



APPIN MINE LONGWALL 709
END OF PANEL
LANDSCAPE REPORT
November 2023

EXECUTIVE SUMMARY

This report has been prepared by the South32 Illawarra Metallurgical Coal Environmental Field Team (IMCEFT) to summarise the observed and measured subsidence effects on water, landscape features and terrestrial ecology, resulting from the extraction of Longwall 709.

Extraction of Longwall 709 commenced on 22 February 2022 and was completed on 8 October 2023.

The IMCEFT conducts detailed monitoring and inspections of landscape features including the Nepean River, tributaries, cliffs and steep slopes, and private properties. This monitoring is conducted in accordance with the Appin Longwalls 709 to 711 and 905 Extraction Plan (EP), dated July 2022.

IMCEFT identified no new surface impacts/triggers associated with the extraction of Longwall 709. Results from specialist analysis and assessment will be incorporated in the Longwall 709 End of Panel Summary Report and associated attachments.

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ABBREVIATIONS

CMA – Corrective Management Action

DPE - Department of Planning and Environment

DPI – Department of Primary Industries

DRE - Department of Trade and Investment, Division of Resources and Energy

EoP – End of Panel

EP – Extraction Plan

IMC – Illawarra Metallurgical Coal

IMCEFT – Illawarra Metallurgical Coal Environmental Field Team

OEH - Office of Environment and Heritage (now BCD)

BCD- Biodiversity and Conservation Division (formerly OEH)

SCA – Sydney Catchment Authority (now WaterNSW)

SA NSW – Subsidence Advisory NSW

TARP – Trigger Action Response Plan

1 INTRODUCTION

This report outlines monitoring of landscape features relevant to Longwall 709 and forms part of the Appin Area 7 Longwall 709 End of Panel Report (EoP Report). Monitored features include the Nepean River and its tributaries, cliffs and steep slopes, terrestrial flora, as well as private properties (farm dams and private boreholes). Monitoring of landscape features relevant to Longwall 709 has been carried out in accordance Appin Longwalls 709 to 711 and 905 Extraction Plan (EP) dated July 2022. The Trigger Action Response Plan (TARP) details the actions required for any subsidence impacts (Appendix B).

Extraction of Longwall 709 commenced on 22 February 2022 and was completed on 8 October 2023. Monitoring was conducted for landscape features for Longwall 709 during baseline, active mining (i.e. longwall within 400m of a feature) and post-mining periods. This monitoring involves measurement of surface water quality and levels, groundwater quality and levels (from Illawarra Metallurgical Coal (IMC) and private boreholes), and general observations of landscape features within the mining area. The results of the monitoring are outlined in the relevant sections below.

2 SUMMARY OF MONITORING PROGRAM

The Appin Longwall 709 to 711 and 905 monitoring program has been designed to identify impacts and consequences of mining and is presented in Figure 1 and Appendix A. Monitoring is conducted during baseline, active mining and post-mining periods. Baseline inspections are undertaken up until the longwall is within 400m of a feature. During active mining, inspections increase to weekly for any features within 400m of the longwall. Monthly post-mining inspections continue as outlined in the EP.

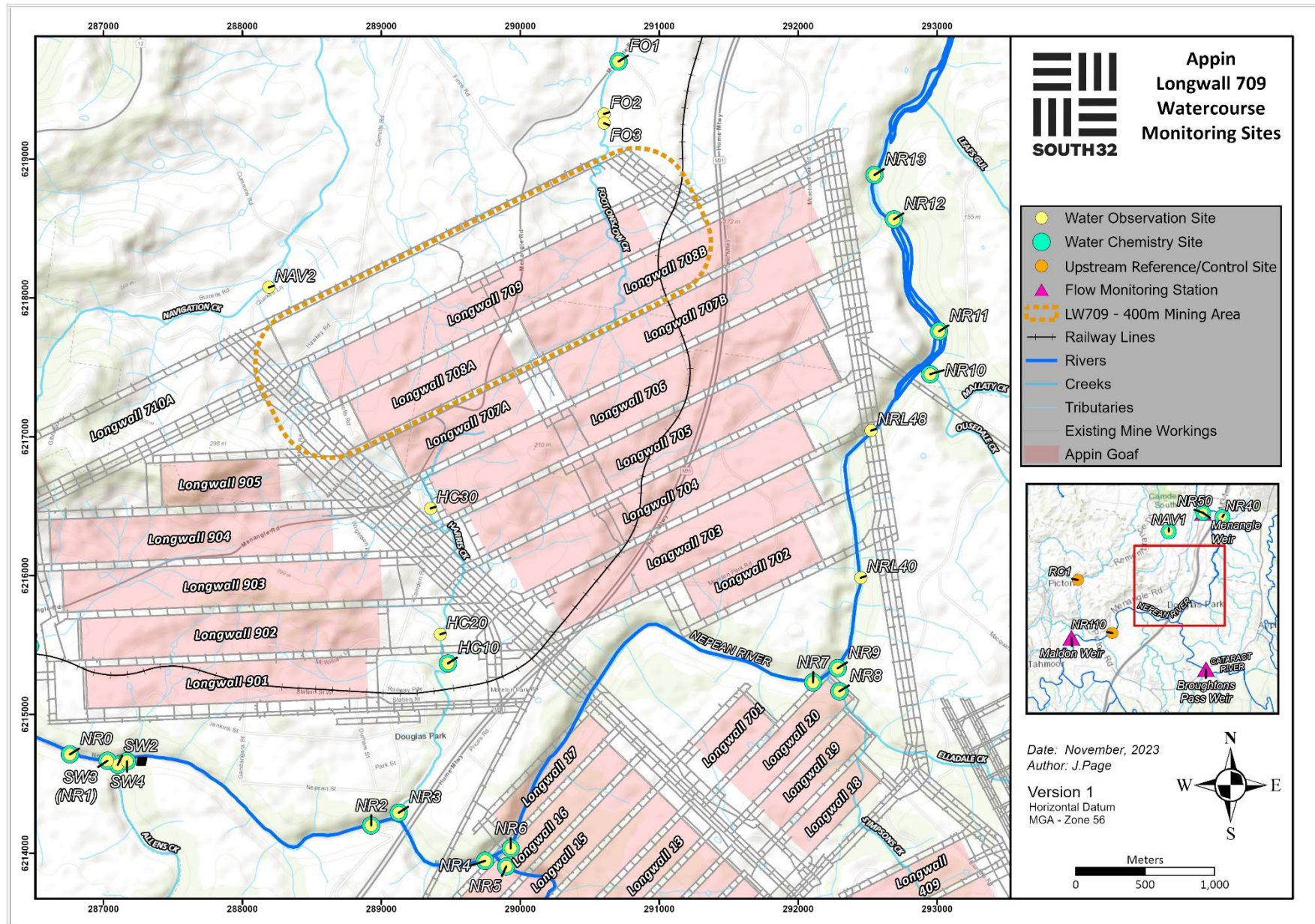


Figure 1: Map showing IMC surface water monitoring sites relevant to Longwall 709.

