WAMBO COAL PTY LIMITED

SOUTH BATES EXTENSION UNDERGROUND MINE

EXTRACTION PLAN
LONGWALLS 17 TO 20

APPENDIX A
WATER MANAGEMENT PLAN

Peabody

WAMBO COAL PTY LIMITED
SOUTH BATES EXTENSION UNDERGROUND MINE

WATER MANAGEMENT PLAN
LONGWALLS 17 - 20

PREPARED BY
WAMBO COAL PTY LIMITED

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DOCUMENT CONTROL

Document No.	WMP LW11-16
Title	Water Management Plan for South Bates Underground Mine Longwalls 17 to 20
General Description	Management of potential subsidence effects, subsidence impacts and environmental consequences on surface water resources, groundwater resources and flooding for the mining of Longwalls 17 to 20 at the South Bates Extension Underground Mine
Key Support Documents	Wambo Coal Surface Water Monitoring Program Wambo Coal Groundwater Monitoring Program Wambo Coal Surface and Groundwater Response Plan

Revisions

Rev No	Date	Description	By	Checked
A	April 2018	Final for Submission	WCPL and Resource Strategies	P. Jaeger

The nominated Coordinator for this document is	Environment and Community Manager

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1 INTRODUCTION

The Wambo Coal Mine is an open cut and underground coal mining operation located approximately 15 kilometres (km) west of Singleton, near the village of Warkworth, New South Wales (NSW) (**Figure 1**). The Wambo Coal Mine is owned and operated by Wambo Coal Pty Limited (WCPL), a subsidiary of Peabody Energy Australia Pty Limited.

The South Bates Extension Underground Mine is a component of the approved Wambo Coal Mine. The South Bates Extension Underground Mine is scheduled to commence in Longwall 17 in September 2018 and involves extraction of coal by longwall mining methods from the Whybrow Seam within Coal Lease (CL) 397, Mining Lease (ML) 1594 and ML 1572 (**Figure 2**).

The potential environmental impacts of the existing Wambo Coal were assessed in the *Wambo Development Project Environmental Impact Statement* (the Wambo Development Project EIS) (WCPL, 2003). Development Consent DA 305-7-2003 for the Wambo Coal Mine was granted on 4 February 2004 by the then NSW Minister for Urban Affairs and Planning under Part 4 of the NSW *Environmental Planning and Assessment Act, 1979*.

An application to modify the Development Consent (DA 305-7-2003 MOD 17) to allow the development of the South Bates Extension Underground Mine (Longwalls 17 to 25) in the Whybrow Seam was approved in December 2017. The application was accompanied by the *South Bates Extension Modification Environmental Assessment* (WCPL, 2017).

1.1 PURPOSE AND SCOPE

Purpose: This WMP for Longwalls 17 to 20 outlines the management of potential environmental consequences of the proposed secondary workings described in the Extraction Plan on water resources.

Scope: This WMP covers surface water resources, groundwater resources and flooding within the Longwalls 17 to 20 Application Area (**Figure 2**).

This WMP has been prepared in accordance with Condition 22C(h) of Schedule 4 of the Development Consent (DA 305-7-2003) as a component of the South Bates Extension Underground Mine Longwalls 17 to 20 Extraction Plan.

Management plan requirements applicable to the preparation of this WMP, and where each of these requirements is addressed within this WMP, are summarised in **Table 1**.

This WMP has been prepared by WCPL, with assistance from Resource Strategies. The WMP draws on the conclusions of reports by Alluvium (2018) and HydroSimulations (2018) that form part of the Extraction Plan. The appointment of the team of suitably qualified and experienced experts (which includes representatives from WCPL, Alluvium, HydroSimulations and Resource Strategies) has been endorsed by the Secretary of the DP&E.

LEGEND
- Mining and Coal Lease Boundary
- Local Government Boundary
- Mining Operation

Source: Geoscience Australia (2009)

WAM-09-15_SBX_MP_Figure 1

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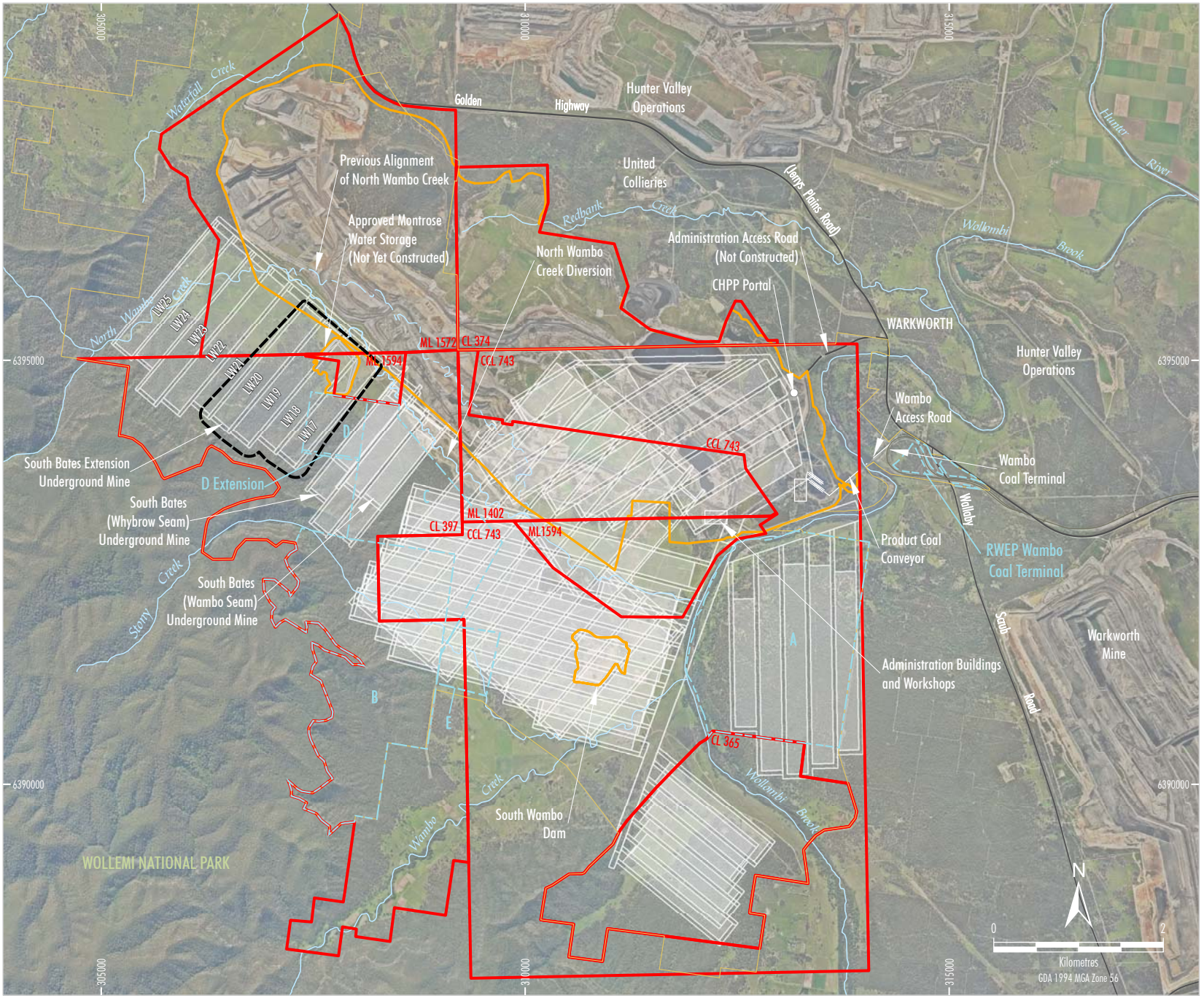
WAMBO COAL MINE

Regional Location

Figure 1



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WAMBO COAL MINE

Approved Wambo Coal Mine Layout

Figure 2

Table 1
Water Management Plan Requirements

Development Consent (DA 305-7-2003) Condition	WMP Section
Condition 22C(h) of Schedule 4 *22C. The Applicant must prepare and implement an Extraction Plan for the second workings within each seam to be mined to the satisfaction of the Secretary. Each Extraction Plan must:* *...*	
(h) include a: • *Water Management Plan, which has been prepared in consultation with EPA and CLWD, which provides for the management of the potential impacts and/or environmental consequences of the proposed second workings on surface water resources, groundwater resources and flooding, and which includes:*	Management of potential impacts and/or environmental consequences on water are addressed in **Section 5**. Performance measures and performance indicators relevant to water are presented in **Section 2** and **Section 6** respectively.
– *surface and groundwater impact assessment criteria, including trigger levels for investigating any potentially adverse impacts on water resources or water quality;*	Addressed in **Table 2**.
– *a program to monitor and report groundwater inflows to underground workings; and*	Addressed in **Table 2**.
– *a program to manage and monitor impacts on groundwater bores on privately-owned land;* *...*	Addressed in **Table 2**.
Condition 22D of Schedule 4 *22D. The Applicant must ensure that the management plans required under condition 22C(h) above include:*	
(a) an assessment of the potential environmental consequences of the Extraction Plan, incorporating any relevant information that has been obtained since this consent;	Addressed in **Section 3**.
(b) a detailed description of the measures that would be implemented to remediate predicted impacts; and	Addressed in **Table 2**.
(c) a contingency plan that expressly provides for adaptive management.	Addressed in **Section 7**.

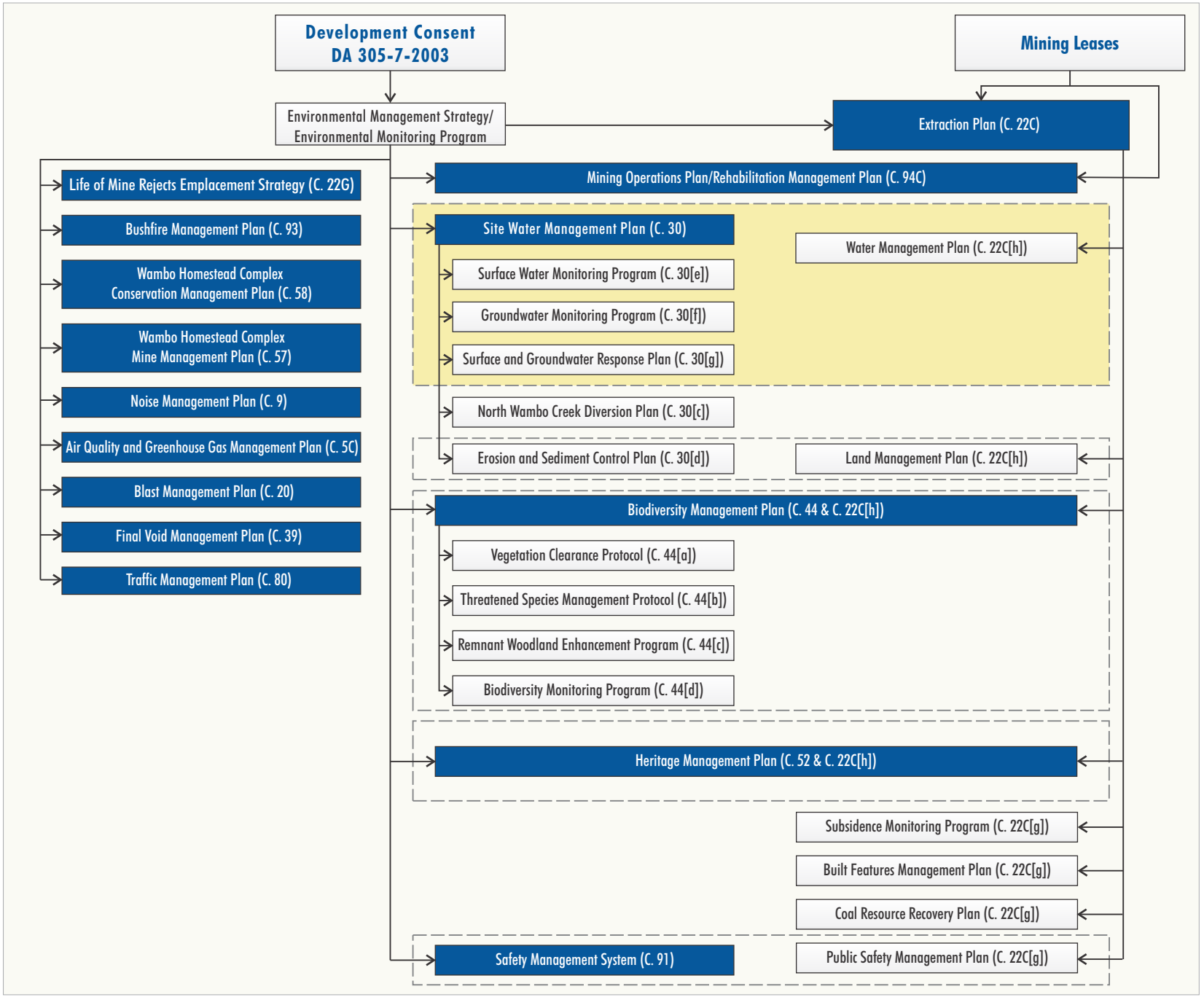
1.2 STRUCTURE OF THE WATER MANAGEMENT PLAN

