – 268: 2022 upstream
 Figure B – 269: 2025 downstream	 Figure B – 270: 2024 downstream	 Figure B – 271: 2023 downstream	 Figure B – 272: 2022 downstream

WCK 35


Figure B – 273: 2025 upstream


Figure B – 274: 2024 upstream


Figure B – 275: 2023 upstream


Figure B – 276: 2022 upstream


Figure B – 277: 2025 downstream


Figure B – 278: 2024 downstream


Figure B – 279: 2023 downstream


Figure B – 280: 2022 downstream

WCK 36

 Figure B – 281: 2025 upstream	 Figure B – 282: 2024 upstream	 Figure B – 283: 2023 upstream	 Figure B – 284: 2022 upstream
 Figure B – 285: 2025 downstream	 Figure B – 286: 2024 downstream	 Figure B – 287: 2023 downstream	 Figure B – 288: 2022 downstream

WCK 37

Figure B – 289: 2025 upstream

Figure B – 290: 2024 upstream

Figure B – 291: 2023 upstream

Figure B – 292: 2022 upstream

Figure B – 293: 2025 downstream

Figure B – 294: 2024 downstream

Figure B – 295: 2023 downstream

Figure B – 296: 2022 downstream

WCK 38

 Figure B – 297: 2025 upstream	 Figure B – 298: 2024 upstream	 Figure B – 299: 2023 upstream	 Figure B – 300: 2022 upstream
 Figure B – 301: 2025 downstream	 Figure B – 302: 2024 downstream	 Figure B – 303: 2023 downstream	 Figure B – 304: 2022 downstream

WCK 39


Figure B – 305: 2025 upstream


Figure B – 306: 2024 upstream


Figure B – 307: 2023 upstream


Figure B – 308: 2022 upstream


Figure B – 309: 2025 downstream


Figure B – 310: 2024 downstream


Figure B – 311: 2023 downstream


Figure B – 312: 2022 downstream

WCK 40

 Figure B – 313: 2025 upstream	 Figure B – 314: 2024 upstream	 Figure B – 315: 2023 upstream	 Figure B – 316: 2022 upstream
 Figure B – 317: 2025 downstream	 Figure B – 318: 2024 downstream	 Figure B – 319: 2023 downstream	 Figure B – 320: 2022 downstream

WCK 41


Figure B – 321: 2025 upstream


Figure B – 322: 2024 upstream


Figure B – 323: 2023 upstream


Figure B – 324: 2022 upstream


Figure B – 325: 2025 downstream


Figure B – 326: 2024 downstream


Figure B – 327: 2023 downstream


Figure B – 328: 2022 downstream

WCK 42

Figure B – 329: 2025 upstream

Figure B – 330: 2024 upstream

Figure B – 331: 2023 upstream

Figure B – 332: 2022 upstream

Figure B – 333: 2025 downstream

Figure B – 334: 2024 downstream

Figure B – 335: 2023 downstream

Figure B – 336: 2022 downstream

WCK 43

 Figure B – 337: 2025 upstream	 Figure B – 338: 2024 upstream	 Figure B – 339: 2023 upstream	 Figure B – 340: 2022 upstream
 Figure B – 341: 2025 downstream	 Figure B – 342: 2024 downstream	 Figure B – 343: 2023 downstream	 Figure B – 344: 2022 downstream

WCK 44


Figure B – 345: 2025 upstream


Figure B – 346: 2024 upstream


Figure B – 347: 2023 upstream


Figure B – 348: 2022 upstream


Figure B – 349: 2025 downstream


Figure B – 350: 2024 downstream


Figure B – 351: 2023 downstream


Figure B – 352: 2022 downstream

WCK 45


Figure B – 353: 2025 upstream


Figure B – 354: 2024 upstream


Figure B – 355: 2023 upstream


Figure B – 356: 2022 upstream


Figure B – 357: 2025 downstream


Figure B – 358: 2024 downstream


Figure B – 359: 2023 downstream


Figure B – 360: 2022 downstream

WCK 46

 Figure B – 361: 2025 upstream	 Figure B – 362: 2024 upstream	 Figure B – 363: 2023 upstream	 Figure B – 364: 2022 upstream
 Figure B – 365: 2025 downstream	 Figure B – 366: 2024 downstream	 Figure B – 367: 2023 downstream	 Figure B – 368: 2022 downstream

WCK 47

 Figure B – 369: 2025 upstream	 Figure B – 370: 2024 upstream	 Figure B – 371: 2023 upstream	 Figure B – 372: 2022 upstream
 Figure B – 373: 2025 downstream	 Figure B – 374: 2024 downstream	 Figure B – 375: 2023 downstream	 Figure B – 376: 2022 downstream

WCK 48

 Figure B – 377: 2025 upstream	 Figure B – 378: 2024 upstream	 Figure B – 379: 2023 upstream	 Figure B – 380: 2022 upstream
 Figure B – 381: 2025 downstream	 Figure B – 382: 2024 downstream	 Figure B – 383: 2023 downstream	 Figure B – 384: 2022 downstream

WCK 49


Figure B – 385: 2025 upstream


Figure B – 386: 2024 upstream


Figure B – 387: 2023 upstream


Figure B – 388: 2022 upstream


Figure B – 389: 2025 downstream


Figure B – 390: 2024 downstream


Figure B – 391: 2023 downstream


Figure B – 392: 2022 downstream

CCK 1

 Figure B – 393: 2025 upstream	 Figure B – 394: 2024 upstream	 Figure B – 395: 2023 upstream	 Figure B – 396: 2022 upstream
 Figure B – 397: 2025 downstream	 Figure B – 398: 2024 downstream	 Figure B – 399: 2023 downstream	 Figure B – 400: 2022 downstream

CCK 2


Figure B – 401: 2025 upstream


Figure B – 402: 2024 upstream


Figure B – 403: 2023 upstream


Figure B – 404: 2022 upstream


Figure B – 405: 2025 downstream


Figure B – 406: 2024 downstream


Figure B – 407: 2023 downstream


Figure B – 408: 2022 downstream

CCK 3


Figure B – 409: 2025 upstream


Figure B – 410: 2024 upstream


Figure B – 411: 2023 upstream


Figure B – 412: 2022 upstream


Figure B – 413: 2025 downstream


Figure B – 414: 2024 downstream


Figure B – 415: 2023 downstream


Figure B – 416: 2022 downstream

CCK 4


Figure B – 417: 2025 upstream


Figure B – 418: 2024 upstream


Figure B – 419: 2023 upstream


Figure B – 420: 2022 upstream


Figure B – 421: 2025 downstream


Figure B – 422: 2024 downstream


Figure B – 423: 2023 downstream


Figure B – 424: 2022 downstream

CCK 5

 Figure B – 425: 2025 upstream	 Figure B – 426: 2024 upstream	 Figure B – 427: 2023 upstream	 Figure B – 428: 2022 upstream
 Figure B – 429: 2025 downstream	 Figure B – 430: 2024 downstream	 Figure B – 431: 2023 downstream	 Figure B – 432: 2022 downstream

CCK 6


Figure B – 433: 2025 upstream


Figure B – 434: 2024 upstream


Figure B – 435: 2023 upstream


Figure B – 436: 2022 upstream


Figure B – 437: 2025 downstream


Figure B – 438: 2024 downstream


Figure B – 439: 2023 downstream


Figure B – 440: 2022 downstream

CCK 7


Figure B – 441: 2025 upstream


Figure B – 442: 2024 upstream


Figure B – 443: 2023 upstream


Figure B – 444: 2022 upstream


Figure B – 445: 2025 downstream


Figure B – 446: 2024 downstream


Figure B – 447: 2023 downstream


Figure B – 448: 2022 downstream

CCK 8

 Figure B – 449: 2025 upstream	 Figure B – 450: 2024 upstream	 Figure B – 451: 2023 upstream	 Figure B – 452: 2022 upstream
 Figure B – 453: 2025 downstream	 Figure B – 454: 2024 downstream	 Figure B – 455: 2023 downstream	 Figure B – 456: 2022 downstream

CCK 9


Figure B – 457: 2025 upstream


Figure B – 458: 2024 upstream


Figure B – 459: 2023 upstream


Figure B – 460: 2022 upstream


Figure B – 461: 2025 downstream


Figure B – 462: 2024 downstream


Figure B – 463: 2023 downstream


Figure B – 464: 2022 downstream

CCK 10

 Figure B – 465: 2025 upstream	 Figure B – 466: 2024 upstream	 Figure B – 467: 2023 upstream	 Figure B – 468: 2022 upstream
 Figure B – 469: 2025 downstream	 Figure B – 470: 2024 downstream	 Figure B – 471: 2023 downstream	 Figure B – 472: 2022 downstream