3 SUMMARY OF IMPACTS

Monitoring and inspections of the Nepean River and its associated tributaries is undertaken in accordance with the approved Appin Longwall 709 to 711 and 905 EP. Monitoring is conducted by the Illawarra Metallurgical Coal Environmental Field Team (IMCEFT) monthly prior to and after mining, and weekly during active subsidence. Water quality and water levels are recorded along with photographic records and observational notes. Observations of cliffs, steep slopes and terrestrial flora along the Nepean gorge are also undertaken.

During the extraction of Longwall 709, no new impacts were observed. Three previously reported gas release zones had active gas release at some stage during the Longwall 709 extraction period.

3.1 Water Quality

In-situ water quality parameters are measured at the relevant monitoring sites on the Nepean River and its tributaries. In-situ water quality parameters include: temperature, electrical conductivity (EC), oxidation-reduction potential (ORP), pH, dissolved oxygen (DO) as well as visual observations. Water samples are also taken for laboratory analysis. Specialist assessment of water quality results will be included in the Surface Water and Groundwater Assessment of the Longwall 709 EoP Report.

3.2 Gas Releases

No new gas releases were observed during the extraction of Longwall 709. One previously reported gas release was active on the last inspection on 4 October 2023. Continued monitoring of gas release zones previously reported during the extraction of Appin Area 7 also occurred. A summary of gas releases observed as active during Longwall 709 are summarised in Table 1 and displayed in Figure 2.

3.3 Water Level and Flow

Water levels in the Nepean River and its tributaries are monitored by the IMCEFT using photo observations and installed benchmark measurements where available. Inspections are undertaken where access is safe and granted. No subsidence induced flooding of river banks was observed. Specialist assessment of water level and flow will be included in the Surface Water and Groundwater Assessment of the Longwall 709 EoP Report.

3.4 Appearance

The appearance of the Nepean River and its tributaries are monitored by the IMCEFT where access is safe and granted. Photographs are taken of monitoring sites, gas zones and any other potential impact site. Apart from the previously mentioned gas release zones, no impacts to the appearance of the Nepean River or tributaries were observed during the extraction of Longwall 709.

3.5 Groundwater

Boreholes relevant to the Longwall 709 to 711 and 905 EP are: S1913, S1941, S1954, S2157, S2536, S2356A, S2537, S2538. Specialist assessment of groundwater level data will be included in the Surface Water and Groundwater Assessment of the Longwall 709 EoP Report.

3.6 Landscape Features

Observations of clifflines and steep slopes along the Nepean Gorge and associated tributaries were conducted by the IMCEFT on a monthly basis. Observational and photographic monitoring is conducted for cliff/ steep slope instability and seeps. Observations above the active longwall were conducted where access is available. No impacts to clifflines were identified during the extraction of Longwall 709. Results of ground movement recorded to built features above Longwall 709, including roads and railway, will be included in the Subsidence Assessment of the LW709 EoP Report.

3.7 Terrestrial Ecology

Terrestrial ecology in Appin Area 7 is monitored by the IMCEFT in conjunction with general observational monitoring. Aspects that are considered whilst monitoring include: changes in vegetation condition and vegetation that may have been impacted by rockfalls, soil slippage or gas emissions. No impacts or changes to terrestrial ecology was observed during monitoring for Longwall 709.

3.8 Private Property Inspections

Built Feature Management Plans (BFMPs) have been prepared by IMC for landholders within the Longwall 709 to 711 and 905 mining area. Post-mining inspection of dams, boreholes and natural features set out in the BFMPs are conducted by the IMCEFT with the consent of the relevant property/infrastructure owner and tenant (if applicable). Post-mining inspections were undertaken at properties where access was granted. These include Lot 16 DP251063, Lot 73 DP883462, Lot 11 DP7754437 and Lot 900 DP1072947 (Figure 3). Inspections include collection of in-situ water quality parameters and water samples for laboratory analysis. Results of water quality and piezometer data will be included in the Surface Water and Groundwater Assessment of the Longwall 709 EoP Report. Post-mining inspections were unable to be undertaken at other properties due to access issues.

3.9 Aboriginal Archaeology

No applicable aboriginal archaeology sites on the Aboriginal Heritage Information Management System (AIHMS) database are within the Longwall 709 mining area.

Table 1: Summary of Longwall 709 impacts and triggers.

Site ID	Easting	Northing	Impact/Trigger Type	Identification Date	Status (as of 04/10/2023)	Description	Impact Level	Report Date
AA7_LW701_Gas Zone 4	292230	6215262	Gas Release	15/01/2008	Inactive	Three infrequent, light gas releases within a 3m ² surface area. Identified on three inspections during Longwall 709.	1	11/12/2008
AA7_LW703_Gas Zone 10	292967	6217438	Gas Release	21/05/2010 & 2/11/2020 (Update)	Active	Four light, intermittent gas releases within a 10m by 3m surface area. Identified on 21 inspections during Longwall 709.	1	27/05/2010 & 5/11/2020 (Update)
AA7_LW704_Gas Zone 18	290623	6215275	Gas Release	2/08/2012	Inactive	One light constant gas release within a 0.5m ² surface area. Identified on one inspection during Longwall 709.	1	10/08/2012