This WMP forms part of WCPL's Environmental Management System for the Wambo Coal Mine. The relationship of this WMP to the Wambo Coal Mine Environmental Management System is shown on **Figure 3**.

To avoid duplication of existing Environmental Management Plans, this WMP references components of the existing WCPL Site Water Management Plan, including the:

- Surface Water Monitoring Program (SWMP);
- Groundwater Monitoring Program (GWMP); and
- Surface and Groundwater Response Plan (SGWRP).

The GWMP, SWMP and SGWRP have been revised in support of this Extraction Plan, and a draft of the revised GWMP, SWMP and SGWRP are included in **Attachments 2, 3 and 4**, respectively.



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WAMBO COAL MINE

Wambo Coal Mine
Environmental Management System

Figure 3

The sections of the SWMP, GWMP and SGWRP relevant to the WMP are summarised in **Table 2**, with the monitoring site locations shown in **Figure 4**. The SWMP, GWMP and SGWRP are included as **Attachments 2 to 4**, respectively.

If the SWMP, GWMP or SGWRP are revised separately in accordance with the Development Consent (DA 305-7-2003), as part of the consultation process with relevant agencies, **Attachments 2 to 4** of this WMP will be updated accordingly.

Table 2
Supporting Documents – Reference Summary

WMP Component	Existing Program/Plan Reference	Section Description
Description of the existing environment[1]	GWMP Section 2 – Existing Groundwater Conditions and Baseline Data	Section 2 of the GWMP includes an overview of the hydrogeology in proximity to the Wambo Coal Mine.
	SWMP Section 2 – Existing Surface Water Conditions and Baseline Data	Section 2 of the SWMP includes an overview of the hydrological features in proximity to the Wambo Coal Mine.
Surface water monitoring	SWMP Section 4.1.1 – Surface Water Quality	Water sampling is undertaken at sites along Wollombi Brook, North Wambo Creek, the North Wambo Creek Diversion, Wambo Creek (also known as South Wambo Creek), and Stony Creek. The location of these sites is presented in **Figure 4**. Parameters monitored include pH, electrical conductivity (EC) and total suspended solids (TSS). Metals and ions are sampled at a subset of sites. Sampling is only undertaken during flow periods to ensure that increased solute concentration (caused by evaporation) does not cause incorrect sample results.
	SWMP Section 4.1.2 – Mine Water Quality	A number of monitoring sites relevant to mine water are sampled as described in Table 14 of the SWMP. Mine water storage dams including Eagles Nest Dam, Box Cut Dam, Gordon Below Franklin Dam, Homestead Open Cut and C11 Void are sampled monthly for pH and EC.
	SWMP Section 4.1.3 – Surface Water Flows	WCPL monitors flow in North Wambo Creek, the North Wambo Creek Diversion, Wambo Creek and Stony Creek using continuous flow monitoring stations. Surface water flow monitoring data for Wollombi Brook is sourced from Department of Industry – Water (DI-Water) operated flow gauging stations, located at Warkworth (FM10) and Bulga (FM11) (**Figure 4**).
	SWMP Section 4.1.5 – Riparian Vegetation and Creek Bed Stability	A program to monitor for potential subsidence impacts to fluvial geomorphology commenced in October 2006. The program aims to distinguish natural erosion from mine subsidence associated instability, through pre-mining and post-mining survey mapping in North Wambo Creek, the North Wambo Creek Diversion, Wambo Creek and Stony Creek and annual transect monitoring of riparian vegetation.
	SWMP Section 4.1.7 – Diversion and Subsidence Monitoring Program	This section of the SWMP provides a consolidated description of the monitoring methodology for the North Wambo Creek Diversion.

Table 2 (Continued)
Supporting Documents – Reference Summary

WMP Component	Existing Program/Plan Reference	Section Description
Groundwater monitoring	GWMP Section 4 – Groundwater Monitoring Program	Section 4 of the GWMP summarises the WCPL groundwater monitoring program including the monitoring network, measured parameters and monitoring frequency.
	GWMP Section 4.1 – Monitoring Network, Parameters and Frequency	The WCPL groundwater monitoring network is presented in **Figure 4**. Standpipe monitoring sites are regularly monitored for water level, pH and EC. The GWMP takes into account the existing site groundwater data, both from WCPL and the neighbouring United Colliery, as well as the historical and current mining operations.
	GWMP Section 4.1.5 – Inflows to Underground Workings	Dewatering volumes and underground water levels will be recorded on a daily basis during pumping. This data will be incorporated into the site water balance on an annual basis to allow calculation of groundwater inflows including loss of groundwater from alluvium and to verify whether WCPL holds sufficient groundwater licence entitlements.
Surface water impact assessment criteria	SWMP Section 3 – Surface Water Impact Assessment Criteria	Section 3 of the SWMP summarises the surface water impact assessment criteria adopted for Wollombi Brook, North Wambo Creek, Wambo Creek, Stony Creek and Waterfall Creek. If monitoring data exceed these criteria an investigation is undertaken to identify any adverse impacts on water resources or water quality.
	SWMP Section 4.4 – Data Review and Investigation	Section 4.4 of the SWMP outlines the procedure for review of data collected as part of the SWMP, as well as the investigation and response protocol implemented if water quality monitoring data are found to exceed the water quality criteria (i.e. if the trigger levels are exceeded).
Groundwater impact assessment criteria	GWMP Section 3 – Groundwater Triggers	Trigger levels have been developed for groundwater quantity and quality. Shallow bore trigger levels are listed in Table 9 of the GWMP.
	GWMP Section 4.4 – Data Review and Investigation	Section 4.4 of the GWMP outlines the procedure for review of data collected as part of the GWMP, as well as the investigation and response protocol implemented if water quality monitoring data are found to exceed the water quality criteria (i.e. if the trigger levels are exceeded).
Program to manage and monitor impacts on groundwater bores on privately-owned land	SGWRP Section 2.3 – Impacts on Groundwater	Section 2.3 of the SGWRP details the investigation undertaken in the event that a trigger level is exceeded or a complaint is received in relation to loss of groundwater supply. If the investigation identifies groundwater impacts attributable to WCPL activities, appropriate measures will be developed in consultation with relevant agencies and any affected adjacent landowners.
	SGWRP Section 2.12 – Unforeseen Impacts	This section details the general response procedure initiated in the event that an unforeseen surface or groundwater impact is detected.

Table 2 (Continued)
Supporting Documents – Reference Summary

WMP Component	Existing Program/Plan Reference	Section Description
Responsibilities[1]	SWMP Section 7 – Responsibilities	This section summarises the SWMP responsibilities and timing of SWMP tasks.
	GWMP Section 7 – Responsibilities	This section summarises the GWMP responsibilities and timing of GWMP tasks.
	SGWRP Section 5 – Responsibilities	This section summarises the SGWRP responsibilities and timing of SGWRP tasks.

[1] Not a specific requirement of this WMP under Condition 22C(h) of Schedule 4 of the Development Consent (DA 305-7-2003).

An overview of the main text sections and attachments of this WMP is presented below:

Section 1 Provides an introduction to the WMP, including the purpose and scope of the WMP and the context of the WMP in relation to WCPL's Environmental Management System for the Wambo Coal Mine.

Section 2 Describes the performance measures relevant to water.

Section 3 Summarises the predicted subsidence impacts and environmental consequences resulting from the extraction of Longwalls 17 to 20.

Section 4 Provides a summary of the monitoring of the North Wambo Creek Diversion that will be undertaken in relation to Longwalls 17 to 20.

Section 5 Describes the management measures that will be implemented for the North Wambo Creek Diversion.

Section 6 Describes how monitoring data will be used to assess the extraction of Longwalls 17 to 20 against the relevant performance indicators and performance measures.

Section 7 Provides a Contingency Plan to manage any unpredicted impacts and their consequences.

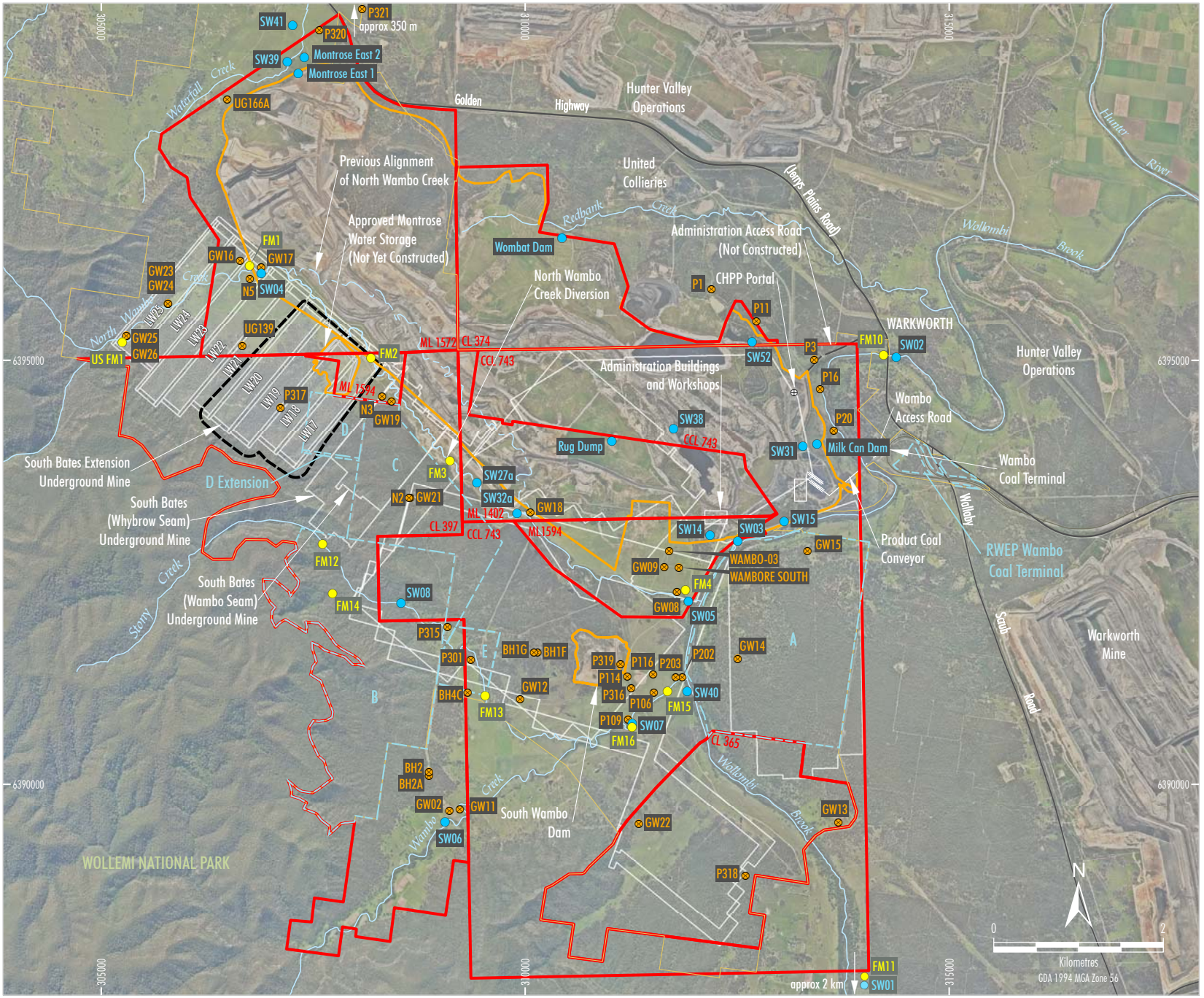
Section 8 Lists the documents referred to in **Sections 1 to 7** of this WMP.