Appendix E Site stability scores

Wilpinjong Creek site stability scores 2017-2025 comparisons

Site	2017 Rating	2018 Rating	2019 Rating	2020 Rating	2021 Rating	2022 Rating	2023 Rating	2024 Rating	2025 Rating	Difference
WCk1	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Stable	Stable	Stable	Unchanged
WCk2	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Unchanged
WCk3	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unchanged
WCk4	Moderately Unstable	Moderately Unstable	Moderately Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unchanged
WCk5	Moderately Stable	Moderately Stable	Moderately Stable	Highly Stable	Highly Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Unchanged
WCk6	Moderately Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Moderately Stable	Moderately Stable	Moderately Stable	Unchanged
WCk7	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Unchanged
WCk8	Stable	Stable	Unstable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Unchanged
WCk9	Stable	Stable	Unstable	Stable	Stable	Unstable	Unstable	Unstable	Unstable	Unchanged
WCk10	Highly Stable	Moderately Stable	Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Unchanged
WCk11	Highly Stable	Highly Stable	Moderately Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Unchanged
WCk12	Highly Stable	Highly Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Unchanged
WCk13	Moderately Stable	Stable	Stable	Highly Stable	Highly Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Unchanged
WCk14	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Unchanged
WCk15	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Unchanged
WCk16	Moderately Stable	Moderately Stable	Stable	Highly Stable	Highly Stable	Highly Stable	Moderately Stable	Moderately Stable	Moderately Stable	Unchanged

Site	2017 Rating	2018 Rating	2019 Rating	2020 Rating	2021 Rating	2022 Rating	2023 Rating	2024 Rating	2025 Rating	Difference
WCk17	Moderately Stable	Moderately Stable	Moderately Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Unchanged
WCk18	Stable	Stable	Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Unchanged
WCk19	Stable	Stable	Stable	Moderately Stable	Moderately Stable	Moderately Stable	Highly Stable	Highly Stable	Highly Stable	Unchanged
WCk20	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Stable	Stable	Stable	Stable	Unchanged
WCk21	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Unchanged
WCk22	Stable	Stable	Stable	Stable	Stable	Stable	Stable	Stable	Stable	Unchanged
WCk23	Stable	Stable	Stable	Unstable	Unstable	Unstable	Unstable	Unstable	Stable	Improved
WCk24	Unstable	Unstable	Unstable	Unstable	Unstable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Unchanged
WCk25	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Stable	Improved
WCk26	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unchanged
WCk27	Unstable	Moderately Unstable	Moderately Unstable	Moderately Unstable	Moderately Unstable	Moderately Unstable	Moderately Unstable	Moderately Unstable	Moderately Unstable	Unchanged
WCk28	Stable	Stable	Stable	Stable	Stable	Stable	Stable	Stable	Unstable	Worsened
WCk29	Stable	Stable	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unchanged
WCk30	Moderately Stable	Highly Stable	Moderately Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Unchanged
WCk31	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unchanged
WCk32	Moderately Unstable	Moderately Unstable	Moderately Unstable	Moderately Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unchanged
WCk33	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unchanged
WCk34	Unstable	Unstable	Unstable	Stable	Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Unchanged
WCk35	Moderately Stable	Stable	Stable	Stable	Stable	Unstable	Unstable	Unstable	Unstable	Unchanged
WCk36	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Unchanged

Site	2017 Rating	2018 Rating	2019 Rating	2020 Rating	2021 Rating	2022 Rating	2023 Rating	2024 Rating	2025 Rating	Difference
WCk37	Stable	Stable	Stable	Unstable	Unstable	Stable	Stable	Stable	Stable	Unchanged
WCk38	Stable	Stable	Stable	Moderately Stable	Moderately Stable	Highly stable	Moderately Stable	Moderately Stable	Moderately Stable	Unchanged
WCk39	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unchanged
WCk40	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unstable	Unchanged
WCk41	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Unchanged
WCk42	Moderately Unstable	Moderately Unstable	Moderately Unstable	Moderately Unstable	Moderately Unstable	Moderately Unstable	Moderately Unstable	Moderately Unstable	Moderately Unstable	Unchanged
WCk43	Unstable	Unstable	Unstable	Unstable	Unstable	Stable	Stable	Stable	Stable	Unchanged
WCk44	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Highly Stable	Moderately Stable	Moderately Stable	Moderately Stable	Unchanged
WCk45	Stable	Stable	Stable	Moderately Stable	Moderately Stable	Highly Stable	Moderately Stable	Moderately Stable	Moderately Stable	Unchanged
WCk46	Moderately Stable	Moderately Stable	Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Unchanged
WCk47	Moderately Stable	Stable	Stable	Moderately Stable	Moderately Stable	Moderately Stable	Stable	Stable	Stable	Unchanged
WCk48	Stable	Stable	Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Unchanged
WCk49	Stable	Stable	Unstable	Stable	Stable	Stable	Stable	Stable	Stable	Unchanged

Cumbo Creek site stability scores 2017-2025 comparison

Site	2017 Rating	2018 Rating	2019 Rating	2020 Rating	2021 Rating	2022 Rating	2023 Rating	2024 Rating	2025 Rating	Difference
CCK1	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Unchanged
CCK2	Stable	Stable	Stable	Stable	Stable	Stable	Stable	Stable	Stable	Unchanged
CCK3	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Unchanged
CCK4	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Unchanged
CCK5	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Unchanged
CCK6	Highly Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Moderately Stable	Highly Stable	Highly Stable	Highly Stable	Unchanged
CCK7	Moderately Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Unchanged
CCK8	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Unchanged
CCK9	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Unchanged
CCK10	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Highly Stable	Unchanged

Appendix F Monthly rainfall data

Table C - 1: Monthly rainfall from 2015-2025 (mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
2015	127.6	11.6	9.4	108.4	42.8	42.8	38.0	53.8	7.8	61.0	59.0	118.4	680.6
2016	152.1	7.2	23.5	14.8	66.8	104.2	101.1	40.9	198.7	86.6	51.9	90.6	938.4
2017	27.8	34.2	146	23	32.4	10.4	5.8	25.2	3	28.4	92.6	102.6	531.4
2018	24.4	77	24.6	42.2	12.4	21.6	1.2	43.8	39.6	56.8	47.4	91.2	482.2
2019	54.8	7.4	108.8	0	17.6	10.6	2.6	10.2	23	5.6	22	3	265.6
2020	27.2	127	92	117	16	23.4	70	36.4	77.2	150.6	17.4	161.6	915.8
2021	52.6	126.6	159.8	1.8	9.4	84.4	66.8	25.4	44.2	40.8	249.2	81.4	942.4
2022	101.4	16	119.8	95	43.6	13	136.4	103.2	93.8	174.4	64	26.6	987.2
2023	48.6	24.6	64.6	47.8	2.8	28.8	23.2	29.8	18	36.2	94	59.6	478
2024	86.6	78.6	32.8	68.8	62.2	68.6	65	39.8	45.4	51	116.6	30.8	745.2
2025	106.5	45.5	57.0	22.5	114.5	23.5	62.0	42.5	58.5	36.5	22.0	x	x
Historical Mean	67.2	62.2	55.2	39.3	37.2	44.0	43.0	41.1	41.7	52.1	57.0	60.9	593.1

Source: 2025 and historical data from the BoM weather station Wollar (Barrigan Street) weather station number: 62032 (BOM 2026).

2025 Stream Health Monitoring Report

WCPL Annual Monitoring Program

Wilpinjong Coal Mine Pty Ltd

Document Tracking

Project Name:	2025 Stream Health Monitoring Report: WCPL Annual Monitoring Program
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Abbreviations

Abbreviation	Description
ANZECC	Australian and New Zealand Environmental and Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
AUSRIVAS	Australian Rivers Assessment System
DO	Dissolved oxygen
EC	Electrical conductivity
ELA	Eco Logical Australia
EPL	Environmental Protection Licence
NP	National Park
NTU	Turbidity
RCE	Riparian, Channel and Environmental
RO	Reverse osmosis
SHM	Stream health monitoring
SIGNAL2	Stream Invertebrate Grade Number - Average Level
WCM	Wilpinjong Coal Mine
WCPL	Wilpinjong Coal Pty Ltd

Executive Summary

Stream health monitoring (SHM) was undertaken during spring 2025 within the catchments surrounding Wilpinjong Coal Mine (WCM). A total of ten permanent sites were monitored along Wilpinjong, Wollar and Cumbo creeks, as well as two control sites located along Barigan Creek.

The monitoring results were largely consistent with previous years' results. Most sites recorded mid-range Riparian, Channel and Environmental scores (RCE), typical of catchments in the region.

Water quality results were recorded for various parameters and differed across most sites in comparison with previous years. Parameters were inside Australian and New Zealand Environmental and Conservation Council (ANZECC) guidelines at all but three site for pH and were within at six sites for turbidity, likely as a result of decreased runoff and stream flow leading up to the monitoring period.

Water quality results for temperature, electrical conductivity (EC), and dissolved oxygen (DO) have fluctuated considerably across monitoring years (2016-2025), during times of variable stream flow and at sites both upstream and downstream of the WCM licensed discharge point. As such, these results indicate that natural factors and fluctuating climatic conditions, rather than mining operations are the primary influences on water quality in the catchments surrounding the WCM.