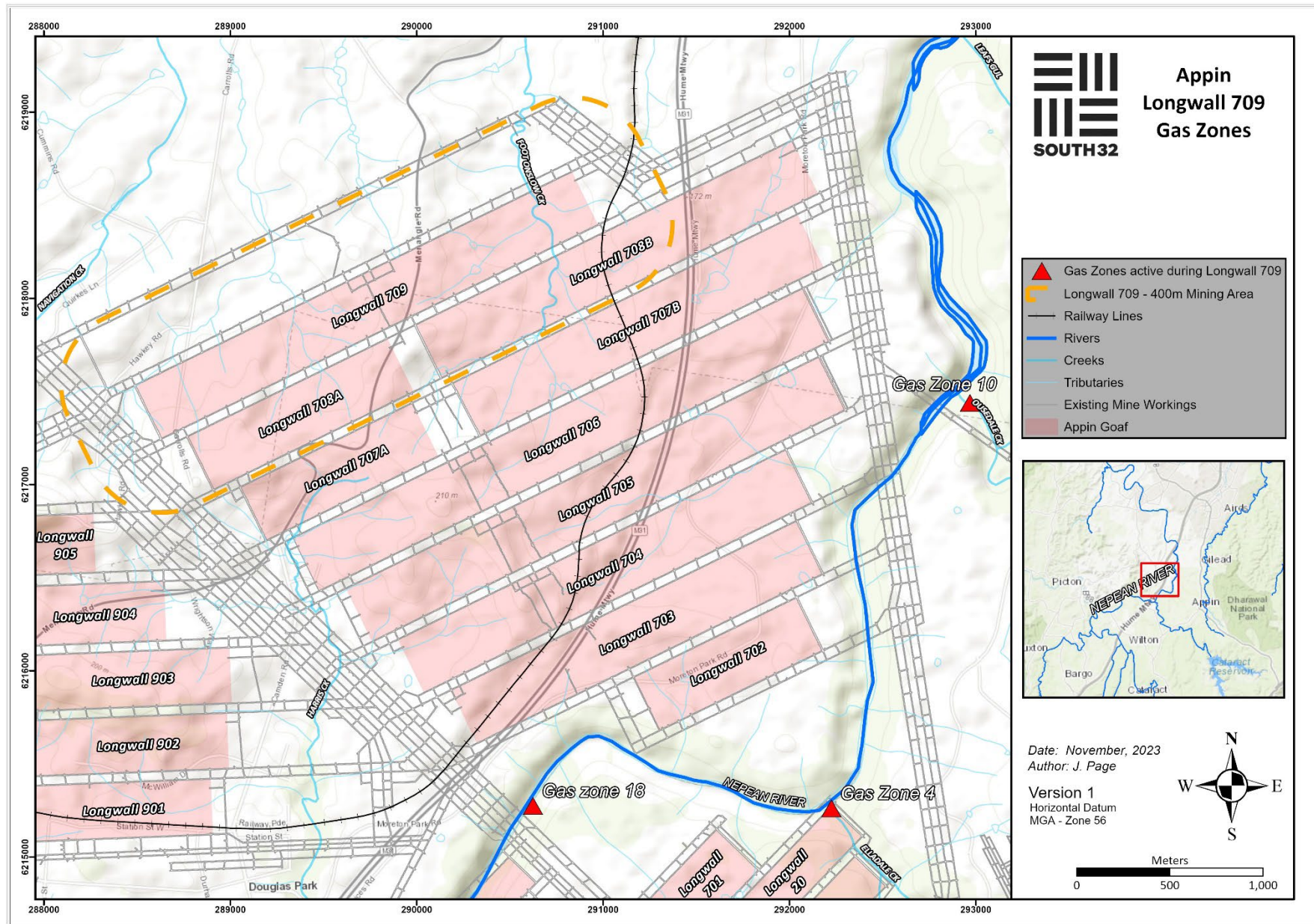


Figure 2: Map showing subsidence impacts and triggers relevant to Longwall 709.