Attachment 1 Provides a Trigger Action Response Plan (TARP) for this WMP which is a simple and transparent snapshot of the monitoring of environmental performance and, where required, the implementation of management and/or contingency measures.

Attachment 2 Provides a copy of the draft revised SWMP (Version 12).

Attachment 3 Provides a copy of the draft revised GWMP (Version 12).

Attachment 4 Provides a copy of the draft revised SGWRP (Version 12).



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1.3 CONSULTATION ON THE WATER MANAGEMENT PLAN

This WMP builds upon consultation conducted as part of:

- the development and review of referenced components of the existing WCPL Site Water Management Plan (the GWMP, SWMP and SGWRP);
- the WMP prepared for Longwalls 11 to 16; and
- the consultation conducted during the preparation and the assessment of DA 305-7-2003 MOD 17.

Consultation relevant to this WMP has included the following:

- A draft WMP for Longwalls 11 to 16 (Version D) and was provided to the Department of Primary Industries Water (DPI Water) and the Environment Protection Authority (EPA) in December 2016 for consultation.
- Version E of the WMP for Longwalls 11 to 16 was provided to DPI Water, EPA, Division of Resources and Geoscience (DRG) and DP&E in January 2017.
- The EPA indicated it would not be providing comments on the WMP for Longwalls 11 to 16 in January 2017.
- Comments were received from DP&E on Version E of the WMP for Longwalls 11 to 16 in May 2017.
- A revised WMP for Longwalls 11 to 16 (Version F) was submitted in July 2017.
- The South Bates Extension Modification EA in support of DA 305-7-2003 MOD 17 was placed on public exhibition from 30 March to 2 May 2018.
- The EPA's submission on the South Bates Extension Modification EA (2 May 2017) raised no subsidence-related or water-related issues.
- The DPI Water, subsequently Crown Lands & Water Division (CLWD), made submissions on the South Bates Extension Modification EA and Responses to Submissions on 29 June 2017, 12 October 2017 and 2 November 2017. The submissions raised particular concerns regarding:
- The CLWD provided comments on Site Water Management Plan components on 19 December 2017.
- The Department of Industry – Water (DI-Water) and the EPA were provided with draft revisions to the following plans for consultation on 10 April 2018:
  - Groundwater Monitoring Program;
  - Surface Water Monitoring Program and
  - Surface and Groundwater Response Plan.
- This WMP for Longwalls 17 to 20 will be provided to the DI-Water, EPA, DRG and DP&E in April 2018.

The GWMP, SWMP and SGWRP include an appendix that outlines how comments received on the plans have been considered and addressed.

2 PERFORMANCE MEASURE

This WMP has been developed to manage the potential environmental consequences of the proposed secondary workings described in the Extraction Plan on surface water resources, groundwater resources and flooding in accordance with Condition 22C(h) of Schedule 4 of the Development Consent (DA 305-7-2003).

In accordance with Condition 22 of Schedule 4 of the Development Consent (DA 305-7-2003), WCPL must ensure that there is no exceedance of the subsidence impact performance measures listed in Tables 14A and 14B of Schedule 4 of the Development Consent (DA 305-7-2003). The performance measure specified in Table 14A of Schedule 4 of the Development Consent (DA 305-7-2003) relevant to water is listed in **Table 3**.

Table 3
Water Performance Measure

Feature	Subsidence Impact Performance Measure
Wollombi Brook	Negligible subsidence impacts[1] to Wollombi Brook. Negligible environmental consequences[2] to Wollombi Brook. Controlled release of excess site water only in accordance with EPL requirements.

Source: Table 14A of Schedule 4 of the Development Consent (DA 305-7-2003).

[1] A subsidence impact is defined by the Development Consent (DA 305-7-2003) as "*physical changes to the ground and its surface caused by subsidence effects, including tensile and shear cracking of the rock mass, localised buckling of strata caused by valley closure and upsidence and surface depressions or troughs*".

[2] An environmental consequence is defined by the Development Consent (DA 305-7-2003) as "*The environmental consequences of subsidence impacts, including: damage to infrastructure, buildings and residential dwellings; loss of surface flows to the subsurface; loss of standing pools; adverse water quality impacts; development of iron bacterial mats; cliff falls; rock falls; damage to Aboriginal heritage sites; impacts on aquatic ecology; ponding*".

Section 6 provides a summary of the analysis of monitoring data that will be undertaken to assess the impact of Longwalls 17 to 20 against the performance measure.

3 PREDICTED SUBSIDENCE IMPACTS AND ENVIRONMENTAL CONSEQUENCES

3.1 SURFACE WATER

3.1.1 Background

Wambo is situated adjacent to Wollombi Brook, south-west of its confluence with the Hunter River (**Figures 1 and 2**). Wollombi Brook drains an area of approximately 1,950 square kilometres and joins the Hunter River some 5 km north-east of the Wambo Coal Mine. The Wollombi Brook sub-catchment is bound by the Myall Range to the south-east, Doyles Range to the west, the Hunter Range to the south-west and Broken Back Range to the north-east (Hunter Catchment Management Trust, 2002).

The majority of lands within WCPL mining tenements drain via Wambo Creek, Stony Creek, North Wambo Creek and Redbank Creek to Wollombi Brook, while Waterfall Creek drains directly to the Hunter River (**Figure 2**).

A section of North Wambo Creek has been diverted to avoid the Wambo Open Cut (**Figure 2**). The North Wambo Creek Diversion was constructed in accordance with the approved North Wambo Creek Diversion Plan (WCPL, 2007).

3.1.2 Potential Subsidence Impacts and Environmental Consequences

Approved Subsidence Impacts and Environmental Consequences

The approved subsidence impacts and environmental consequences relating to surface water associated with the South Bates Extension Underground Mine are described in the *South Bates Extension Modification Environmental Assessment* (South Bates Extension Modification EA) (WCPL, 2017). Advisian (2016) prepared a surface water assessment in support of the South Bates Extension Modification EA.

Wollombi Brook

The potential environmental consequences to Wollombi Brook described in the South Bates Extension Modification EA (WCPL, 2017) include:

- no measurable impact on flows in Wollombi Brook when licensed extraction of water is permitted (flow greater than 38 megalitres per day); and
- negligible change in water quality with the implementation of mitigation measures in upstream areas impacted by subsidence.

North Wambo Creek Diversion

Approximately 980 metres (m) of the North Wambo Creek Diversion has been undermined by Longwalls 11 to 13 at South Bates Underground Mine. An additional 120 m will be undermined by Longwall 17.

Subsidence impacts on the North Wambo Creek Diversion as a result of the extraction of Longwall 17 are expected to be similar to those observed at the adjacent South Bates Underground Mine.

The potential environmental consequences to the North Wambo Creek Diversion described in the South Bates Extension Modification EA (WCPL, 2017) include:

- potential for minor increased ponding above Longwall 17;
- potential for surface cracking above Longwall 17 (similar to that observed above Longwall 11) and minor cracking along the section of the North Wambo Creek Diversion not located directly above the longwalls;
- potential for increased scour (and associated suspended solids) prior to the implementation of scour protection works; and
- potential for increased leakage from the North Wambo Creek Diversion prior to crack remediation works.

North Wambo Creek (Upstream of the North Wambo Creek Diversion)

A portion of North Wambo Creek upstream of the North Wambo Creek Diversion would be affected by subsidence from later longwalls at the South Bates Extension Underground Mine.

Approved subsidence impacts and environmental on North Wambo Creek include creation of ephemeral or semi-permanent pools, changes in grade, potential for flow diversion and cracking of surface soil and underlying rock.

Other Ephemeral Drainage Lines

The unnamed ephemeral drainage lines above Longwalls 17 to 20 have shallow incisions into the natural surface soils, with some isolated bedrock outcropping along the upper reaches (Advisian, 2016).

Potential subsidence impacts and environmental consequences on ephemeral drainage lines identified in the South Bates Extension Modification EA (WCPL, 2017) include:

- development of topographical depressions and potential for ponding in areas of low topographic relief (i.e. above the north-eastern ends of the longwall panels); and
- cracking of surface soil and underlying rock that may result in temporary changes in surface flow and/or sediment loads prior to remediation.

No significant change in the water quality in the ephemeral drainage lines is expected as a result of the South Bates Extension Underground Mine (Advisian, 2016).

Overview of Revised Predicted Subsidence Effects and Impacts

Predicted subsidence parameters for Longwalls 17 to 25 were provided in the subsidence assessment prepared by MSEC (2017) in the South Bates Extension Modification EA (WCPL, 2017).

This WMP has been informed by predictions of subsidence effects and impacts prepared by MSEC (2018) for Longwalls 17 to 20 only. There has been no change to the longwall layout between MSEC (2017) and MSEC (2018).

Wollombi Brook

As summarised in **Table 3**, the Development Consent (DA 305-7-2003) includes a performance measure specific to Wollombi Brook.

Wollombi Brook is located more than 4 km from Longwalls 17 to 20 and would not be affected by subsidence associated with Longwalls 17 to 20. Notwithstanding, performance indicators have been developed for Wollombi Brook and are detailed in **Section 6**.

North Wambo Creek Diversion

MSEC (2018) predicts the extraction of Longwall 17 would result in maximum vertical subsidence to the North Wambo Creek Diversion of about 300 millimetres (mm), maximum tilt of 25 millimetres per metre (mm/m), hogging curvature greater than 3.0 km^{-1} and negligible sagging curvature. This is consistent with previous subsidence effect predictions.

Potential subsidence impacts to the North Wambo Creek Diversion include (MSEC, 2018):

- Surface cracking and heaving above Longwall 17 (similar to that observed above Longwall 11) and minor cracking along the section of the North Wambo Creek Diversion not located directly above the longwalls.
- Changes in grade along the North Wambo Creek Diversion.

- Creation of a topographical depression along the North Wambo Creek Diversion directly above the Longwall 17. This depression is estimated to be up to 0.1 m deep and up to 25 m long.
- Potential for increased connectivity between the workings and the North Wambo Creek Diversion (noting that an increase in water make in the workings was not observed during the extraction of Longwalls 11 to 13 beneath the Diversion).