Across all monitoring sites, a total of 17 macroinvertebrate Orders comprised of 41 Families were recorded. Stream invertebrate grade number average level (SIGNAL2) scores notably fluctuated compared to the SHM period in 2024. A combination of low levels of flowing water, higher water temperature, and high DO likely limited the diversity of macroinvertebrate communities. Nine out of 10 sites scored <4.0, which is indicative of severely disturbed systems and only one site achieved a score of 4.0, indicating a moderately disturbed system, while in the 2024 SHM period nine out of 12 sites scored below 4.0 and three sites scored above 4.0. The overall temporal and spatial consistency of these macroinvertebrate results indicate that historical disturbances, combined with fluctuating climatic conditions within the larger catchments surrounding the WCM, are the main factors responsible for current stream health conditions.

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1. Introduction

1.1. Background

Wilpinjong Coal Pty Ltd (WCPL) is required to undertake annual stream health monitoring (SHM) to satisfy the updated requirement of Development Consent SSD 6764 Condition 29 & 30 (ii) (previously under Schedule 3, Condition 32 of WCPL's Project Approval (05-0021)) and the SHM criteria detailed in Appendix 2 of the Wilpinjong Water Management Plan (WCPL 2018). Eco Logical Australia (ELA) was engaged by WCPL to undertake SHM in the 2025 monitoring period.

1.2. Regional Overview

The Wilpinjong Coal Mine (WCM) is located in the Mid-Western Regional Council Local Government Area, approximately 45 km north-east of Mudgee. The mine is owned and operated by WCPL, a wholly owned subsidiary of Peabody Energy Australia.

The WCM is located at the headwaters of the Goulburn River which is a major tributary of the Hunter River. Wilpinjong Creek is the main drainage channel within the WCM. It is an intermittent creek with a narrow floodplain that has a history of cattle grazing. The northern edge of the floodplain is bordered by the sandstone escarpments of Goulburn River National Park (NP). Wilpinjong Creek has three coal mines in its catchment, Moolarben, Ulan, and Wilpinjong, with the latter positioned furthest downstream. WCPL discharges water (as of 2017), treated by reverse osmosis (RO), into Wilpinjong Creek at Environment Protection Licence (EPL) point 24 (EPL 24) directly adjacent to WCM.

Barigan Creek flows north through agricultural land as a tributary to Wollar Creek, joining south of the town of Wollar. Cumbo Creek flows north through land managed by WCPL, passing between Pit 3 and Pit 4, before joining Wilpinjong Creek north of the eastern pit area. Wilpinjong Creek continues to flow east, for approximately 4.5 km downstream where it joins Wollar Creek, which continues another 13 km through the Goulburn River NP before entering the Goulburn River (Figure 1).

1.3. Objectives

The ongoing SHM program for WCM is aimed to assist in determining the need for any maintenance and/or contingency measures. The objectives of annual SHM within Wilpinjong, Cumbo, Wollar and Barigan creeks include:

- Survey of aquatic macroinvertebrate assemblages in spring if streamflow or ponded water is present and access to the creeks is safe. In situ surface water quality sampling and analysis (pH, EC, temperature, dissolved oxygen, salinity and turbidity) is also conducted at each macroinvertebrate sampling sites at the time of the survey to identify and characterise the possible stressors upon macroinvertebrate assemblages.

Compilation of a variety of interpretive indices using the survey data to evaluate environmental quality at the survey sites. Comparing the site indices compiled for other sites within each survey and assessing changes in the indices for each site over time, including assessment against a trigger level for further investigation (Section 7.2)

2. Methodology

2.1. Survey Overview

The 2025 SHM was undertaken by ELA ecologists from 4 November to 7 November 2025. A total of 12 permanent monitoring sites were surveyed along Wilpinjong, Cumbo and Wollar creeks, including two control sites at Barigan Creek established in 2020 (Table 1, Table 2).in 2024, macroinvertebrate and water sampling did not occur at BC2 along Barigan Creek and at WC2 along Wilpinjong Creek because they were dry. BC2 was monitored in 2025, while WC2 was still dry and only the RCE was able to be monitored as physical features can be used to assess the aquatic habitat. In 2025, WC1and CC2 were also dry, meaning only RCE was monitored.

A total of ten permanent monitoring sites were surveyed along Wilpinjong, Cumbo and Wollar creeks, along with two control sites at Barigan Creek established in 2020 (Table 1). In 2024 macroinvertebrate and water sampling did not occur at BC2 along Barigan Creek and at WC2 along Wilpinjong Creek because they were dry, both sites were monitored in 2025.

Monitoring locations reflect a balance of sites both upstream and downstream of WCPL discharge point (EPL Point 24), as well as the various creeks (including external creeks) within the surrounding catchment (Figure 1). Photographs of each site are included in (Appendix A).

Table 1: 2025 monitoring sites

Creek	Site	Upstream / Downstream*	Inundation Status	Easting	Northing
Wilpinjong Creek	WC1	Upstream	Wet	767680	6422970
	WC2	Upstream	wet	768490	6422490
	WC6	Downstream	Wet	774580	6420860
	WC8	Downstream	Wet	775860	6420820
Cumbo Creek	CC1	Upstream	Wet	772710	6418130
	CC2	Upstream	Wet	772980	6418950
Wollar Creek	WO1	Upstream	Wet	777940	6418170
	WO2	Upstream	Wet	777780	6418950
	WO3	Downstream	Wet	777790	6420100
	WO4	Downstream	Wet	778030	6420596
Barigan Creek	BC1	Upstream	Wet	778704	6409493
	BC2	Upstream	Wet	779830	6403765

*Indicates Upstream / Downstream of EPL Point 24

Table 2: Monitoring methods undertaken at the 2025 monitoring sites

Monitoring method	WC1	WC2	WC6	WC8	CC1	CC2	WO1	WO2	WO3	WO4	BC1	BC2
RCE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Water quality	N*	N*	Y	Y	Y	N*	Y	Y	Y	Y	Y	Y
Macroinvertebrates	N*	N*	Y	Y	Y	N*	Y	Y	Y	Y	Y	Y

- Y = Yes, monitoring was undertaken at the site. N = No, monitoring was not undertaken at the site and * = Site was dry.

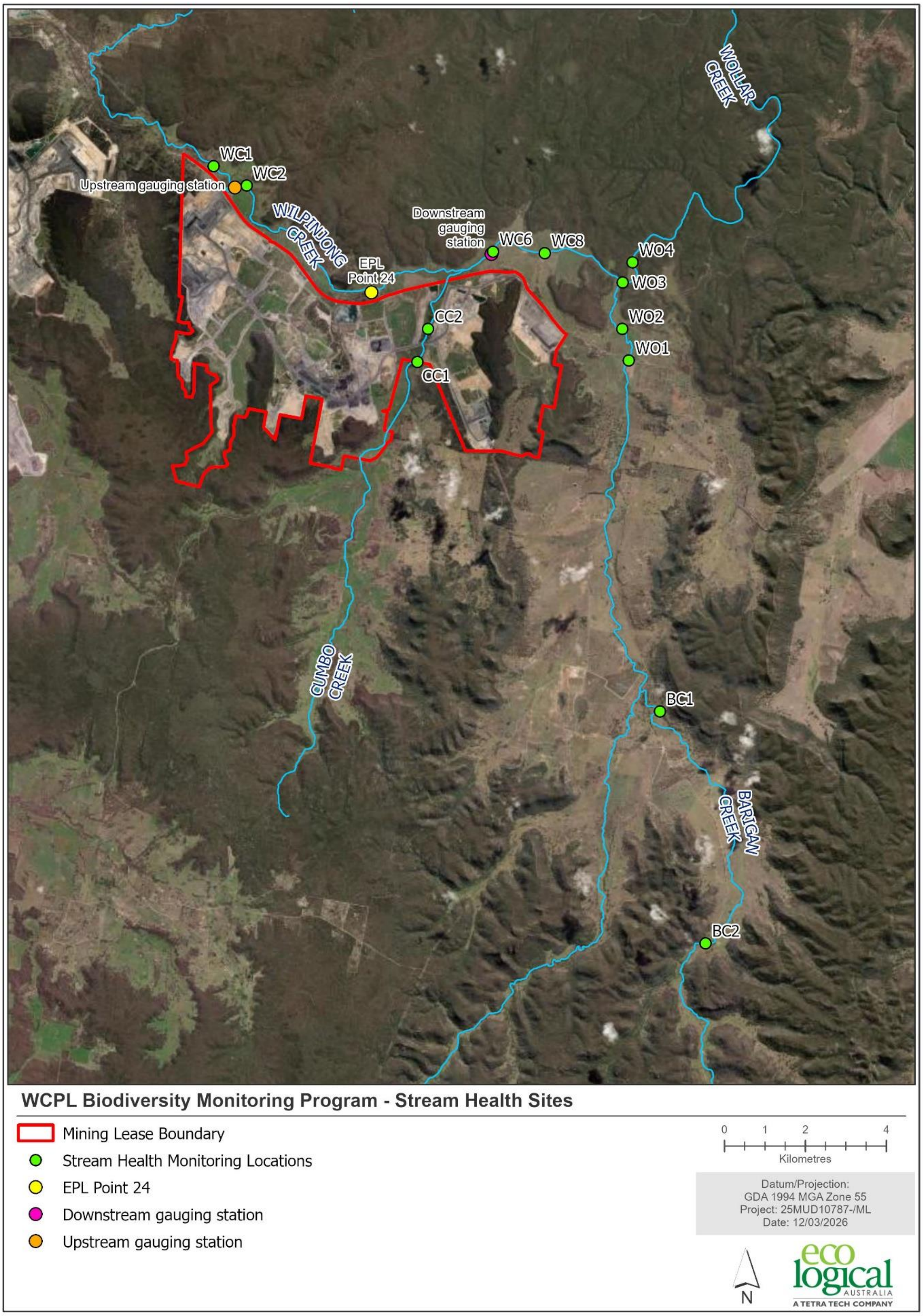

Figure 1: 2025 monitoring sites along Wilpinjong, Cumbo, Wollar and Barigan Creek.