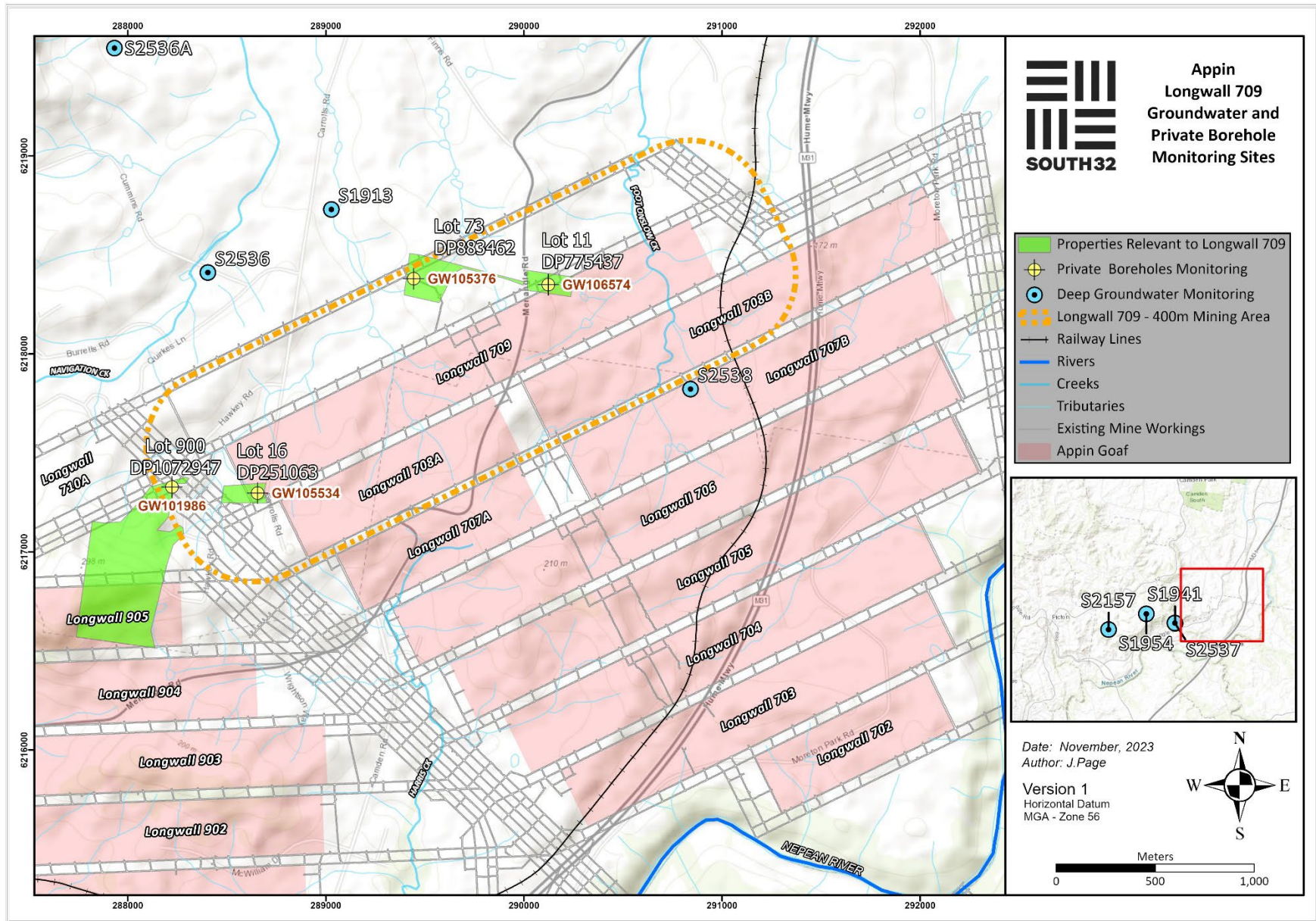


Figure 3: Map showing IMC and private properties boreholes relevant to Longwall 709.

4 FUTURE MONITORING

Future monitoring in Appin Area 7, particularly concerning Longwall 710, is outlined in Appendix A. These are based on monitoring commitments outlined in the EP.

5 APPENDIX A

Appendix A: Longwall 709 to 711 and 905 Key Monitoring

MONITORING SITE	MONITORING TYPE	MONITORING FREQUENCY	PARAMETERS	FUTURE MONITORING (LONGWALL 710)
SURFACE WATER				
<p>Foot Onslow Creek FO1 (Lab, Field, Level, Obs) FO2 (Obs) FO3 (Field, Obs)</p> <p>Harris Creek HC10 (Lab, Field, Obs) HC20 (Level, Obs) HC30 (Obs)</p> <p>Navigation Creek NAV1 (Lab, Field, Level, Obs) NAV2 (Obs)</p> <p>Nepean River NR110 (Lab, Field, Level, Obs) NR0 (Lab, Field, Level, Obs) SW2 (Lab, Field, Obs) SW3 (Lab, Field, Obs) SW4 (Field, Obs) NR2 (Lab, Field, Level, Obs) NR3 (Lab, Field, Obs) NR4 (Lab, Field, Level, Obs) NR5 (Lab, Field, Obs) NR6 (Lab, Field, Obs) NR7 (Lab, Field, Obs) NR8 (Lab, Field, Level, Obs) NR9 (Lab, Field, Level, Obs) NR10 (Lab, Field, Obs) NR11 (Lab, Field, Obs) NR12 (Lab, Field, Level, Obs) NR13 (Lab, Field, Level, Obs) NR40 (Lab, Field, Obs) NR50 (Lab, Field, Obs)</p>	<ul style="list-style-type: none"> • Laboratory analysis (Lab) • Field parameters (Field) • Water levels (Level) (where a suitable structure exists) • Observations (Obs) 	<ul style="list-style-type: none"> • Monthly baseline monitoring prior to mining • Weekly observations and field analysis during active subsidence • Monthly laboratory analysis during active subsidence • Monthly monitoring for two years post mining • If required as a result of assessment of mining impacts 	<p>Field Parameters:</p> <ul style="list-style-type: none"> • Temperature • Dissolved Oxygen (DO) • Specific Conductivity • pH • ORP <p>Laboratory analysis:</p> <ul style="list-style-type: none"> • pH and EC • Filtered, Na, K, Ca, Mg, Cl, Ni, Zn, Fe, Mn, Al, SO₄ • Total Fe, Mn, Al • Total Alkalinity • TKN, TP, NH₃-N, NO_x-N (TON), FRP, TSS, DOC <p>Lab Sample for Gas Releases#:</p> <ul style="list-style-type: none"> • CH₄ • C₂H₆ • Trace Phenols • Sulphide <p>Observations:</p> <ul style="list-style-type: none"> • Iron or salinity staining (e.g. orange or white staining in water or on banks/seeps) • Evidence of springs in the Nepean River • Visual signs of impacts (i.e. cracking, fracturing, vegetation changes, increased erosion, changes in water colour etc) • Stream flow and pool water level • Impacts determined from comparing photo points taken prior to, during and post mining 	<p>No changes</p>

MONITORING SITE	MONITORING TYPE	MONITORING FREQUENCY	PARAMETERS	FUTURE MONITORING (LONGWALL 710)
<p>Racecourse Creek, Remembrance Drive RC1 (Lab, Field, Level, Obs) – Reference Site</p> <p>#If and where strata gas emission plumes above 3000 L/min are detected (Lab, Field, Obs)</p>				
<p>Flow monitoring</p> <ul style="list-style-type: none"> • Maldon Weir • Broughtons Pass Weir • Menangle Weir 	<ul style="list-style-type: none"> • Gauged flow station 	<ul style="list-style-type: none"> • Daily flow 	<ul style="list-style-type: none"> • Monitoring undertaken by WaterNSW. Observational data to be compared with flow records at weir sites. 	No Changes

MONITORING SITE	MONITORING TYPE	MONITORING FREQUENCY	PARAMETERS	FUTURE MONITORING (LONGWALL 710)
<p>Foot Onslow Creek FO1 (qualitative obs) FOS1 (gauge with logger)</p> <p>Navigation Creek NAV1 (qualitative obs) NAVS1 (gauge with logger)</p>	<ul style="list-style-type: none"> Visual observation of inflow and outflow Gauged flow site 	<ul style="list-style-type: none"> Monthly/weekly inspection (obs sites) Daily flow (logger sites) 	<ul style="list-style-type: none"> Inspection for potential fracturing for observable loss of surface water flow 	
GROUNDWATER				
<p>Private Bores</p> <p>GW108990 GW100289 GW072874 GW100673 GW101986 GW105531 GW105534 GW106675 GW111781 GW112381 GW105376 GW105574 GW106574 GW107791 GW108907 GW108990 GW072196 GW110671</p> <p><i>(in consultation with bore owner and if accessible and access is granted)</i></p>	<ul style="list-style-type: none"> Lab sample Field parameters Water levels Observations 	<ul style="list-style-type: none"> Where access is available and granted, water level and water quality monitoring at least once before and once after the bore is mined under 	<p>Field Parameters:</p> <ul style="list-style-type: none"> Electrical Conductivity pH <p>Laboratory analysis:</p> <ul style="list-style-type: none"> pH and EC Filtered, Na, K, Ca, Mg, Cl, Ni, Zn, Fe, Mn, Al, SO₄ Total Fe, Mn, Al Total Alkalinity TKN, TP, NH₃-N, NO_x-N (TON), FRP, TSS, TDS, DOC <p>Lab Sample for Gas Releases:</p> <ul style="list-style-type: none"> CH₄ C₂H₆ Trace Phenols Sulphide <p>Observations:</p> <ul style="list-style-type: none"> Iron or salinity staining (e.g. orange or white staining in water or in the bores) 	No Changes
<p>IMC Boreholes</p> <p>S1913 S1941 S1954 S2157 S2536</p>		<ul style="list-style-type: none"> Water levels to be logged at least twice daily in the pre-mining baseline, impact and post-mining period At least one appropriately purged sample pre-mining 		No Changes