North Wambo Creek (Upstream of the North Wambo Creek Diversion)

North Wambo Creek is located more than 400 m to the north-west of Longwalls 17 to 20, and at this distance, it is unlikely that North Wambo Creek would experience adverse impacts due to the extraction of Longwalls 17 to 20 (MSEC, 2018).

Other Ephemeral Drainage Lines

Ephemeral drainage lines are located directly across the extents of Longwalls 17 to 20 and are expected to experience the full range of predicted subsidence movements consistent with previous subsidence impact predictions. This includes localised increased ponding and surface cracking.

Overview of Revised Predicted Environmental Consequences

An assessment of potential subsidence effects and impacts on the North Wambo Creek Diversion, and ephemeral drainage lines was prepared by MSEC (2018) as part of the Extraction Plan. Alluvium (2018) has undertaken detailed modelling to further quantify the environmental consequences and to design appropriate mitigation works to minimise the potential for increased scour or increased sediment loads (Surface Water Technical Report) in consideration of the subsidence effects predicted by MSEC (2018).

Consistent with subsidence impact predictions, there are no expected environmental consequences for Wollombi Brook.

North Wambo Creek Diversion

Modelling by Alluvium (2018) concluded that the extraction of Longwalls 17 to 20 will have a negligible effect on in-channel storage when compared to existing conditions. The impact of subsidence of the extraction of Longwalls 17 to 20 on flow in North Wambo Creek is minimal. Longwalls 17 to 20 are estimated to result in a reduction in flow volume of 0.86% for a 1 in 2 year Annual Recurrence Interval rainfall event.

WCPL proposes to maintain the predicted in-channel ponding, as it results in minimal impacts on flows in North Wambo Creek and works to allow free drainage of the pools would require significant disturbance of the North Wambo Creek Diversion.

Alluvium (2018) considers that management measures can be put in place to reduce the risk of an increase in suspended sediments in the North Wambo Creek Diversion to negligible.

HydroSimulations (**Technical Report 2**) estimates that increased leakage from the North Wambo Creek Diversion to the underground workings could conservatively be up to 12.5 megalitres per day (ML/day) prior to remediation during periods of flow (reducing significantly following remediation). No increase in groundwater inflows to the workings in the Whybrow Seam following rainfall events has been observed as part of the experience to date.

Management and remediation measures to mitigate the risk of scour and leakage associated with Longwalls 17 to 20 are summarised in **Section 5**.

North Wambo Creek (Upstream of the North Wambo Creek Diversion)

Consideration of potential subsidence impacts and environmental consequences on the natural section of North Wambo Creek upstream of the North Wambo Creek Diversion will be the subject of a future Extraction Plan that includes Longwalls 23, 24 and/or 25.

Other Ephemeral Drainage Lines

Surficial and subsurface erosion responses can be expected where cracks occur as a result of Longwalls 17 to 20 in colluvial and alluvial sediments (Alluvium, 2018). The sediments across this terrain above Longwalls 17 to 20 can be dispersive, which makes them prone to changes in rates of erosion (Alluvium, 2018).

Alluvium (2018) considers the areas of greatest risk would be where cracks open in erodible sediments with an orientation downslope or where local ponding occurs in the same location as cracking.

The geometry of flow paths towards North Wambo Creek Diversion would also change as a result of Longwalls 17 to 20 (Alluvium, 2018). The changes in flow paths have been identified by Alluvium (2018) based on the software CatchmentSIM using the predicted subsidence digital terrain model (DTM).

Without appropriate mitigation measures, the changes in flow paths may impact on the future effectiveness of an existing diversion bund and drain, and result in increases in erosion and scour. Mitigation measures to manage this risk are summarised in **Section 5** and described in detail in Alluvium (2018).

3.2 GROUNDWATER

3.2.1 Background

The hydrogeological regime of the Wambo Coal Mine area comprises two main systems (Australasian Groundwater and Environmental Consultants [AGE], 2003):

- a Quaternary alluvial aquifer system of channel fill deposits associated with Wollombi Brook, North Wambo Creek, Wambo Creek and Stony Creek; and
- underlying Permian strata of hydrogeologically “tight” and hence very low yielding to essentially dry sandstone and lesser siltstone and low to moderately permeable coal seams which are the prime water bearing strata within the Permian sequence.

The alluvial flow in North Wambo Creek has been altered by historical and existing mining operations including the removal of alluvium across the full width of the channel with consequent desaturation of the adjacent upstream and downstream alluvium.

As described in **Section 3.1.1**, a section of North Wambo Creek has been diverted to avoid the Wambo Open Cut (**Figure 2**). The North Wambo Creek Diversion (**Figure 2**) was constructed in accordance with the approved North Wambo Creek Diversion Plan (WCPL, 2007).

Historical and ongoing open cut and underground mining within the Wambo Coal Mine area (including adjoining mining operations) has created significant groundwater sinks and this has generated a regional zone of depressurisation within the Permian coal measures.

3.2.2 Potential Subsidence Impacts and Environmental Consequences

Approved Subsidence Impacts and Environmental Consequences

The approved subsidence impacts and environmental consequences relating to groundwater associated with the South Bates Extension Underground Mine are described in the *South Bates Extension Modification Environmental Assessment* (South Bates Extension Modification EA) (WCPL, 2017). HydroSimulations (2017) prepared a groundwater assessment in support of the South Bates Extension Modification EA informed by contemporary, peer reviewed numerical modelling techniques.

Alluvial Aquifers

In regard to potential environmental consequences on alluvial aquifers, HydroSimulations (2017) concluded the following as part of the South Bates Extension Modification EA:

- *The alluvium adjacent to the South Bates Extension footprint has been disconnected from the regional alluvial system due to the removal of alluvium downstream of the longwalls by the approved open cut mining operations (and associated construction of the North Wambo Creek Diversion).*
- *The alluvium adjacent to the South Bates Extension footprint has been affected by open cut mining activities, with several metres of drawdown in the alluvium observed to date.*
- *There are no bores above the South Bates Extension footprint that are used for irrigation, domestic or stock use.*

…

- *There is expected to be negligible impact on the highly productive alluvium associated with the Wollombi Brook and Hunter River as a result of the Modification.*

…

- *The Modification would not result in reduced beneficial uses of the alluvium (from a water quality perspective).*

Permian Aquifers

In regard to potential environmental consequences on Permian aquifers, HydroSimulations (2017) concluded the following as part of the South Bates Extension Modification EA:

- *For the Modification, inflows to South Bates Underground are predicted to peak at a maximum of about 1.0 ML/d at the end of 2018.*

…

- *The Modification would not have a significant impact on water levels in the Permian coal measures from a regional perspective due to the regional zone of depressurisation within the Permian coal measures created by historical and ongoing open cut and underground mining.*
- *The Wambo Coal Mine would not lower the beneficial use category of the groundwater within the Permian aquifers, as there would be no migration of groundwater away from the underground mining areas in the Permian aquifers either during mining or following completion of mining activities.*

Overview of Predicted Environmental Consequences

A groundwater assessment review, supported by review of the numerical model outputs, was prepared by HydroSimulations (2018) as part of the Extraction Plan for Longwalls 17 to 20 (Groundwater Technical Report).

The groundwater assessment review considered the cumulative predicted impacts on groundwater during the period of extraction of Longwalls 17 to 20 (HydroSimulations, 2018).

Following a review of monitoring data, HydroSimulations (2018) concluded revision of the potential cumulative environmental consequences for groundwater is not required. Of note to Longwalls 17 to 20, HydroSimulations (2018) concluded:

- Groundwater drawdowns of up to 200 m are expected in the Whybrow Seam, due to extraction of Longwalls 17 to 20.
- Extraction of Longwalls 17 to 20 would not have a significant impact on water levels in the Permian coal measures from a regional perspective due to the regional zone of depressurisation within the Permian coal measures created by historical and ongoing open cut and underground mining.
- Negligible loss of baseflow to the natural North Wambo Creek is expected due to extraction of Longwalls 17 to 20.
- There is an expectation of enhanced leakage from the North Wambo Creek diversion if the creek happens to flow during the period of extraction of Longwall 17 beneath the diversion.
- There are no additional private registered bores that would be likely to be affected by 2 m drawdown or more as a result of the incremental impacts of Longwalls 17 to 20.

4 MONITORING

Surface water and groundwater monitoring will be undertaken in accordance with the programs outlined in the SWMP and GWMP (**Section 1.2**). Specific monitoring for Longwalls 17 to 20 is outlined in **Table 4**.

The SWMP, GWMP and SGWRP (that form part of the Water Management Plan) incorporate a number of revisions to augment the monitoring programs to account for Longwall 17 to 20 and to address issues raised by DI-Water. These additional components of the monitoring program include:

- installation of an upstream flow gauge site on North Wambo Creek (US FM1);
- inclusion of two multi-level vibrating wire piezometers (VWPs) (sites P317 and UG139) to monitor depressurisation above the South Bates Extension Underground Mine; and
- installation of shallow monitoring bores adjacent to North Wambo Creek upstream of the North Wambo Creek Diversion (sites GW23, GW24, GW25 and GW26).

Alluvium (2018) reviewed the current subsidence and diversion monitoring program in the SWMP and concluded it provides appropriate and sufficient coverage for Longwalls 17 to 20.

Table 4
Water Management Plan Monitoring Program Overview

Monitoring Component	Parameter	Timing/Frequency	Responsibility
Pre-Mining			
Diversion and subsidence monitoring program.	As outlined in the SWMP.	In accordance with the SWMP.	Environment and Community Manager
Monitoring of surface water quality and flow monitoring sites (SW04, SW27a, US FM1, FM1, FM2, FM3).	In accordance with the SWMP.	In accordance with the SWMP.	Environment and Community Manager
Monitoring of groundwater sites (GW16, GW17, N3, N5, P317, UG139, GW23, GW24, GW25, GW26).	In accordance with the GWMP.	In accordance with the GWMP.	Environment and Community Manager
During Mining			
Longwalls 17 to 20 subsidence monitoring lines as described in the Subsidence Monitoring Program.	Monitoring parameters include: • subsidence; • tilt; • tensile strain; • compressive strain; and • absolute horizontal translation.	Monitoring during secondary extraction of Longwalls 17 to 20 in accordance with the Subsidence Monitoring Program.	Mine Surveyor
Diversion and subsidence monitoring program.	As outlined in the SWMP.	In accordance with the SWMP.	Environment and Community Manager
Visual inspection of the North Wambo Creek Diversion.	Surface cracks. Surface ponding.	Daily inspections when extraction is occurring directly beneath North Wambo Creek Diversion.	Environment and Community Manager
Visual inspection of drainage line flow paths.	Evidence of erosion or channelisation.	Following a rainfall event of greater than 40 mm in 24 hours.[1]	Environment and Community Manager
Monitoring of surface water quality and flow monitoring sites (SW04, SW27a, US FM1, FM1, FM2, FM3).	In accordance with the SWMP.	In accordance with the SWMP.	Environment and Community Manager
Monitoring of groundwater sites (GW16, GW17, N3, N5, P317, UG139, GW23, GW24, GW25, GW26).	In accordance with the GWMP.	In accordance with the GWMP.	Environment and Community Manager
Inflows to underground workings.	Dewatering volumes and underground water levels in accordance with the GWMP.	Recorded on a daily basis during pumping.	Environment and Community Manager

Table 4 (Continued)
Water Management Plan Monitoring Program Overview

Monitoring Component	Parameter	Timing/Frequency	Responsibility
Post-Mining			
Diversion and subsidence monitoring program	As outlined in the SWMP.	In accordance with the SWMP.	Environment and Community Manager
Visual inspection of surface areas which required remediation.	Stabilisation of erosion and groundcover.	Monthly inspections until monitoring confirms stabilisation of erosion and groundcover is >60%.	Environment and Community Manager
Visual inspection of drainage line flow paths.	Evidence of erosion or channelisation.	Following a rainfall event of greater than 40 mm in 24 hours up to 6 months following completion of mining.[1]	Environment and Community Manager
Monitoring of surface water quality and flow monitoring sites (SW04, SW27a, US FM1, FM1, FM2, FM3).	In accordance with the SWMP.	In accordance with the SWMP.	Environment and Community Manager
Monitoring of groundwater sites (GW16, GW17, N3, N5, P317, UG139, GW23, GW24, GW25, GW26).	In accordance with the GWMP.	In accordance with the GWMP.	Environment and Community Manager

[1] Inspection to occur once access is practicably available following the rainfall event. Inspections would not occur for subsequent rainfall events within 7 days of previous inspection.