2.2. Survey Methods

2.2.1. Aquatic habitat assessment

Aquatic habitat assessments were based on the *Policy and Guidelines for Fish Habitat Conservation and Management* (DPI Fisheries 2013), which outlines the features important for fish habitat in freshwater, estuarine, and marine areas. Habitat assessments allow the significance of river reaches to be determined, regardless of whether target fish species are present permanently, or for brief periods of time.

Aquatic habitat variables (environmental data) were noted for each site, with observations made from the bank on the following characteristics:

- General signs of disturbance
- Habitat type
- Channel topography
- Current water level
- Bank and bed slope
- Degree of river shading
- Amount of detritus
- Macrophyte type and extent
- Riparian zone width
- Snags and large woody debris coverage
- Stream width and depth
- Surrounding land use
- Description of the natural substrate
- Extent of bank overhang
- Amount of trailing bank vegetation.

Riparian condition was assessed using a version of the (RCE) (Peterson 1992) that was modified for Australian conditions (Chessman et al. 1997). The modified RCE has 13 descriptors, each with a score from one (poor condition) to four (good condition).

Descriptors included width and condition of the riparian zone, surrounding land use, extent of bank erosion, stream width, water depth, occurrence of pools, riffles and runs, substratum type, presence of snags and woody debris, in-stream and emergent macrophytes, algae, and barriers to fish passage. The total score for each site was derived by summing the score for each descriptor and calculating the result as a percentage of the highest possible score (up to 52).

Sites with a high RCE score indicate that the riparian zone is largely undisturbed, while those with a low score have undergone substantial modification. Based on the original classification established by Peterson (1992), site condition was rated as follows:

- Poor for RCE scores of 0-24%
- Fair for RCE scores of 25-43%
- Good for RCE scores of 44-62%
- Very Good for RCE scores of 63-81%
- Excellent for RCE scores of 82-100%.

RCE results from 2025 were compared with results from previous monitoring years dating to 2016, when RCE was introduced to the WCPL SHM program (**Section 4.1**).

2.2.2. Water quality

Complementing documented biological data, the following physicochemical parameters were measured at all sites (except for those that were dry; WC1, WC2, CC2):

- Temperature
- Dissolved oxygen (DO)
- Electrical conductivity (EC)
- Turbidity (NTU)
- pH.

Water quality results from 2025 were compared with previous years' results for DO, EC, turbidity and pH (Section 4.2). Results date back to 2006, however, not all parameters have results available for each year. Water quality parameters measured during surveys were compared with the Australian and New Zealand Environmental and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) (2000) guidelines for the protection of aquatic environments. The ANZECC and ARMCANZ guidelines provide different ranges for upland and lowland streams, with upland streams being those above 150 m altitude. All sites surveyed for this project are considered upland stream sites.

2.2.3. Macroinvertebrate communities

Macroinvertebrate samples were collected at each site (exception of WC1, WC2, CC2) using the Australian Rivers Assessment System (AUSRIVAS) protocols (Turak et al. 2004). Three representative samples were collected at each site. Samples were collected from 10 m of representative edge, pool and/or riffle habitats using a standard AUSRIVAS kick net with 250 µm mesh. The net was bounced along the bottom to disturb resting invertebrates, and then rapidly passed again through the water column to collect the disturbed taxa. Edge habitats were defined as adjacent to the creek bank in areas of little or no flow, including alcoves and backwaters, with abundant leaf litter, fine sediment deposits, macrophyte beds and overhanging bank vegetation (Turak et al. 2004).

Macroinvertebrate samples were live sorted in the field for a minimum of 40 minutes. If new taxa were collected in the period from 30 to 40 minutes, picking continued for another 10 minutes. If no new taxa were found after 10 minutes, sorting stopped, but if there were new taxa, another 10-minute block was added. The maximum sorting time was 60 minutes. All picked animals were preserved in 70% ethanol solution and transported to the laboratory for identification. Specific care was taken to ensure small, cryptic, and fast-moving taxa were represented.

Macroinvertebrates were identified to family level, except for Acarina, Copepoda, Ostracoda, Oligochaeta, Platyhelminthes, Hirudinea, and Collembola which were identified to order.

The Stream Invertebrate Grade Number - Average Level (SIGNAL2) is a biotic index that allocates a value to each macroinvertebrate family based upon their sensitivity to pollution. A macroinvertebrate family with a value of 10 indicates high sensitivity, while a value of one indicates low sensitivity (i.e. high pollution tolerance) (Chessman et al. 1997). The SIGNAL2 score for the entire site is calculated by summing the SIGNAL2 grades for each family collected at that site and then dividing by the total number of families collected. SIGNAL2 scores are used to grade aquatic health into the following categories:

- SIGNAL2 Score > 6: Healthy Habitat
- SIGNAL2 Score 5-6: Mild Pollution
- SIGNAL2 Score 4-5: Moderate Pollution

- SIGNAL2 Score < 4: Severe Pollution.

Average SIGNAL2 scores for 2025 were compared with scores from previous years, dating back to 2006 (where available) (Section 4.3). SIGNAL2 scores from 2011 to 2013 (Landline Consulting 2011; 2012; 2013) were calculated using abundance weighting of macroinvertebrate taxa which resulted in slightly higher average SIGNAL2 scores for sites with relatively abundant macroinvertebrates. Since 2014, SIGNAL2 scores were calculated on presence/absence data. Whilst this method differs slightly from that undertaken in previous years, the results are largely consistent and valid for comparison.

2.3. Antecedent conditions

2.3.1. Climate data

During the three days of the 2025 stream health monitoring period, there was very little rainfall and air temperature was consistent with historical averages (Table 3). In the preceding three months prior to monitoring, rainfall averaged 42.4 mm, averaging a lower total rainfall compared to the historical averages. Resulting in the sites being shallow and with very little to no flow (Table 4).

Table 3: Temperature and rainfall data for the 2025 monitoring period

Date	Min. temp (°C)	Max. temp (°C)	Rainfall (mm)
4-Nov-2025	12.4	19.8	1.6
6-Nov-2025	5.1	29.4	0
7-Nov-2025	14.1	31.6	1.2

Table 4: Temperature and rainfall preceding 2025 monitoring period

Month	2025 Averages (WCPL)			Historical Averages		
	Mean min. temp (°C)	Mean max. temp (°C)	Total Rainfall (mm)	Mean min. temp (°C)	Mean max. temp (°C)	Total Rainfall (mm)
January	17.3	30.9	111.8	15.5	31.1	67.2
February	17.0	30.3	41.2	15.4	30.2	62.2
March	17.6	28.5	64.4	13.0	27.8	55.2
April	10.3	24.5	12.8	8.5	23.3	39.3
May	8.6	19.4	99	5.0	18.8	37.2
June	1.8	15.9	26.4	2.6	15.2	44.0
July	3.0	15.0	64.8	1.3	14.4	43.0
August	4.3	16.7	38.2	2.3	16.0	41.1
September	5.2	18.0	53.8	4.4	19.6	41.7
October	10.3	26.6	35.2	7.6	23.4	52.1
November	12.3	28.9	29.8	10.8	26.9	57.0
December*	13.6	30.6	17.2	13.7	29.8	60.9

Source: 2025 data from the WCPL Weather Station Sentinex 34 provided 12 January 2026, historical data from the BoM weather stations at Mudgee Airport (temp) and Wollar-Barigan St weather station (rainfall) (BOM 2024)

* December data record is from the 1 December 2025 to the 14 December 2025. All other months cover every day of the month.

2.3.2. Stream flow

Table 5 summarises the average monthly flow data measured at three gauging stations near WCM. The lack of rainfall from the preceding months resulted in generally little or no flow at some sites.