MONITORING SITE	MONITORING TYPE	MONITORING FREQUENCY	PARAMETERS	FUTURE MONITORING (LONGWALL 710)
S2536A S2537 S2538		and post mining, where access permits, tested for the analytes in the previous column		
Groundwater inflows to the mine	<ul style="list-style-type: none"> Mine water budget Observations 	<ul style="list-style-type: none"> Flow meters 	Water flow from the goaf to the mine (analysed as a moving average i.e. 20 day average)	No Changes
AQUATIC ECOLOGY				
Impact Sites Sites 5, 6, X3 and X4 Control Sites Sites 1, 2, 7, 8, X5, X6, X7 and X8	<ul style="list-style-type: none"> Water quality - field parameters Survey and sampling Observations 	<ul style="list-style-type: none"> Twice in spring for two years prior to the commencement of mining Once every two years during mining Once every two years after mining 	<ul style="list-style-type: none"> Habitat surveys Aquatic macrophyte observations Macroinvertebrate monitoring AUSRIVAS sampling Fish sampling Observations of threatened species Assessments of: <ul style="list-style-type: none"> Water quality Flow River morphology 	No Changes
TERRESTRIAL ECOLOGY				
<ul style="list-style-type: none"> Inspection of the area will be conducted as outlined in the Landscape TARP 	<ul style="list-style-type: none"> As indicated in the Landscape TARP 	<ul style="list-style-type: none"> Prior to mining provide pre-mining baseline survey of vegetation communities and threatened flora populations for comparison with post-mining Monthly prior to mining Weekly during active subsidence In response to any identified impacts on flora/fauna or threatened species, communities or populations. 	<ul style="list-style-type: none"> Observations of threatened species and endangered ecological communities Changes in vegetation condition Stressed or dead vegetation not readily explained by natural processes (causes may include rock / cliff falls or mass movement, gas emissions, changes in flooding/ ponding) 	No Changes

MONITORING SITE	MONITORING TYPE	MONITORING FREQUENCY	PARAMETERS	FUTURE MONITORING (LONGWALL 710)
ABORIGINAL ARCHAEOLOGY				
No sites requiring monitoring				
EUROPEAN HERITAGE				
No non-Aboriginal heritage sites were identified in the Longwalls 709 to 711 and 905 Study Area during the assessments undertaken for the BSO EA				
LANDSCAPE FEATURES				
<p>Nepean River cliff lines - Sensitive terrain near built features (Razorback Range)</p> <p>Razorback Range Cliffs Monitoring locations on private properties to be determined as appropriate/required in consultation with landowner/s</p>	<ul style="list-style-type: none"> • Observational and photographic monitoring • Piezometers • Slope inclinometers 	<p>Harris Creek and Nepean River cliff lines</p> <ul style="list-style-type: none"> - Baseline recording once prior to mining. - Monthly routine inspections with weekly inspections during critical periods <p>Low Terrain Sensitivity (visual inspection)</p> <ul style="list-style-type: none"> - 6 months prior to mining - 6 months after active subsidence <p>Medium Terrain Sensitivity</p> <ul style="list-style-type: none"> - 6 to 12 months prior to mining - 3 monthly during active subsidence - 6 months after active subsidence <p>High Terrain Sensitivity</p>	<ul style="list-style-type: none"> • Visual inspections • Photographic records • Ground survey (mid to high terrain sensitivity) • Piezometers (high terrain sensitivity) • Slope inclinometers (high terrain sensitivity) 	No Changes

MONITORING SITE	MONITORING TYPE	MONITORING FREQUENCY	PARAMETERS	FUTURE MONITORING (LONGWALL 710)
		<ul style="list-style-type: none"> - 12 months before commencement of subsidence for visual and on ground survey - Monthly for visual during active subsidence - 3 monthly for ground survey during active subsidence - Installation of piezometers and inclinometers as required and in consultation with landowners as part of PSMP process 		

1 Fortnightly targeted monitoring of relevant sites when impacts are observed.

2 Analytes tested at closest downstream sample site following Level 2 and above trigger for gas release.

6 APPENDIX B

Appendix B: Appin Mine Areas 7 and 9 TARPS, Key Monitoring, Triggers and Response

Monitoring	Trigger	Action
Surface Water Quality[#]		
Nepean River Control Sites: NR110 (Upstream perturbations) SW2 (Upstream perturbations from Allens Creek) NR5 (Upstream perturbations from Cataract River) NR8 (Upstream perturbations from Elladale Creek) NR10 (Upstream perturbations from Ouesdale Creek) NR40 (Upstream perturbation from Menangle Creek) Impact Sites: NR0 NR4 (assess influence from Harris Creek) NR12 NR13 NR50	Level 1* Impact monitoring sites when comparing the baseline period to the mining period for that site: <ul style="list-style-type: none"> • Mining results in pH reduction greater than 1 standard deviation but less than 2 standard deviations from pre-mining mean resulting from the mining for two consecutive months • Mining results in DO reduction greater than 1 standard deviation but less than 2 standard deviations from pre-mining mean resulting from the mining for two consecutive months • Identification of strata gas plume of flow rate <3000 L/min • Trend analysis shows deviation from baseline post mining. 	<ul style="list-style-type: none"> • Continue monitoring program • Submit an Impact Report to BCS, DPE – Water, WaterNSW and other relevant stakeholders • Report in the End of Panel Report • Summarise actions and monitoring in Annual Review
	Level 2* Impact monitoring sites when comparing the baseline period to the mining period for that site: <ul style="list-style-type: none"> • Mining results in pH reduction greater than 2 standard deviations from pre-mining mean resulting from the mining for two consecutive months 	<ul style="list-style-type: none"> • <i>Actions as stated for Level 1</i> • Review monitoring program • Notify relevant technical specialists and seek advice on any CMA required • Implement agreed CMAs as approved <p><i>Note: CMAs are to be proposed based on appropriate management of environmental and other consequences of mining impacts i.e. water quality</i></p>