5 MANAGEMENT MEASURES

Management measures to remediate impacts on water resources resulting from the extraction of Longwalls 17 to 20 will be undertaken in accordance with **Table 5**, the SGWRP and the measures proposed in **Section 6**.

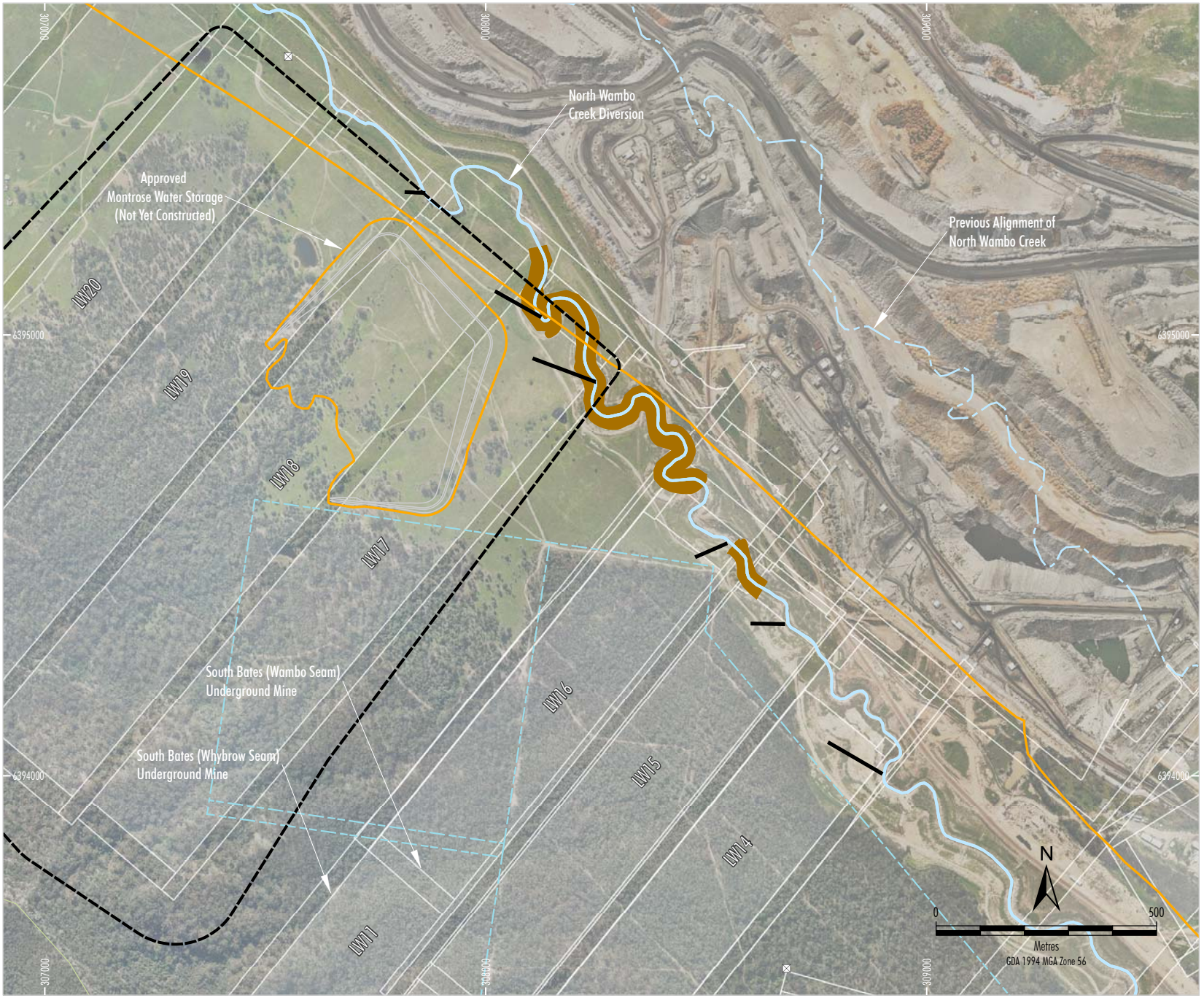
Table 5
Water Management Plan Key Management Measures

Management Measure	Timing/Frequency	Responsibility
Pre-Mining		
Stockpile sufficient materials and make equipment and necessary resources available for: • sealing any surface cracks (particularly in areas that are predicted to be ponded); and • installation of scour protection works.	Prior to commencement of secondary extraction of Longwalls 17 to 20.	Environment and Community Manager

Table 5 (Continued)
Water Management Plan Key Management Measures

Management Measure	Timing/Frequency	Responsibility
During Mining		
Remediation of all visible surface cracks in the North Wambo Creek Diversion low flow channel as soon as practicable. Cracks would be infilled with alluvial/colluvial material that may be blended with bentonite to achieve a level of seal consistent with the surrounding host material.	As soon as practicable following observation (nominally within two weeks, pending weather conditions).	Environment and Community Manager
Remediation of surface cracks[1] in areas outside the North Wambo Creek Diversion low flow channel where practicable using conventional earthmoving equipment (e.g. a backhoe) including: • infilling of surface cracks with soil or other suitable materials; or • locally re-grading and re-compacting the surface.	When required during secondary extraction of Longwalls 17 to 20.	Environment and Community Manager
Stabilisation of any areas of surface cracking or erosion using erosion protection measures (e.g. vegetation planting).	When required during secondary extraction of Longwalls 17 to 20.	Environment and Community Manager
Review of remediation measures and implementation of additional measures if required, in accordance with the TARP (**Attachment 1**).	Ongoing during mining.	Environment and Community Manager
Post-Mining		
Review of areas that may be vulnerable to scour along the North Wambo Creek Diversion (as shown on **Figure 5**) and installation of appropriate scour protection (e.g. vegetation planting, placement of woody debris, localised rock armouring).	To be installed following completion of subsidence on the Diversion (nominally 2020).	Environment and Community Manager
Construction of new batter chutes to manage concentrated overland flow entry to the North Wambo Creek Diversion (see conceptual locations on **Figure 5**).	To be installed following completion of subsidence on the relevant portion of the Diversion (nominally 2019-2020).	Environment and Community Manager
Review of remediation measures and implementation of additional measures if required, in accordance with the TARP (**Attachment 1**).	Following completion of secondary extraction of Longwalls 17 to 20.	Environment and Community Manager
Post-subsidence assessment of impacts to Stony Creek and drainage lines and implementation of any minor remedial works.	Following completion of secondary extraction of Longwalls 17 to 20.	Environment and Community Manager

[1] Minor cracks that develop are not expected to require remediation as geomorphologic processes will result in natural filling of these cracks over time.



LEGEND

- Existing/Approved Surface Development Area
- Approved Underground Development
- Approved Ventilation Shaft
- Remnant Woodland Enhancement Program (RWEP) Area
- Extraction Plan Application Area
- Conceptual Location of Batter Chute
- Extent of Area that may require Stabilisation Measures

Source: NSW Department of Industry (2017); MSEC (2018); WCPL (2018)
Orthophoto: WCPL (May 2017)

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WAMBO COAL MINE

Aerial Photograph of North Wambo Creek Diversion

Figure 5

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6 ASSESSMENT OF PERFORMANCE INDICATORS AND MEASURES

In accordance with Condition 22C(d) of Schedule 4 of the Development Consent (DA 305-7-2003), performance indicators have been developed for the performance measure listed in **Table 3**. The proposed performance indicators are summarised in **Table 6**.

Monitoring conducted to inform the assessment of the extraction of Longwalls 17 to 20 against the performance indicators for the performance measure relating to Wollombi Brook includes:

- monitoring in accordance with the SWMP; and
- monitoring in accordance with the GWMP.

Table 6
Water Performance Measure and Performance Indicators

Performance Measure	Performance Indicator(s)
Negligible subsidence impacts[1] to Wollombi Brook. Negligible environmental consequences[2] to Wollombi Brook.	• The performance indicators will be considered to have been exceeded if the **surface water quality in Wollombi Brook exceeds the surface water quality criteria in the SWMP**. • The performance indicators will be considered to have been exceeded if the **groundwater levels in alluvial bores exceed the groundwater level criteria in the GWMP**. • The performance indicators will be considered to have been exceeded if the **groundwater quality in alluvial bores exceeds the groundwater quality criteria in the GWMP**.

[1] A subsidence impact is defined by the Development Consent (DA 305-7-2003) as "*physical changes to the ground and its surface caused by subsidence effects, including tensile and shear cracking of the rock mass, localised buckling of strata caused by valley closure and upsidence and surface depressions or troughs*".

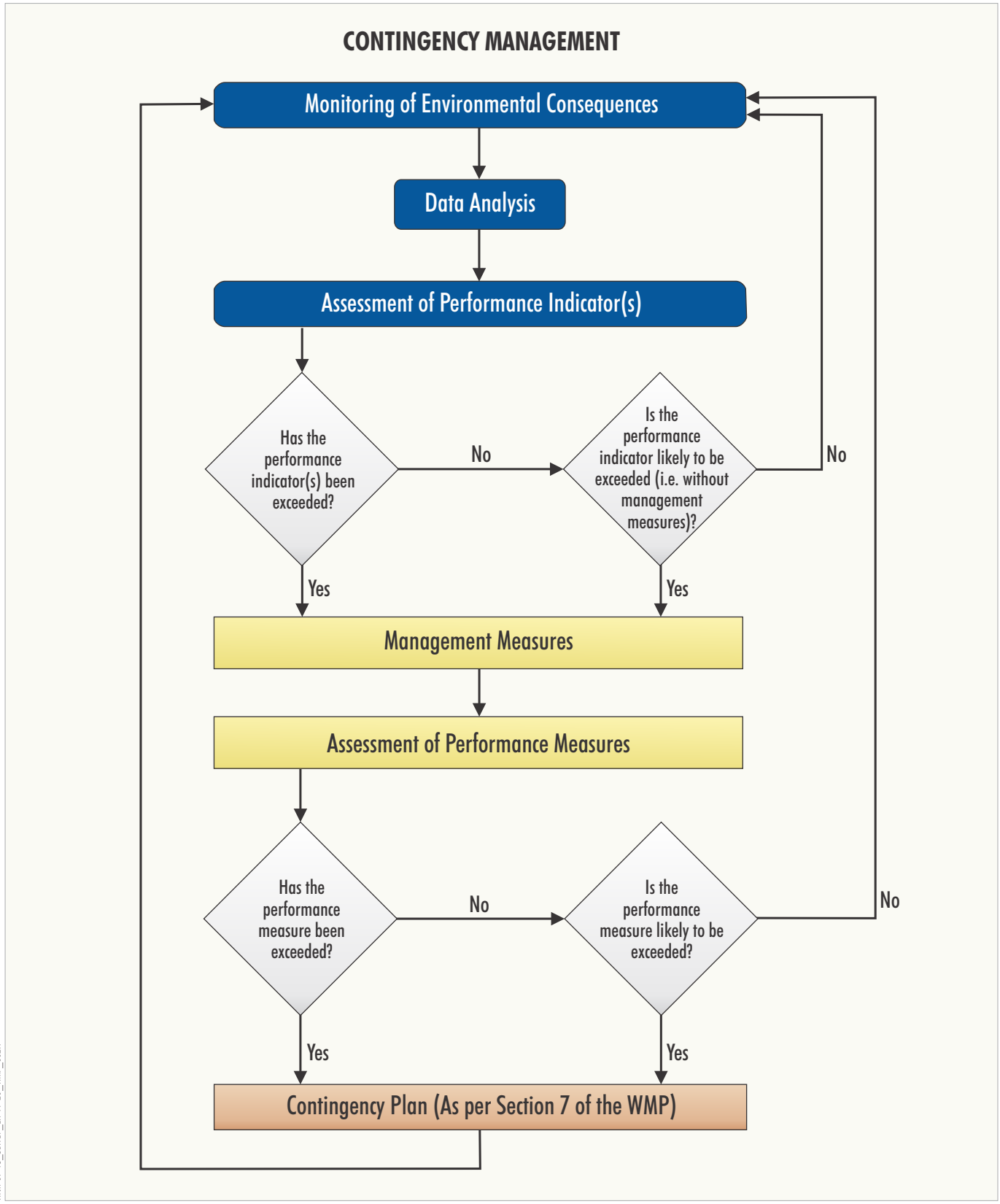
[2] An environmental consequence is defined by the Development Consent (DA 305-7-2003) as "*The environmental consequences of subsidence impacts, including: damage to infrastructure, buildings and residential dwellings; loss of surface flows to the subsurface; loss of standing pools; adverse water quality impacts; development of iron bacterial mats; cliff falls; rock falls; damage to Aboriginal heritage sites; impacts on aquatic ecology; ponding*".