Table 5: Average monthly flow and water quality data at three gauging stations

Month	Wilpinjong Creek Upstream			Wilpinjong Creek Downstream			Cumbo Stream Upstream		
	Flow (cumecs)	EC (µs/cm)	pH	Flow (cumecs)	EC (µs/cm)	pH	Flow (cumecs)	EC (µs/cm)	pH
January	0.001	832.3	7.4	0.102	482.4	7.6	0.001	5825.5	7.2
February	0.000	999.6	7.7	0.084	475.8	7.3	0.000	**	**
March	0.000	1235.3	7.6	0.066	455.6	7.5	0.000	**	**
April	0.000	1309.7	7.5	0.065	448.1	7.7	0.001	**	**
May	0.000	**	**	0.060	468.1	7.7	0.006	5196.9	7.7
June	0.000	579.0	7.4	0.067	416.3	7.9	0.002	4503.8	7.8
July	0.000	550.3	7.4	0.052	501.4	7.8	0.004	4270.0	7.7
August	0.001	472.0	6.8	0.064	629.7	7.9	0.006	3906.2	7.7
September	0.004	545.8	6.6	0.062	599.3	7.8	0.009	3726.9	7.9
October	0.000	1005.6	7.5	0.056	446.4	7.8	0.003	4689.1	7.7
November	0.000	1272.1	7.9	0.066	437.7	7.8	0.000	5093.7	7.7
December	0.000	**	**	0.052	422.8	7.7	0.000	**	**

Source: WCM.
**No data available

3. Results

3.1. Aquatic Habitat Assessment

Results of the habitat assessment, including water, substrate, vegetation, land use, and how these elements contribute to the RCE score are detailed below. A breakdown of how the 13 RCE parameters scored for each site is included in Table 6Table 6.

Table 6: Site results for the 13 RCE parameters

Descriptor	WC1	WC2	WC6	WC8	WO1	WO2	WO3	WO4	BC1	BC2	CC1	CC2
Land use pattern beyond immediate riparian zone	3	3	2	3	2	3	3	4	3	3	3	3
Width of riparian strip of woody vegetation	3	3	3	3	3	3	3	4	3	3	3	3
Completeness of riparian woody strip of vegetation	2	2	2	3	2	2	2	4	3	1	1	1
Vegetation of riparian zone within 10 m of channel	4	4	2	2	3	3	3	4	3	1	2	1
Stream bank	2	2	3	3	3	3	3	3	3	2	3	3
Bank undercutting	3	3	3	4	3	3	3	3	3	3	4	3
Channel form	2	3	3	3	3	3	3	3	3	3	2	3
Riffle/pool sequence	2	3	4	3	3	3	3	3	3	3	2	2
Retention devices in stream	1	1	1	1	4	3	3	3	2	1	1	1
Channel sediment accumulations	4	3	4	4	3	4	3	3	3	3	4	4
Stream bottom	2	2	2	2	2	2	2	2	2	2	2	2
Stream detritus	2	2	2	2	2	2	3	3	2	2	2	1
Aquatic vegetation	2	2	2	2	2	2	2	2	2	2	2	2
Total	32	33	36	35	35	37	36	41	35	29	31	29
Total %	62	63	69	69	67	71	69	79	67	56	60	56
Condition classification	G	VG	VG	VG	VG	VG	VG	VG	VG	G	G	G

G = Good; VG = Very Good

All sites continue to have an RCE classification of 'Good' (four of twelve sites) or 'Very Good' (eight of twelve sites).

3.2. Water Quality

The results of water quality sampling for temperature, EC, DO, pH *in situ* and Turbidity *ex situ* are detailed in Table 7. Water quality was monitored for nine sites out of the 12, as three sites were dry during the 2025 monitoring period. Water temperatures at the time of sampling ranged between 17.9°C and 25.3°C. Variation in water temperature generally reflected the time of day as well as the stream morphology of the monitoring sites, with samples collected later in the day (e.g. WC6, WO1, WO2, WO3, WO4)) and/or from shallower profile streams being warmer.

EC varied between sites; however, all sites, including the control sites, were outside of the ANZECC and ARMCANZ guidelines. Only nine of the 12 sites were monitored, due to three being recorded as dry. The lowest recorded EC was at BC2 (439 µS/cm). The highest three EC values were recorded at CC1 (4931 µS/cm), WO1 (1643 µS/cm) and WO2 (1721 µS/cm). CC1 is located within the WCPL mining lease, however WO1 and WO2 are located outside of the WCPL mining lease.

DO ranged between 101% saturation at CC1 to 214% saturation at WO2. Only site CC1 was within the ANZECC and ARMCANZ (2000) guideline range. The pH ranged between 7.46 and 8.66 resulting in all sites except WO2, WO3 and WO4, being within the ANZECC and ARMCANZ (2000) guidelines. Turbidity ranged from 0.45 NTU to 11.68 NTU. Sites WO2 and BC2 did not meet the recommended ANZECC and ARMCANZ guideline for turbidity.

Table 7: Water quality results.

		Upstream						Downstream				External Waterway	
Variable	Guideline Range	WC1	WC2	WO1	WO2	CC1	CC2	WC6	WC8	WO3	WO4	BC1	BC2
Temperature (°C)	N/A	-	-	19.2	21.4	18.5	-	23.2	19.9	21.9	25.3	19.9	17.9
Conductivity (µS/cm)	30-350	-	-	1643	1721	4931	-	476	457	631	831	886	439
DO (% saturation)	90-110	-	-	137	214	101	-	145	120	164	195	112	130
DO (mg/L)	N/A	-	-	12	18.1	8.9	-	11.18	10.5	13.8	15.4	9.6	11.1
pH	6.5-8.0	-	-	7.87	8.66	7.71	-	7.99	7.71	8.19	8.54	7.46	7.63
Turbidity (NTU)	2-25	-	-	2.19	1.33	7	-	11.68	9.97	13.1	11.12	6.1	0.45

*Red figures are outside of ANZECC Guidelines

* Dry sites (-)

3.3. Macroinvertebrate Communities

A summary of macroinvertebrate results is presented in Table 8 below, with the full results for each site detailed in Appendix B. A total of 17 macroinvertebrate Orders/Classes comprised of 41 Families were recorded during 2025 monitoring. The most observed taxa were Chironomidae from the Order Diptera, Baetidae from Order Ephemeroptera, Caenidae from Order Ephemeroptera, Micronectidae from Order Hemiptera and Leptoceridae from Order Trichoptera. Each of these taxa were recorded at all nine monitoring sites. Across individual sites, macroinvertebrate taxonomic richness ranged from 1 to 24 taxa. At the time of sampling, these sites had a variety of available micro-habitat for macroinvertebrates, including macrophytes, woody debris and riffles.

The average SIGNAL2 scores were used to calculate the pollution sensitivity ratings for each Family/Order for each site. Where Families/Orders have no assigned SIGNAL2 sensitivity rating, they were not included in the averages, however, are still represented in results for taxa richness. Average SIGNAL2 scores range from 3.15 (severely polluted) at WO6 to 4.0 (Moderately polluted) at WO2 (Table 9). Nine of the 12 sites recorded had an average SIGNAL2 score of less than 4.0 and as such are classified as severely disturbed, whereas site WO2, is classified as moderately disturbed. Overall, the scores have remained relatively consistent to last year or decreased slightly.

Section 6.2 of the WCPL Surface Water Management and Monitoring Plan (WCPL, 2018) outlines the following trigger conditions for SHM:

- Minimum taxon richness: 15 taxa; and
- Minimum SIGNAL2 index: 3.0.

Seven of the 10 sites monitored scored above the minimum trigger conditions for taxa richness scores. Sites WC4, WO2 and WO6 did not reach minimum taxa richness index.**Error! Reference source not found.***S = Severe pollution, M = Moderate pollution

Table 9: Taxa richness, average SIGNAL2 scores and pollution condition for 2025 monitoring sites

4. Discussion

4.1. Aquatic Habitat Assessment

All 12 sites were classified as either 'Good' or 'Very Good' for their RCE indices during 2025 monitoring. This puts them in the mid-range for riparian and channel habitat quality. Overall, habitat conditions within Wilpinjong, Wollar, Cumbo, and Barigan creek sites were consistent with those recorded since 2016, both for upstream and downstream of the WCPL licensed discharge point (Figure 2).

The stream bed structure (stream bank, stream bottom and stream detritus) scored low overall, due to lack of vegetation cover and the presence of loose and mobile sediments along the stream bed at most sites. This is typical in a highly modified agricultural landscape where sites have reduced bank stability leading to increased erosion and sedimentation. Temporal differences were largely restricted to changes in vegetation of riparian zone within 10 m of the channel which saw a decrease in macrophyte growth and an increase of algal growth. However, this is not reflective of an overall deterioration in water quality, and therefore habitat quality, but could be attributed to an increase in a limiting factor needed for growth, such as prolonged low to no streamflow throughout the creeks.