<p>Creeks and Tributaries</p> <p>Control Site: RC1</p> <p>Impact Sites: NAV1 FO1 HC10 NR3</p>	<ul style="list-style-type: none"> Mining results in DO reduction greater than 2 standard deviations from pre-mining mean resulting from the mining for two consecutive months Mining results in EC increases greater than 2 standard deviations from pre-mining mean resulting from the mining for two consecutive months Identification of strata gas plume of flow rate >3000 L/min Trend analysis shows significant deviation from baseline post-mining. 	<p><i>changes with insignificant consequences may not require specific CMAs other than ongoing monitoring to confirm there are no ongoing impacts</i></p> <p>Strata Gas Emission Plume:</p> <ul style="list-style-type: none"> Estimate gas emission flow rates. Re-estimate should significant change be observed Take sample of plume (if possible) for: <ul style="list-style-type: none"> chemical composition dissolved methane from exactly above gas plume and at established downriver monitoring site dissolved sulfide and total phenols from exactly above gas plume and at nearest downriver monitoring site
	<p>Level 3*</p> <p>Impact monitoring sites when comparing the baseline period to the mining period for that site:</p> <ul style="list-style-type: none"> Level 2-type reduction in water quality resulting from the mining observed for six consecutive months 	<ul style="list-style-type: none"> Actions stated for Level 2 Notify BCS, DPE - Water, WaterNSW and relevant resource managers and technical specialists and seek advice on any CMA required Invite stakeholders for site visit Develop site CMA (subject to stakeholder feedback) Completion of works following approvals, including monitoring and reporting on success Review the TARP and Management Plan in consultation with key stakeholders <p><i>Note: CMAs are to be proposed based on appropriate management of environmental and other consequences of mining impacts i.e. water quality changes with insignificant consequences may not require specific CMAs other than ongoing monitoring to confirm there are no ongoing impacts</i></p>
	<p>Exceeding Performance Measures</p> <p>Mining results in more than negligible gas releases, iron staining or water cloudiness on Nepean River.</p> <p>Mining results in greater subsidence impact or environmental consequences than predicted in the EA and PPR</p>	<ul style="list-style-type: none"> Actions stated for Level 3 Investigate reasons for the exceedance Update future predictions based on the outcomes of the investigation Provide environmental offset if CMAs are unsuccessful
<p>Surface Water Flow and Level</p>		
<p>Nepean River</p> <p>Maldon Weir Broughtons Pass Weir Menangle Weir</p> <p>Creeks and Tributaries</p> <p>NAV1 FO1 HC10 NR3</p>	<p>Level 1*</p> <ul style="list-style-type: none"> Mining results in observational changes to pool level (dry and/or flooded) in comparison to baseline observations and flows, for less than two consecutive months. 	<ul style="list-style-type: none"> Continue monitoring program Submit an Impact Report to BCS, DPE – Water, WaterNSW and other relevant stakeholders Report in the End of Panel Report Summarise actions and monitoring in Annual Review
	<p>Level 2*</p> <ul style="list-style-type: none"> Mining results in observational changes to pool level (dry and/or flooded) in comparison to baseline observations and flows, for more than two consecutive months. 	<p><i>Actions as stated for Level 1</i></p> <ul style="list-style-type: none"> Review monitoring program Notify relevant technical specialists and seek advice on any CMA required Implement agreed CMAs as approved
	<p>Level 3*</p>	<p><i>Actions stated for Level 2</i></p> <ul style="list-style-type: none"> Notify BCS, DPE - Water, WaterNSW and relevant resource managers and technical specialists and seek advice on any CMA required

	<ul style="list-style-type: none"> Mining results in observational changes to pool level (dry and/or flooded) in comparison to baseline observations and flows, for six consecutive months. 	<ul style="list-style-type: none"> Invite stakeholders for site visit Develop site CMA (subject to stakeholder feedback) Completion of works following approvals, including monitoring and reporting on success Review the TARP and Management Plan in consultation with key stakeholders
	<p>Exceeding Performance Measures</p> <p>Mining results in more than negligible diversion of flows or changes in the natural drainage behaviour of pools in the Nepean River</p>	<p><i>Actions stated for Level 3</i></p> <ul style="list-style-type: none"> Investigate reasons for the exceedance Update future predictions based on the outcomes of the investigation Provide environmental offset if CMAs are unsuccessful
<p>Creeks and Tributaries</p> <p>Foot Onslow Creek FO1 FOS1</p> <p>Navigation Creek NAV1 NAVS1</p>	<p>Level 1*</p> <ul style="list-style-type: none"> Fracturing with no observable loss of surface water flow 	<ul style="list-style-type: none"> Continue monitoring program Submit an Impact Report to BCS, DPE – Water, WaterNSW and other relevant stakeholders Report in the End of Panel Report Summarise actions and monitoring in Annual Review
	<p>Level 2*</p> <ul style="list-style-type: none"> Fracturing resulting in loss of surface flow in some creeks or tributary 	<p><i>Actions as stated for Level 1</i></p> <ul style="list-style-type: none"> Review monitoring program Notify relevant technical specialists and seek advice on any CMA required Implement agreed CMAs as approved
	<p>Level 3*</p> <ul style="list-style-type: none"> Fracturing resulting in total loss of surface flow in all sections of a creek or tributary 	<p><i>Actions stated for Level 2</i></p> <ul style="list-style-type: none"> Notify BCS, DPE - Water, WaterNSW and relevant resource managers and technical specialists and seek advice on any CMA required Invite stakeholders for site visit Develop site CMA (subject to stakeholder feedback) Completion of works following approvals, including monitoring and reporting on success Review the TARP and Management Plan in consultation with key stakeholders
	<p>Exceeding Performance Measures</p> <ul style="list-style-type: none"> Mining results in greater subsidence impact or environmental consequences than predicted in the EA and PPR 	<p><i>Actions stated for Level 3</i></p> <ul style="list-style-type: none"> Investigate reasons for the exceedance Update future predictions based on the outcomes of the investigation Provide environmental offset if CMAs are unsuccessful
Groundwater		
<p>Groundwater inflows to the mine</p> <p>Private Bores GW072196 GW072874 GW100289 GW100673</p>	<p>Level 1*</p> <ul style="list-style-type: none"> Increase in water flow from the goaf between 2.7 to 3 ML/day (over 20-day average) >10 m reduction in water level/pressure in the HBSS from the average level in the period of 12 months prior to the start of a longwall, over a minimum of two months 	<ul style="list-style-type: none"> Continue monitoring program Submit an Impact Report to BCS, DPE - Water, WaterNSW and other relevant stakeholders Report in the End of Panel Report Summarise actions and monitoring in Annual Review
	<p>Level 2*</p>	<ul style="list-style-type: none"> <i>Actions as stated for Level 1</i> Review monitoring frequency