Monitoring results will be used to assess the extraction of Longwalls 17 to 20 against the performance indicators and performance measure as detailed in **Table 7**. The monitoring process and subsequent assessment of performance indicators and measures is outlined in **Figure 6**.

If data analysis indicates a performance indicator has been exceeded or is likely to be exceeded, an assessment will be made against the performance measure. If the performance measure is considered to have been exceeded, the Contingency Plan will be implemented (**Section 7**). If data analysis indicates that the performance measure has not been exceeded, WCPL will continue to monitor.

Table 7
Monitoring of Environmental Consequences against Performance Indicators and Measures

Performance Measure	Monitoring of Environmental Consequence			Data Analysis to Assess against Performance Indicator(s)	Performance Indicator	Assessment of Performance Indicator	Assessment of Performance Measure	Potential Relevant Management and Contingency Measure
	Site	Parameter	Frequency					
Negligible subsidence impacts to Wollombi Brook. Negligible environmental consequences to Wollombi Brook.	• Surface water quality monitoring sites listed in Table 13 of the SWMP. • FM10. • FM11.	• pH. • EC. • Surface water flow.	• Monthly/Rainfall event. • Continuous.	• Analysis of surface water quality monitoring data in accordance with the SWMP.	• The surface water quality in the Wollombi Brook does not exceed the surface water quality criteria listed in Table 11 of the SWMP.	• The performance indicators will be considered to have been exceeded if the surface water quality in Wollombi Brook exceeds the surface water quality criteria listed in Table 11 of the SWMP. • If data analysis indicates the performance indicators have been exceeded, an assessment will be made against the performance measure (**Figure 6**).	• A preliminary investigation will be conducted to determine the likely cause of the performance indicator exceedance. No further hydrological and/or hydrogeological analysis will be conducted where: – the exceedance is not a result of underground extraction (e.g. climatic variations); or – the exceedance is of the groundwater level criteria or groundwater quality criteria and the exceedance is isolated to one or more alluvial bores that are not located in proximity to Wollombi Brook. • The performance measure is exceeded if subsidence, groundwater and surface water monitoring data and hydrological and/or hydrogeological analysis indicate subsidence from development of Longwalls 17 to 20 has resulted in: – a greater than negligible change in Wollombi Brook surface water flow (e.g. stream baseflow); or – a greater than negligible change in Wollombi Brook water quality. • The above analysis will include consideration of streamflow gauging sites FM10 and FM11 listed in the SWMP (i.e. DPI Water Gauging Stations Wollombi Brook at Bulga and Wollombi Brook at Warkworth). • The above analysis will be peer reviewed by a specialist approved by the DP&E. • The results of the above analysis will be reported to the DP&E, NSW Environment Protection Authority (EPA) and DPI Water. • If the performance measure has been exceeded, the Contingency Plan will be implemented (**Section 7**).	• Implementation of stream flow loss remediation techniques (e.g. injection grouting or installation of a geomembrane). • Provision of offsets (i.e. retirement of an equivalent volume of water licence). • Implementation of erosion and sediment control measures and stabilisation techniques. • Additional monitoring (e.g. increase in monitoring frequency). • Consideration of changes to longwall extraction geometry in consultation with relevant regulatory authorities.
	• Groundwater monitoring sites listed in Table 12 of the GWMP. • FM10. • FM11.	• Water level. • Surface water flow.	• Every two months or as specified in Table 12 of the GWMP. • Continuous.	• Analysis of groundwater level monitoring data in accordance with the GWMP.	• The groundwater levels in alluvial bores do not exceed the groundwater level criteria listed in Table 9 of the GWMP.	• The performance indicators will be considered to have been exceeded if the groundwater levels in alluvial bores exceed the groundwater level criteria listed in Table 9 of the GWMP. • If data analysis indicates the performance indicators have been exceeded, an assessment will be made against the performance measure (**Figure 6**).		
	• Groundwater monitoring sites listed in Table 12 of the GWMP. • FM10. • FM11.	• pH. • EC. • Surface water flow.	• Every two months or as specified in Table 12 of the GWMP. • Continuous.	• Analysis of groundwater quality monitoring data in accordance with the GWMP.	• The groundwater quality in alluvial bores does not exceed the groundwater quality criteria listed in Table 10 of the GWMP.	• The performance indicators will be considered to have been exceeded if the groundwater quality in alluvial bores exceeds the groundwater quality criteria listed in Table 10 of the GWMP. • If data analysis indicates the performance indicators have been exceeded, an assessment will be made against the performance measure (**Figure 6**).		



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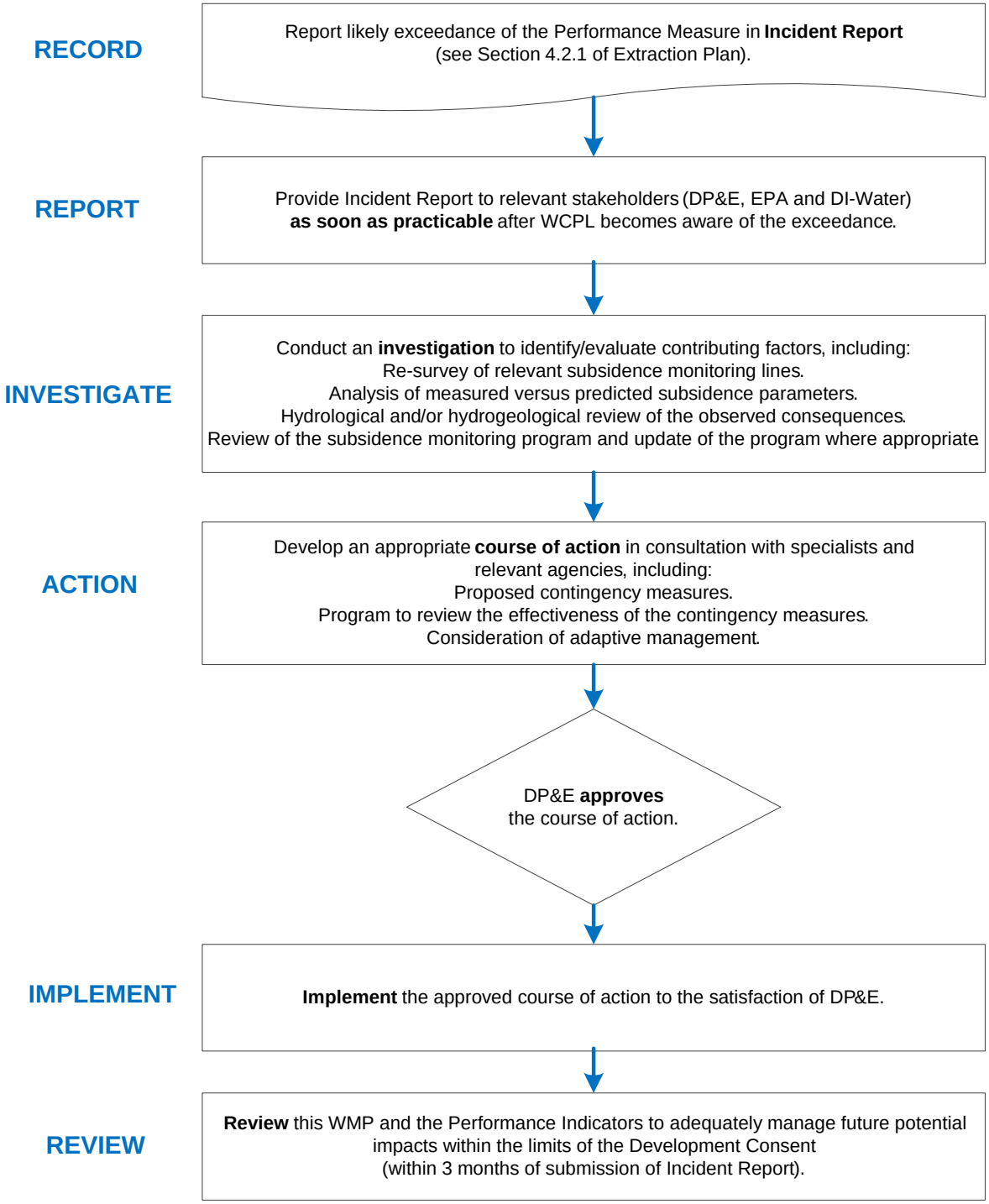
Monitoring of Environmental Consequences against Performance Indicators and Measures

Figure 6

7 CONTINGENCY PLAN

In the event the Wollombi Brook performance measure summarised in **Table 6** is considered to have been exceeded or is likely to be exceeded, in accordance with the schematic presented in **Figure 6**, WCPL will implement the following Contingency Plan:



The framework for the various components of the WMP are summarised in the WMP TARP which is included as **Attachment 1**. The WMP TARP illustrates how the various predicted subsidence impacts, monitoring components, performance measures and responsibilities are structured, and the framework for management and contingency actions.

8 REFERENCES

Advisian (2016) *South Bates Extension Modification Surface Water Assessment*. Report prepared for Wambo Coal Pty Limited.

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Wambo Coal Pty Limited (2007) *North Wambo Creek Diversion Plan.*

Wambo Coal Pty Limited (2017) *South Bates Extension Underground Mine Modification – Environmental Assessment*.