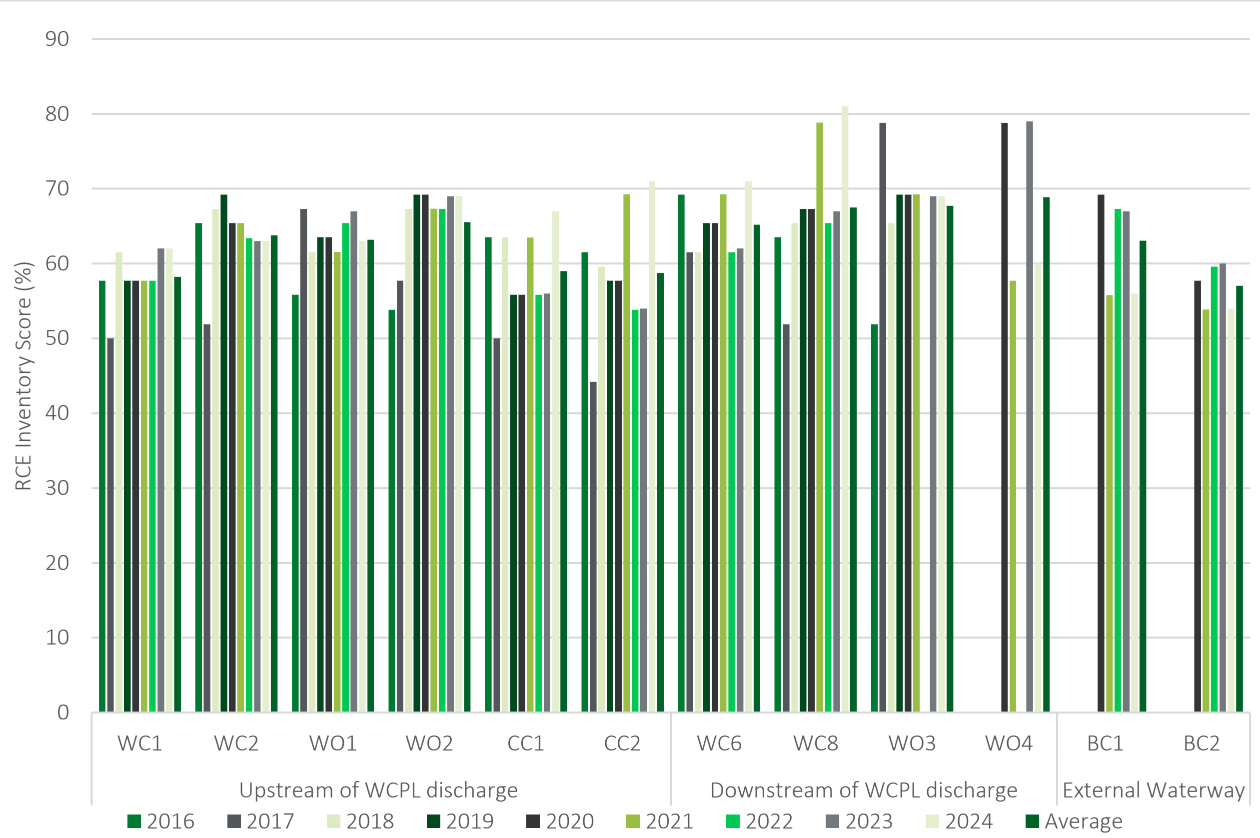

Figure 2: RCE scores across all sites and years

4.2. Water Quality

Water temperature overall was slightly lower than 2024 temperatures, which has the potential to be influenced by survey timing. Specifically, the survey occurred a month earlier than the previous years when the ambient temperature was lower. There was little to no flow in each creek due to the lack of rainfall leading up to the monitoring period. Low flow can impact water temperature, as the water sits stagnant and becomes heated by the sun. Further fluctuations in water temperature throughout the day are expected at each site in line with the generally shallow stream depth, minimal riparian shading, algal growth and turbidity reducing transparency of water.

DO concentrations at only one monitoring site in 2025 was within the ANZECC and ARMCANZ (2000) guideline range (three sites were dry and therefore no DO was recorded); an overall decrease from 2024. DO concentrations fluctuate due to a range of factors including water temperature, organic and bacterial activity, wind, water flow and circulation, and time of day

DO concentrations have fluctuated considerably across sites and years and have frequently been outside of ANZECC and ARMCANZ (2000) guidelines (Figure 3). These results have been recorded not only both upstream and downstream of the WCPL discharge point, but the two control sites located along the external Barigan Creek. This suggests that DO concentrations and fluctuations may be a result of catchment-scale processes and are not linked to mining operations.

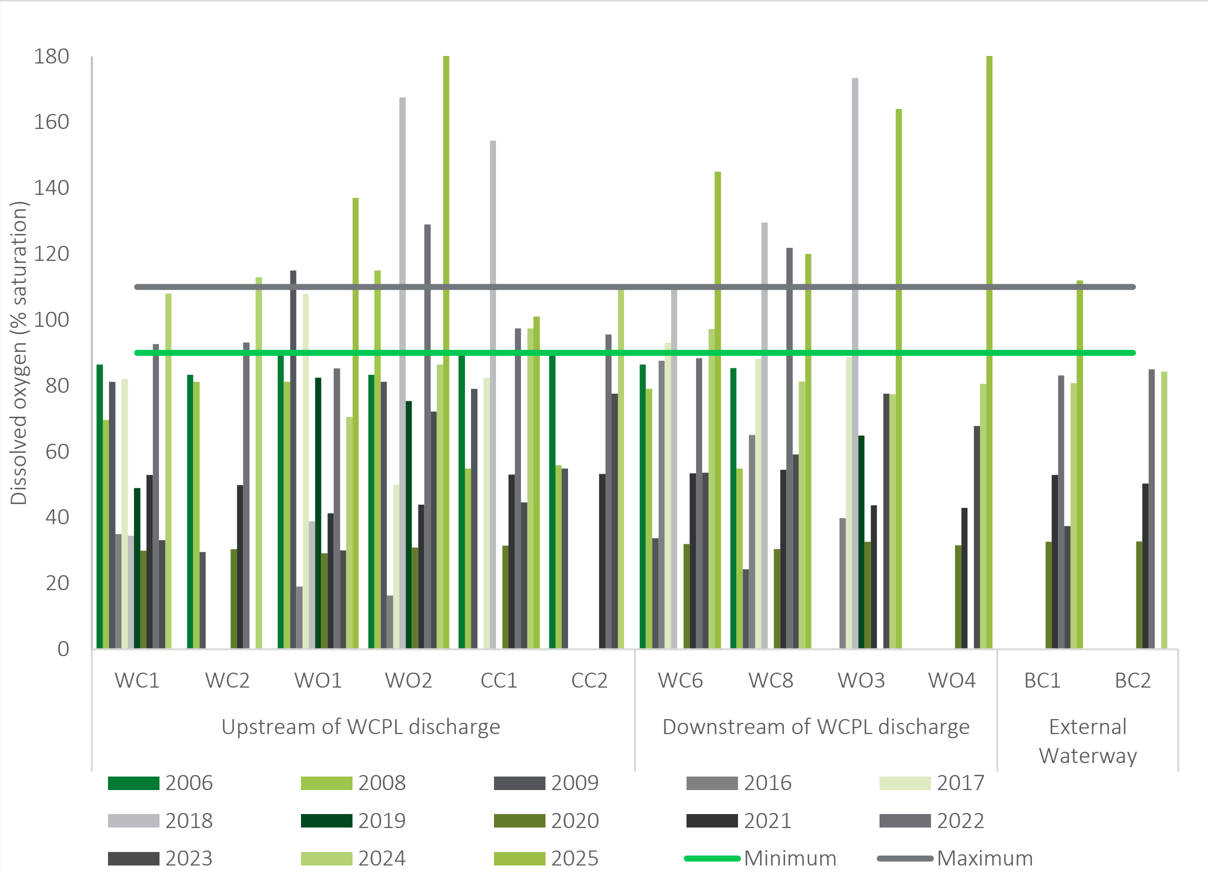

Figure 3: DO (% saturation) results across all sites and years

***Minimum and Maximum refer to ANZECC range**

EC in 2025 varied between the sites, with most sites (five sites) recording an increase in EC compared to the 2024 results. Three sites (WC1, WC2 and CC2) did not record EC due to the creek being dry at the time of the survey, and the remaining four recorded a decrease in EC, however, all sites were out of the ANZECC (2000) range. While EC is out of the ANZECC range, it is unlikely that mining operations are having an influence on the EC in the sampled catchments but is most likely due to natural factors, (BIO-ANALYSIS 2005) states during monitoring, pre-mining, the conductivity at all sites was much higher than the recommended ANZECC (2000) guideline of 350 µS/cm and the results ranged between 1,458 to 6,060 µS/cm.