<p>GW101986 GW104661 GW105376 GW105388 GW105531 GW105534 GW105574 GW106574 (grouted) GW106675 GW108907 GW112381 GW112441 (grouted)</p> <p>IMC Boreholes S1913 S1941 S1954 S2157 S2536 S2536A S2537 S2538</p>	<ul style="list-style-type: none"> • Increase in water flow from the goaf between 3 to 3.4ML (over 20-day average) • >15 m reduction in water level/pressure in the HBSS from the average level in the period of 12 months prior to the start of a longwall, over a minimum of two months 	<ul style="list-style-type: none"> • Notify relevant technical specialists and seek advice on any CMA required • Implement agreed CMAs as approved <p><i>Note: CMAs are to be proposed based on appropriate management of environmental and other consequences of mining impacts i.e. cracking at the surface with insignificant consequences may not require specific CMAs other than ongoing monitoring to confirm there are no ongoing impacts</i></p>
	<p>Level 3*</p> <ul style="list-style-type: none"> • Abnormal increase in water flow from the goaf >3.4ML (20-day average) • >20 m reduction in water level/pressure in the HBSS from the average level in the period of 12 months prior to the start of a longwall, over a minimum of two months • Mining results in groundwater bores unsafe, unserviceable or damaged 	<ul style="list-style-type: none"> • Actions as stated for Level 2 • Notify BCS, DPE - Water, WaterNSW and relevant resource managers and technical specialists and seek advice on any CMA required • Invite stakeholders for site visit • Develop site CMA (subject to stakeholder feedback). This may include: <ul style="list-style-type: none"> - Make area safe - Any actions agreed to in the Property Subsidence Management Plan - Provisions of alternate water supply where this has been impacted by mining • Completion of works following approvals, including monitoring and reporting on success • Review the Groundwater Model, TARP and Management Plan in consultation with key stakeholders <p><i>Note: CMAs are to be proposed based on appropriate management of environmental and other consequences of mining impacts i.e. cracking at the surface with insignificant consequences may not require specific CMAs other than ongoing monitoring to confirm there are no ongoing impacts</i></p>

Landscape Features		
<p>Cliffs and Steep Slopes</p> <ul style="list-style-type: none"> • Nepean River cliff lines • Razorback Range cliffs • Sensitive terrain near built features (Razorback Range) <p>Monitoring locations on private properties to be determined as appropriate/required in consultation with landowner</p>	<p>Level 1*</p> <ul style="list-style-type: none"> • Rock fall from a cliff where the cliff is left mostly intact (<10% length of any single cliff) • Surface movement or rock displacement where any exposed soil surface is stable • Crack at the surface which does not result in ongoing erosion or ground movement • Erosion which stabilises within the period of monitoring without CMA • Crack or fracture up to 100 mm width • Crack or fracture up to 10 m length 	<ul style="list-style-type: none"> • Continue monitoring program • Submit an Impact Report to BCD, DPE and MEG • Report in the End of Panel Report • Summarise actions and monitoring in AR
	<p>Level 2*</p> <ul style="list-style-type: none"> • Rock fall from cliff where the characteristics of the cliff change (>10% length of any single cliff) • Ground disturbance that is unlikely to stabilise within the period of monitoring without CMA • Mass movement of a slope causing areas of exposed soil • Crack or fracture between 100 – 300 mm width 	<ul style="list-style-type: none"> • <i>Actions as stated for Level 1</i> • Report trigger to key stakeholders • Review monitoring frequency • Notify relevant technical specialists and seek advice on any CMA required • Provide safety signage and barricades where appropriate in areas as required for public safety (refer PSMP) • Implement agreed CMAs as approved