ATTACHMENT 1

WATER MANAGEMENT PLAN
TRIGGER ACTION RESPONSE PLAN

Table A1-1
Water Management Plan Trigger Action Response Plan

Condition	Normal	Level 1	Level 2
	Normal Conditions	**Management Measures**	**Restoration/Contingency Phase**
Trigger	• No visible cracks along North Wambo Creek Diversion. • Dewatering volumes and underground water levels at normal conditions and not significantly influenced by climatic conditions. • Predicted impacts on other surface water and groundwater as described in **Section 3**.	• Cracks observed along North Wambo Creek Diversion. • Dewatering volumes and underground water levels are elevated and responding significantly to climatic conditions. • Impacts requiring remediation observed on ephemeral drainage lines/overland flow paths. • Groundwater or surface water impacts greater than expected.	• Functionality of North Wambo Creek Diversion materially affected. • Dewatering volumes and underground water levels continue to respond significantly to climatic conditions following remediation. • The Wollombi Brook performance measure has been exceeded, or is likely to be exceeded.
Action	• Conduct monitoring, consistent with **Tables 4 and 7**, the GWMP, SWMP and the Subsidence Monitoring Program (Appendix H of the Extraction Plan). • Assess the environmental consequences of the subsidence in accordance with **Section 6** and the SGWRP. • Assess the need for management measures in accordance with **Section 5** and the SGWRP.	• Implement management measures, as required, in accordance with **Section 5** and the SGWRP.[1] • Continue monitoring, consistent with **Tables 4 and 7**, the GWMP, SWMP and the Subsidence Monitoring Program (Appendix H of the Extraction Plan).	• Implement Contingency Plan described in **Section 7**. • Develop action plan for additional measures, including consideration of: – additional scour protection, crack remediation and/or stabilisation; and/or – isolation sealing of the diversion cutting, for example through injection grouting or installation of low permeability material.
Frequency	• Frequency consistent with **Table 5**, the GWMP, SWMP and SGWRP.	• As required, in accordance with **Section 6** and the SGWRP.	• As required, in accordance with **Section 7**.
Position of Decision Making	• Environment and Community Manager.	• Environment and Community Manager.	• General Manager. • Implementation of additional management measures will be undertaken in consultation with DRG and DI-Water.

1 With regard to the specific circumstances of the subsidence impact [e.g. the location, nature and extent of the impact] and the assessment of environmental consequences, in accordance with **Sections 5 and 6** and the SGWRP.

Note: GWMP refers to the Wambo Coal Groundwater Monitoring Program.
SWMP refers to the Wambo Coal Surface Water Monitoring Program.
SGWRP refers to the Wambo Coal Surface Water Groundwater Response Plan.
DRG refers to the NSW Department of Environment and Planning - Division of Resources and Geoscience.
DI-Water refers to the Water division in the Department of Industry.

ATTACHMENT 2

WAMBO COAL PTY LIMITED
SURFACE WATER MONITORING PROGRAM

WAMBO COAL
SURFACE WATER MONITORING PROGRAM

Document No. WA-ENV-MNP-509.2
March 2018

Document Control

Document No.	WA-ENV-MNP-509.2
Title	Surface Water Monitoring Program
General Description	Surface Water Monitoring at WCPL
Document Owner	Environment & Community Manager

Revisions

Rev No	Date	Description	By	Checked	Signature
0	August 2005	Original Draft	Resource Strategies	JT/TS	
1	August 2005	Revised Draft	Resource Strategies	JT/TS	
2	August 2007	Management Plan Consolidation	Hansen Bailey	SW	
3	October 2008	Management Plan Consolidation	WCPL	SB	
4	November 2009	Consent Modification	WCPL	SB	
5	March 2012	Audit Findings/Rail Loop DA Mod	WCPL	LC	
6	September 2014	Revision 6	WCPL	TF	
7	April 2015	Addressing DP&E Comment	WCPL	TF	
8	September 2015	New management plan format and revision	WCPL/Palaris	SP	
9	October 2015	Revised following receipt of comments from DP&E on Rev 8	WCPL/Palaris	SP	
10	December 2016	Revised to incorporate LW11-16	WCPL	SP	
11	July 2017	Revised to address DPE comments and submitted as a component of SBU LW11-16 EP	WCPL	SP	
12	March 2018	Revised to address IESC and DPE comments following MOD17 approval, Summary of commitments added.	WCPL		

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1.0 Introduction

1.1 Background

The Wambo Coal Mine (the Mine) is situated approximately 15 kilometres west of Singleton, near the village of Warkworth, New South Wales (Figure 1). Wambo is owned and operated by Wambo Coal Pty Limited (WCPL), a subsidiary of Peabody Energy Australia Pty Limited.

A range of open cut and underground mine operations have been conducted at WCPL since mining operations commenced in 1969. Mining under the current Development Consent (DA 305-7-2003) commenced in 2004 and permits both open cut, underground operations and associated activities to be conducted.

The approved run-of-mine (ROM) coal production rate is 14.7 million tonnes per annum and all product coal is transported from WCPL by rail. DA 177-8-2004 (as modified) provides approval for the rail and train loading infrastructure. A summary of the approved Wambo Coal Mine is provided in Table 1.

Table 1: Summary of the Approved Wambo Coal Mine[1, 2]

Component	Approved Wambo Coal Mine[1]
Life of Mine	Wambo Coal may carry out mining operations at the Wambo Mining Complex until 31 December 2039, except for open cut coal extraction, which may only be undertaken until 31 December 2020.
Open Cut Mining	Open cut mining at a rate of up to 8 Mtpa of ROM coal from the Whybrow, Redbank Creek, Wambo and Whynot Seams
	An estimated total open cut ROM coal reserve of 98 Mt
	Open cut mining operations under current approved MOP
	Open cut mining operations up to 31 December 2020
Underground Mining	Underground mining of up to 9.75 Mtpa of ROM coal from the Whybrow, Wambo, Woodlands Hill and Arrowfield Seams. Underground ROM coal reserves are estimated at 143.3 Mt. Underground mining operations up to 31 December 2039
Subsidence commitments and management.	The subsidence performance measures listed in Conditions 22 and 22A of the Development Consent (DA305-7-2003).
ROM Coal Production Rate	Up to 14.7 Mtpa of ROM coal
Total ROM Coal Mined	259.1 Mt
Waste Rock Management	Waste rock deposited in open cut voids and in waste rock emplacements adjacent open cut operations
Total Waste Rock	640 million bank cubic metres (Mbcm)
Coal Washing	Coal handling and preparation plant (CHPP) capable of processing approximately 1,800 tonnes per hour (tph)
Rail and Train Loading Infrastructure	Construction and operation of a rail spur, rail loop, coal reclaim area, product coal conveyor and train load out bin to enable the transport of coal (DA 177-8-2004)
Product Coal	Production of up to 11.3 Mtpa of thermal coal predominantly for export
CHPP Reject Management	Coarse rejects and tailings would be incorporated, encapsulated and/or capped within open cut voids in accordance with existing Wambo management practices
Total CHPP Rejects	Approximately 40.3 Mt of coarse rejects and approximately 24.5 Mt of tailings
Water Supply	Make-up water demand to be met from runoff recovered from tailings storage areas, operational areas, dewatering, licensed extraction from Wollombi Brook and Hunter River
Mining Tenements	Coal Lease (CL) 365, CL374, CL397, Consolidated Coal Lease (CCL) 743, Mining Lease (ML) 1402, ML1572, ML1594, Authorisation (A) 444, Exploration Licence (EL) 7211.

Note: [1] Development Consent DA305-7-2003 (as modified December 2017) [2] Development Consent DA177-8-2004

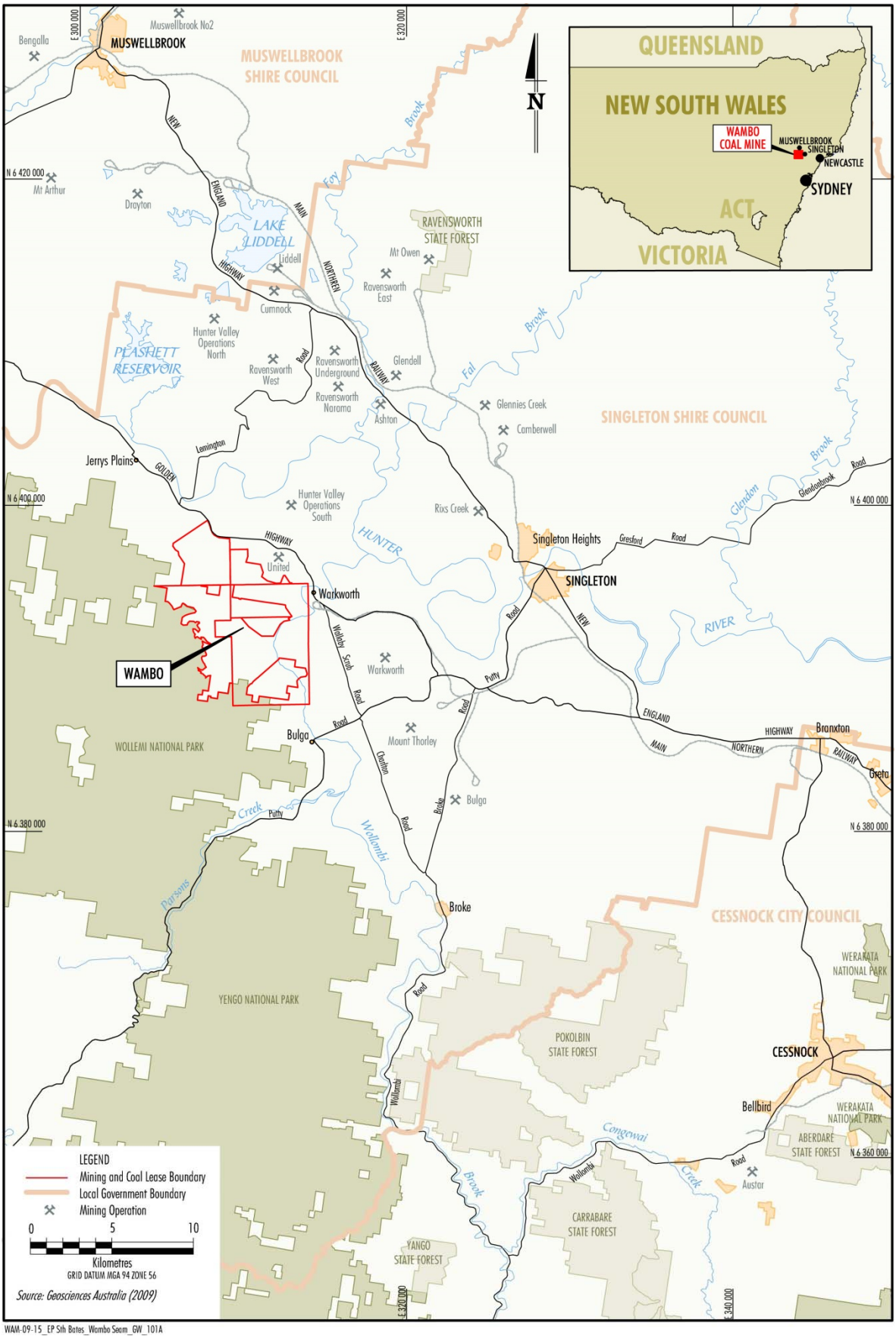

Figure 1: Wambo Coal Regional Location

In accordance with Schedule 4, Condition 30 of DA305-7-2003 and Schedule 4, Condition 17 of DA177-4-2008, WCPL is required to prepare a Site Water Management Plan (SWMP). This Surface Water Monitoring Program (SWMP) is a component of the WCPL Site Water Management Plan. Figure 2 shows the components of the WCPL Site Water Management Plan. This SWMP should be read in conjunction with the other components of the WCPL Site Water Management Plan, in particular the Surface and Ground Water Response Plan (SGWRP).