CC1 is still recording substantially higher EC values (4931(µS/cm) than all other sites, which has been the case for many years. Cumbo Creek was noted to have recorded one of the highest EC values, pre mining (BIO-ANALYSIS 2005). The region has been known to have naturally occurring saline groundwater (BIO-ANALYSIS 2015), which likely contributed to baseflow in all creeks. This coupled with dry conditions preceding the monitoring period can cause reduction dilution within the surface flow and therefore the EC increases. Four sites decreased in EC downstream of the Cumbo Creek confluence which is potentially a result of a dilution by the licenced discharge of RO water at EPL 24.

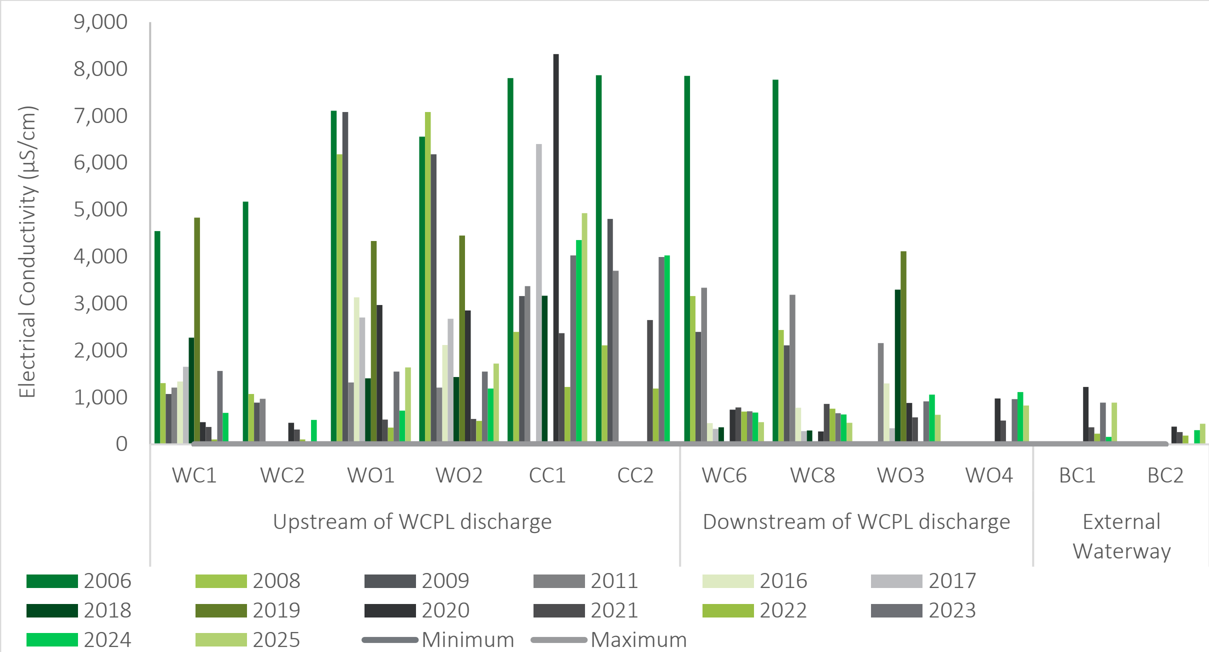

Figure 4: EC (µS/cm) results across all sites and years

Seven of nine sites surveyed (3 were dry) were within the recommended ANZECC and ARMCANZ (2000) guideline range for turbidity. Overall, turbidity was notably lower to 2024 monitoring, with the exception of WO3 and WO4 which had only had a slight increase compared to last years. 2025 results remain generally lower compared to historical monitoring results, likely due to less rainfall and lower volumes of sediment and organic matter transported by the river during the dry conditions in the 2025 monitoring period (Figure 5).

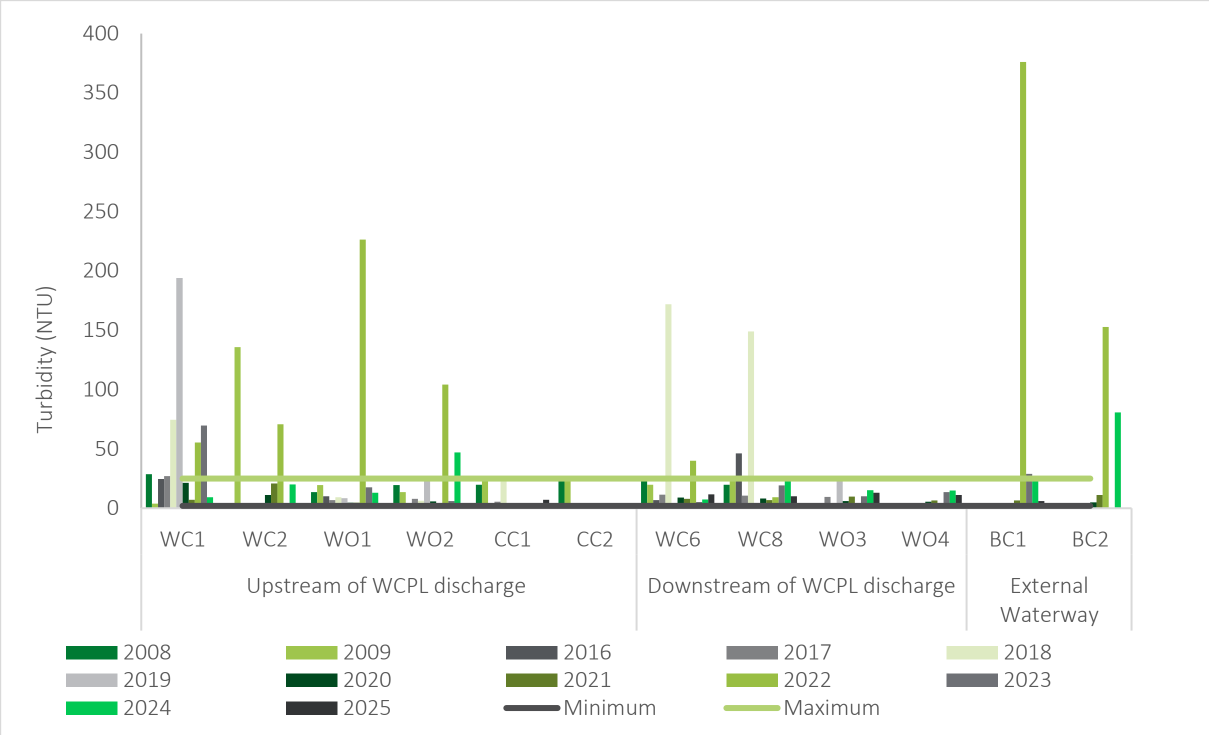

Figure 5: Turbidity (NTU) results across all sites and years

The pH at all but three sites (WO2, WO3 and WO4) monitored in 2025 were within ANZECC guidelines, ranging between 7.46 and 8.66, and largely consistent with historical monitoring across all sites (Figure 6).

Figure 6: pH results across all sites and years

4.3. Macroinvertebrate Communities

Across all monitoring years, the average SIGNAL2 score for nine of the 12 sites are <4.0 indicting severely disturbed systems. One site scored ≥4.0 indicative of moderately disturbed systems (Figure 7). Low SIGNAL2 scores have been consistently recorded during periods of variable surface water availability and at sites both upstream and downstream of the WCM, including the two control sites located in Barigan Creek. Such results therefore reflect the overall disturbed nature of the catchment, largely attributable to historical and current agricultural and land use practices.

SIGNAL2 scores decreased across all sites except for BC2 and CC1 from 2024. Furthermore, all the sites except for WC4, WO2 and WO6, scored above the minimum taxa richness and minimum SIGNAL2 index. This should trigger an investigation into the cause of this as outlined in the WCPL SWMMP (WCPL, 2018). However, it is likely that that prevailing conditions in the months leading up to the monitoring (i.e. low rainfall) and relevant parameters (i.e. lower DO) have strongly influenced the score, and therefore it is recommended that a review of macroinvertebrate taxa richness is undertaken following subsequent monitoring conducted under closer to average rainfall conditions.