	<ul style="list-style-type: none"> • Crack or fracture between 10 – 50 m length 	<p><i>Note: CMAs are to be proposed based on appropriate management of environmental and other consequences of mining impacts i.e. cracking at the surface with insignificant consequences may not require specific CMAs other than ongoing monitoring to confirm there are no ongoing impacts</i></p>
	<p>Level 3*</p> <ul style="list-style-type: none"> • Cliff collapse (100% length of any single cliff) • Ground disturbance that does not stabilise within the period of monitoring • Mass movement of a slope causing areas of exposed soil that does not stabilise within the period of monitoring • Crack or fracture over 300 mm width • Crack or fracture over 50 m length 	<ul style="list-style-type: none"> • <i>Actions as stated for Level 2</i> • Notify BCD, DPE, Resources Regulator, relevant resource managers and technical specialists and seek advice on any CMA required. • Invite stakeholders for site visit • Develop site CMA (subject to stakeholder feedback). This may include: <ul style="list-style-type: none"> – Erosion prevention works – Establishment of vegetation • Completion of works following approvals, including monitoring and reporting on success • Review the TARP and Management Plan in consultation with key stakeholders <p><i>Note: CMAs are to be proposed based on appropriate management of environmental and other consequences of mining impacts i.e. cracking at the surface with insignificant consequences may not require specific CMAs other than ongoing monitoring to confirm there are no ongoing impacts</i></p>
	<p>Exceeding Prediction</p> <ul style="list-style-type: none"> • For cliffs of 'special significance' and other cliffs flanking the Nepean River - mining results in more than negligible environmental consequences (i.e. more than occasional rockfalls, displacement or dislodgement of boulders or slabs, or fracturing, that in total impact more than 0.5% of the total face area of such cliffs within any longwall mining domain • Other cliffs – mining results in more than minor environmental consequences (that is occasional rockfalls, displacement or dislodgment of boulders or slabs or fracturing, that in total impact more than 3% of the total face area of such cliffs within any longwall mining domain 	<ul style="list-style-type: none"> • <i>Actions as stated for Level 3</i> • Make area safe • Investigate reasons for the exceedance • Update future predictions based on the outcomes of the investigation • Provide environmental offset if CMAs are unsuccessful
Aquatic Ecology		
<p>Impact Sites: 5, 6, X3 and X4</p> <p>Control Sites: 1, 2, 7, 8, X5, X6, X7 and X8</p>	<p>Level 1*</p> <ul style="list-style-type: none"> • Reduction in aquatic habitat resulting from the mining over 1 season 	<ul style="list-style-type: none"> • Continue monitoring program • Submit an Impact Report to BCD, DPE, DPI Fisheries and other relevant resource managers • Report in the End of Panel Report • Summarise actions and monitoring in AR
	<p>Level 2*</p> <ul style="list-style-type: none"> • Reduction in aquatic habitat resulting from the mining over 2 seasons 	<ul style="list-style-type: none"> • <i>Actions as stated for Level 1</i> • Report trigger to key stakeholders • Review monitoring program

		<ul style="list-style-type: none"> • Notify relevant technical specialists and seek advice on any CMA required • Implement agreed CMAs as approved <p><i>Note: CMAs are to be proposed based on appropriate management of environmental and other consequences of mining impacts i.e. impacts to aquatic habitat with insignificant consequences may not require specific CMAs other than ongoing monitoring to confirm there are no ongoing impacts</i></p>
	<p>Level 3*</p> <ul style="list-style-type: none"> • Reduction in aquatic habitat resulting from the mining for >2 consecutive seasons or complete loss of habitat 	<ul style="list-style-type: none"> • <i>Actions as stated for Level 2</i> • Notify BCD, DPE, DPI Fisheries, relevant resource managers and technical specialists and seek advice on any CMA required. • Invite stakeholders for site visit • Develop site CMA (subject to stakeholder feedback). This may include: <ul style="list-style-type: none"> – Grouting of fractures which result in flow diversion – Completion of works following approvals • Completion of works following approvals, including monitoring and reporting on success • Review the TARP and Management Plan in consultation with key stakeholders <p><i>Note: CMAs are to be proposed based on appropriate management of environmental and other consequences of mining impacts i.e. impacts to aquatic habitat with insignificant consequences may not require specific CMAs other than ongoing monitoring to confirm there are no ongoing impacts</i></p>
	<p>Exceeding Prediction</p> <ul style="list-style-type: none"> • Mining results in more than negligible environmental consequences for a threatened species, threatened population or endangered ecological communities 	<ul style="list-style-type: none"> • <i>Actions as stated for Level 3</i> • Investigate reasons for the exceedance • Update future predictions based on the outcomes of the investigation • Provide environmental offset if CMAs are unsuccessful
Terrestrial Ecology		
<p>Visual inspections as part of landscape and water monitoring programs in active mining areas</p>	<p>Level 1*</p> <ul style="list-style-type: none"> • Impacts detectable via observational monitoring (e.g. canopy thinning, thinning of shrub layer, minor loss of ground cover) to a single vegetation strata • Subsidence impacts (such as surface cracking, rock falls) resulting in small areas of disturbance that will mitigate without CMA 	<ul style="list-style-type: none"> • Continue monitoring program • Submit an Impact Report to BCD, DPE and other relevant resource managers • Report in the End of Panel Report • Summarise actions and monitoring in AR
	<p>Level 2*</p> <ul style="list-style-type: none"> • Impacts detectable via observational monitoring (e.g. canopy thinning with dead branches present, thinning of the shrub layer with dead branches, loss of ground cover in multiple areas) to multiple vegetation strata • Subsidence impacts (such as surface cracking, rock falls) resulting in small areas of disturbance that will not mitigate without CMA 	<ul style="list-style-type: none"> • <i>Actions as stated for Level 1</i> • Report trigger to key stakeholders • Review monitoring program • Notify relevant technical specialists and seek advice on any CMA required • Implement agreed CMAs as approved <p><i>Note: CMAs are to be proposed based on appropriate management of environmental and other consequences of mining impacts i.e. impacts to terrestrial habitat with insignificant consequences may not require specific CMAs other than ongoing monitoring to confirm there are no ongoing impacts</i></p>

	<p>Level 3*</p> <ul style="list-style-type: none"> • Impacts (e.g. canopy thinning with dead branches present, thinning of the shrub layer with dead branches, loss of ground cover in multiple areas) to multiple vegetation strata caused by subsidence effects • Subsidence impacts (such as surface cracking, rock falls) resulting in large areas of disturbance that will not mitigate without CMA • Negligible environmental consequences to threatened species, populations or EEC Reduction in aquatic habitat resulting from the mining for >2 consecutive seasons or complete loss of habitat 	<ul style="list-style-type: none"> • <i>Actions as stated for Level 2</i> • Notify BCD, DPE, relevant resource managers and technical specialists and seek advice on any CMA required. • Invite stakeholders for site visit • Develop site CMA (subject to stakeholder feedback). This may include: <ul style="list-style-type: none"> – Erosion prevention works – Establishment of vegetation • Completion of works following approvals, including monitoring and reporting on success • Review the TARP and Management Plan in consultation with key stakeholders <p><i>Note: CMAs are to be proposed based on appropriate management of environmental and other consequences of mining impacts i.e. impacts to terrestrial habitat with insignificant consequences may not require specific CMAs other than ongoing monitoring to confirm there are no ongoing impacts</i></p>
	<p>Exceeding Prediction</p> <ul style="list-style-type: none"> • Mining results in more than negligible environmental consequences for a threatened species, threatened population or endangered ecological communities 	<ul style="list-style-type: none"> • <i>Actions as stated for Level 3</i> • Investigate reasons for the exceedance • Update future predictions based on the outcomes of the investigation • Provide environmental offset if CMAs are unsuccessful