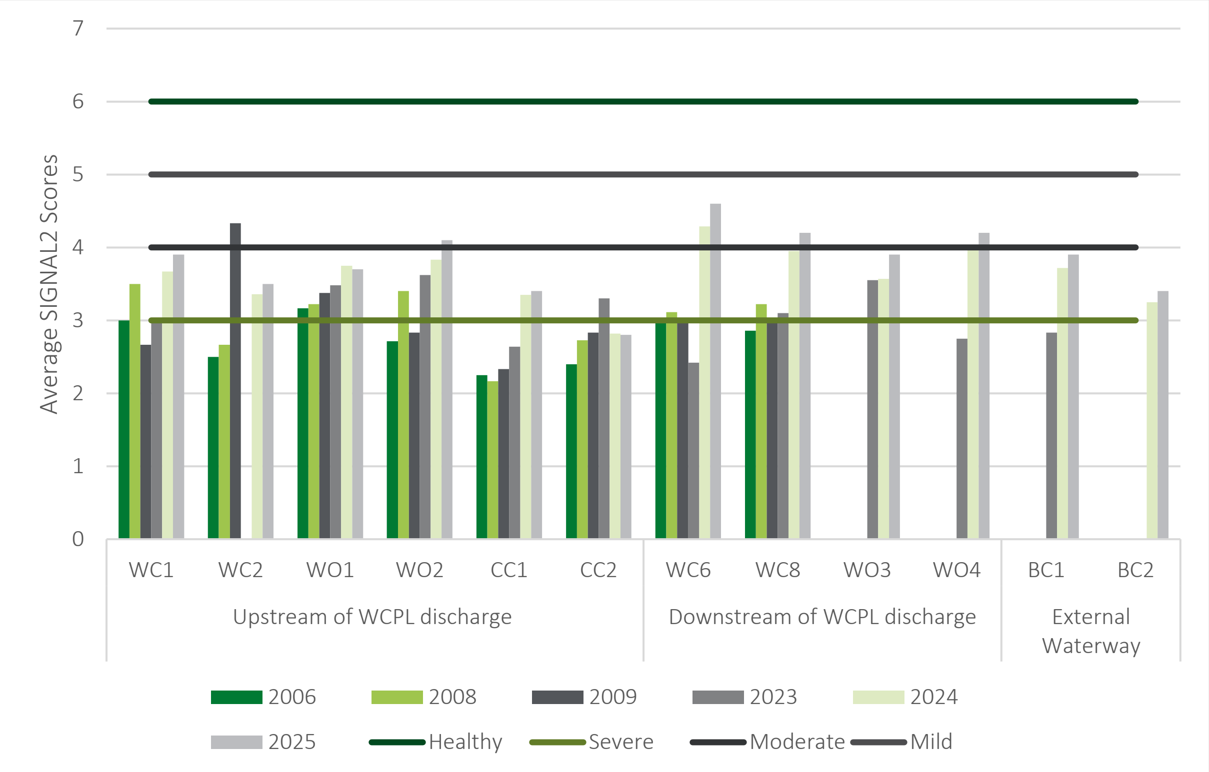

Figure 7: Average SIGNAL2 macroinvertebrate scores across all sites and years

5. Conclusions and recommendations

A total of nine permanent sites along Wilpinjong, Wollar, and Cumbo creeks were sampled in 2025 (due to three sites being dry), along with two control sites at Barigan Creek. The habitat conditions at twelve sites were classified as either good or very good using the RCE inventory, which places the sites in the mid-range of aquatic habitat scores, typical of catchments in the surrounding region. Overall, aquatic habitat results have remained largely consistent across survey years, with differences primarily relating to changes in stream bed macrophyte, because of fluctuating water levels after dry condition. There is the capacity to improve instream habitat through the re-introduction of logs and boulders as instream retention devices. These works would also help limit downstream erosion and can be tied in with ongoing revegetation and rehabilitation works along Cumbo and Wilpinjong creeks.

Water quality parameters have fluctuated considerably across years and varying stream flow levels, at sites both upstream and downstream of the WCPL licensed discharge point. The results also showed some improvement compared to recent years, with all but three of the sites falling within the ANZECC and ARMCANZ (2000) guidelines for pH. All but two of the sites met the guidelines for turbidity, likely due to the decrease in rainfall in 2025, compared to 2024. All of the sites were outside of the ANZECC and ARMCANZ (2000) guidelines for EC and eight out of nine sites were out of the guidelines for DO (% saturation). This is likely due to decreased rainfall in most months leading up to the monitoring period, as well as high water temperatures, algae growth, and decomposition of organic matter in the water.

EC recorded at sites upstream of the WCPL discharge was generally consistent with sites downstream of WCPL discharge. Hence, water quality results overall indicate that natural variables, rather than mining operations are the main factors which influence water quality in the sampled catchments. It is possible that the guidelines for these measures, excluding turbidity and pH, are not appropriate at the local and/or regional catchment level.

A total of 17 macroinvertebrate Orders and 41 Families were recorded across all sites. In line with previous years, SIGNAL2 scores were <4.0 for nine of the 12 sites, indicative of severely disturbed sites. One site recorded SIGNAL2 scores ≥4.0 indicative of moderately disturbed systems. Three sites, WC4, WO2 and WO6 scored below the minimum trigger conditions for taxa richness scores, while all sites were within the SIGNAL2 index score. A combination of low levels of flowing water, higher water temperature, and high DO potentially limited the diversity of macroinvertebrate communities. Species richness was relatively consistent across all sites, excluding WC4, WO2 and WO6, and well above the minimum taxa richness.

Future surveys may be conducted during a period of cooler days earlier in the monitoring season when water temperatures are lower to maximise the potential of recording greatest macroinvertebrate diversity and abundance. It is also strongly recommended to undertake surveys when there is sufficient water flow at each monitoring site.

6. References

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Appendix A Site photos

Site WC1 (from left to right: site location, upstream, downstream)

Site WC2 (from left to right: site location, upstream, downstream)

 Site WC6 (from left to right: site location, upstream, downstream)		
 Site WC8 (from left to right: site location, upstream, downstream)		

Site WO1 (from left to right: site location, upstream, downstream)

Site WO2 (from left to right: site location, upstream, downstream)


Site WO3 (from left to right: site location, upstream, downstream)


Site WO4 (from left to right: site location, upstream, downstream)

 Site CC1 (from left to right: site location, upstream, downstream)		
 Site CC2 (from left to right: site location, upstream, downstream)		

 Site BC1 (from left to right: site location, upstream, downstream)		
 Site BC2 (from left to right: site location, upstream, downstream)		

Appendix B Macroinvertebrate data

Order	Family	Signal	BC1	BC2	CC1	CC2	WC1	WC2	WC6	WC8	WO1	WO2	WO3	WO4	WO6
Decapoda	Atyidae	3				-	-	-	3		1	1		2	1
	Palaemonidae			3		-	-	-							
Trichoptera	Leptoceridae	6	5	4	5	-	-	-	7	4	11	4	9	4	9
	Hydroptilidae	4	2	4	1	-	-	-	3	1	3	5	2	2	6
	Hydropsychidae	6		3	1	-	-	-	1			1		2	3
	Glossosomatidae	9				-	-	-	2	1			1		1
	Hydrobiosisdae	8		2		-	-	-							
	Limnephilidae	8				-	-	-			7				
	Calamoceratidae	7				-	-	-					1		
	Odontoceridae	7				-	-	-		1					
	Unknown					-	-	-						3	
Ephemeroptera	Caenidae	4	7	7		-	-	-	6	4	5	4	13	8	12
	Baetidae	5	5	11	3	-	-	-	15		3	12	11	13	24
	Leptophlebiidae	8				-	-	-	11			2			
	Hydrophilidae	2			11	-	-	-							
	Coloburiscidae	8				-	-	-			2				
Hemiptera	Micronectidae	2	9	9		-	-	-	11	5	2	10	5	7	14
	Notonectidae	1	1	1	4	-	-	-	4	1	2			3	2
Coleoptera	Dytiscidae	2	1	5	1	-	-	-	5	4	2	2	2		2
	Hydraenidae	3	1			-	-	-	5	1			1		7
	Hydrochidae	4				-	-	-			2				
Odonata	Libellulidae	4	3	5	11	-	-	-	1	3	8	1	5	6	
	Argiolestidae	4	1	2	1	-	-	-	1		2	3			
	Aeshnidae	4	1	2	9	-	-	-							
	Corduliidae	5	8	1	2	-	-	-		1	2				
	Unknown					-	-	-						1	
	Coenagrionidae	2			9	-	-	-							

Order	Family	Signal	BC1	BC2	CC1	CC2	WC1	WC2	WC6	WC8	WO1	WO2	WO3	WO4	WO6
	Lestidae	1				-	-	-		2	8				
Gastropoda	Physidae	1	4	2	1	-	-	-	8	4	4	1	5	2	12
	Planorbidae	2		4	10	-	-	-		1	1		1		
Diptera	Chironomidae	3	7	9	17	-	-	-	8	3	8	5	4	1	9
	Culicidae	1		4		-	-	-	6		2		2		10
	Sciomyzidae	2	2			-	-	-							
	Hydrobiosisdae	8			2	-	-	-							
	Stratiomyidae	2			1	-	-	-							
	Ceratopogonidae	4			1	-	-	-							
	Sciaridae	6				-	-	-		1	1				
Arachnida	N/A	N/A				-	-	-	1						1
Ostracoda	Podocopida	NA		2		-	-	-	1				2		
Lepidoptera	N/A	N/A	1			-	-	-							
Mollusca	Bivalva	N/A	1			-	-	-							
Platyhelminthes	N/A	2			1	-	-	-			2				
Oligochaeta	N/A	N/A			1	-	-	-							
Amphipoda	N/A	N/A		1		-	-	-		4	1				
Hirudinea	N/A	1		1		-	-	-							
Ostracoda	Podocopida	N/A		2		-	-	-							
Acarina	Eylaidae	N/A		1		-	-	-							