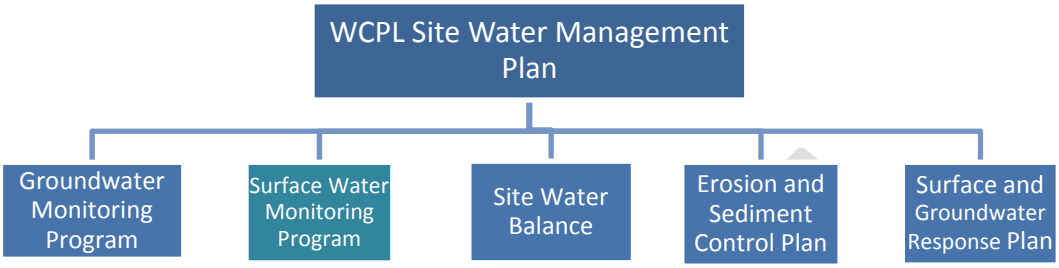

Figure 2: WCPL Site Water Management Plan

In accordance with WCPL's continuous improvement and review processes and Conditions 4 & 6, Schedule 6 of DA305-7-2003, a review of the SWMP has been undertaken to ensure that surface water monitoring at the Mine continues to be undertaken in a manner that ensures compliance and that surface water impacts from the Mine are minimised where possible.

1.2 Purpose

This SWMP has been developed to address the relevant requirements of relevant consent conditions and regulatory requirements. The SWMP also addresses the relevant conditions of WCPL mining leases and Environmental Protection Licence (EPL). In accordance with Condition 33, Schedule 4 of DA305-7-2003 and Schedule 4, Condition 17 of DA177-4-2008, WCPL have prepared this SWMP to provide:

- Detailed baseline data on surface water flows and quality in the Wollombi Brook, and North Wambo, South Wambo, and Stony Creeks;
- Surface water impact assessment criteria;
- A program to monitor surface water flows and quality in the Wollombi Brook; and North Wambo, South Wambo, and Stony Creeks;
- A program to monitor bank and bed stability in North Wambo, South Wambo, and Stony Creeks;
- A program to monitor the quantity and quality of the vegetation in the riparian zones adjacent to North Wambo, South Wambo, and Stony Creeks;
- A program to monitor the effectiveness of the Erosion and Sediment Control Plan; and
- A program to monitor the water quality of sediment dam discharges from the site.

1.3 Scope

This SWMP applies to all surface water monitoring activities undertaken within WCPL's mining authorisations and approved mining areas (Figure 3). This SWMP has been prepared to allow for the collection and interpretation of surface water data such that WCPL can implement appropriate measures to manage potential impacts to surface water during the

operation of the Mine. This SWMP forms part of WCPL's Environmental Management System (EMS).

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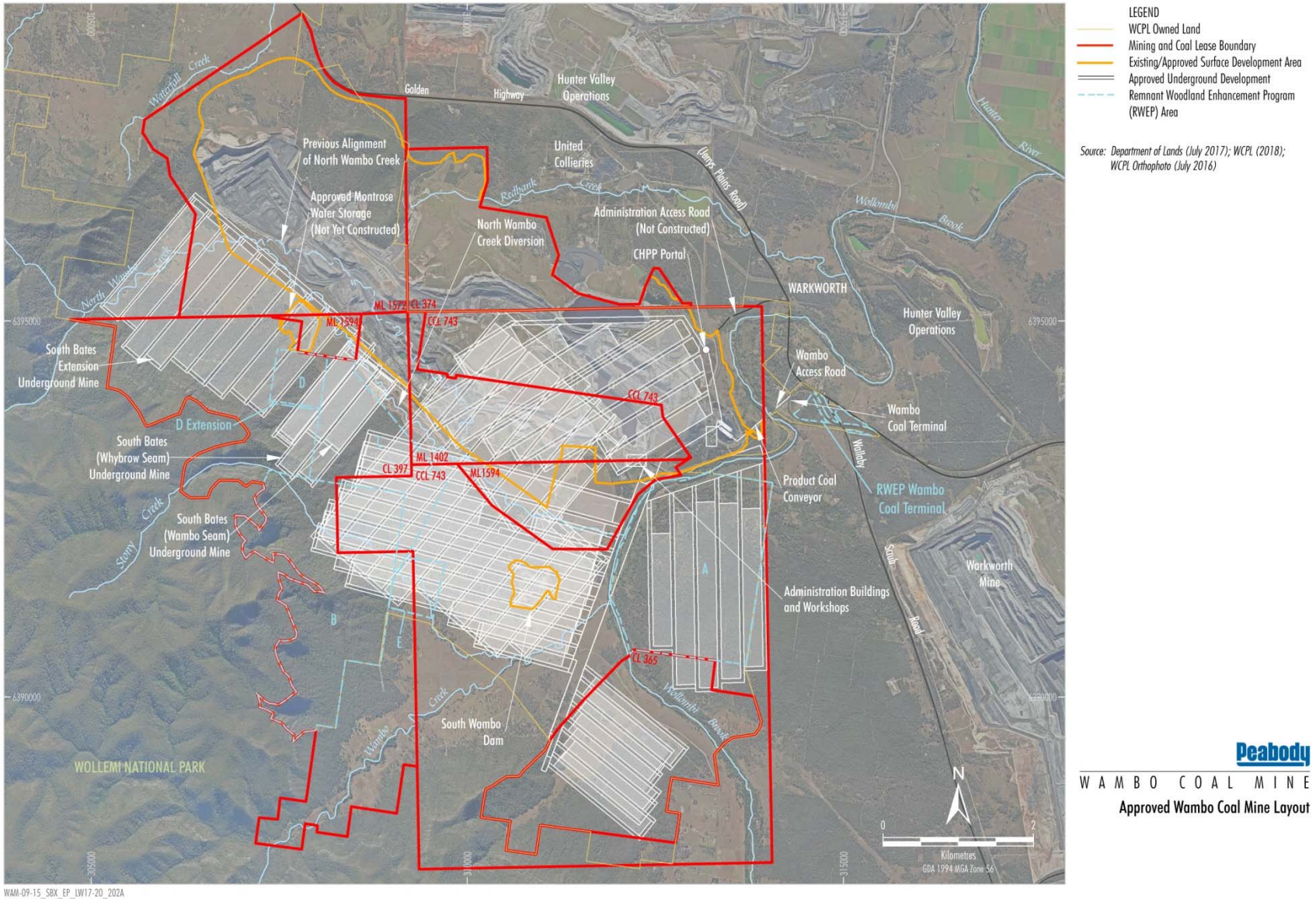


Figure 3: Approved Wambo Coal Mine Layout

1.4 Statutory Requirements

This SWMP has been prepared to address the relevant Development Approval (DA) consent conditions within DA305-7-2003 and DA177-8-2004 (Table 2). Additional monitoring requirements are included in Table 3.

The SWMP has also been prepared to address the requirements of WCPL's Environment Protection Licence (EPL) 529 (Section 1.4.2).

1.4.1 Environmental Planning & Assessment Act 1979

WCPL received Development Consent (DA305-7-2003) in accordance with the *Environmental Planning & Assessment Act 1979* (EP&A Act) from the NSW Department of Planning and Environment (DP&E), formerly NSW Department of Planning, on 4 February 2004. Conditions within DA305-7-2003 relevant to surface water monitoring at the Mine are summarised in Table 2.

WCPL received Development Consent (DA177-8-2004) in accordance with the EP&A Act from the NSW DP&E on 16 December 2004. Conditions within DA177-8-2004 relevant to surface water monitoring at the Mine are summarised in Table 2.

In April 2008, the North Wambo Creek Diversion Plan was approved subject to the additional requirements shown in Table 3.

Table 2: Development Consent Requirements for the Surface Water Monitoring Program

Schedule	Condition	Requirements	SWMP Section
DA305-7-2003			
4	29	The applicant must: (a) measure: The volume of water discharged from the site; … Dam and water structure storage levels; …. (b) monitor the quality of the surface water: Discharged from the licenced discharge point/s at the development; and Upstream and downstream of the development. (c) monitor flows in the Wollombi Brook, and North Wambo, South Wambo, and Stony Creeks; (d) monitor the volume and quality of water inflows from each separate source to the underground and open cut workings… to the satisfaction of the EPA, CLWD and the Secretary.	**Section 4.1.8** **Section 4.1.2** **Section 4.1.1** **Section 4.1.3** **Section 4.1.9**
4	30	Before carrying out any development, the Applicant must prepare a Site Water Management Plan for the development in consultation with DRE and CLWD, and to the satisfaction of the Secretary. This plan must include: … (d) a Surface Water Monitoring Program; *By the end of October 2009, the Applicant must revise the Site Water Management Plan in consultation with DRG, EPA, and CLWD, and to the satisfaction of the Secretary.**	**This SWMP**

Schedule	Condition	Requirements	SWMP Section
4	33	The Surface Water Monitoring Program must include: (a) detailed baseline data on surface water flows and quality in the Wollombi Brook, and North Wambo, South Wambo, and Stony Creeks;	**Section 2.0**
		(b) surface water impact assessment criteria;	**Section 3.0**
		(c) a detailed program to monitor surface water flows and quality in the Wollombi Brook; and North Wambo, South Wambo, and Stony Creeks;	**Sections 4.1.1 and 4.1.3**
		(d) a detailed program to monitor bank and bed stability in North Wambo, South Wambo, and Stony Creeks;	**Section 4.1.5**
		(e) a program to monitor the quantity and quality of the vegetation in the riparian zones adjacent to North Wambo, South Wambo, and Stony Creeks; and.	**Section 4.1.5**
		(f) a program to monitor the effectiveness of the Erosion and Sediment Control Plan; and (g) a program to monitor the water quality of dam discharges on site.	**Section 4.1.4** **Section 4.1**
4	33A	Within 3 months of the approval of Modification 17, or as otherwise agreed with the Secretary, the Applicant must, in consultation with CLWD, revise the surface water monitoring program to: (a) Include installation of an upstream flow gauge site on North Wambo Creek; (b) Complete a geomorphic context statement for North Wambo Creek; (c) Undertake a pre-subsidence survey and energy profile analysis, and develop pre-subsidence channel profiles for both cross sectional and long profiles. The Applicant must complete the installation of the flow gauge and other actions required under this condition and implement a program to regularly monitor flows in North Wambo Creek within 12months of the Secretary's approval of the revised Surface Water Monitoring Program.	**Section 2.2.3.2** **Section 2.2.3.3**
6	3	**Adaptive Management** The Applicant must assess and manage project-related risks to ensure that there are no exceedances of the criteria and/or performance measures in schedule 4. Any exceedance of these criteria and/or performance measures constitutes a breach of this consent and may be subject to penalty or offence provisions under the EP&A Act or EP&A Regulation. Where any exceedance of these criteria and/or performance measures has occurred, the Applicant must, at the earliest opportunity: (a) take all reasonable and feasible steps to ensure that the exceedance ceases and does not recur; (b) consider all reasonable and feasible options for remediation (where relevant) and submit a report to the Department describing those options and any preferred remediation measures or other course of action; and (c) implement remediation measures as directed by the Secretary,	**Refer SGWRP**

Schedule	Condition	Requirements	SWMP Section
		to the satisfaction of the Secretary.	
6	4	**Management Plan Requirements** The Applicant must ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include: (a) detailed baseline data; (b) a description of: - the relevant statutory requirements (including any relevant consent, licence or lease conditions); - any relevant limits or performance measures/criteria; - the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures; (c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/ criteria; (d) a program to monitor and report on the: - impacts and environmental performance of the Wambo Mining Complex; - effectiveness of any management measures (see c above); (e) a contingency plan to manage any unpredicted impacts and their consequences; (f) a program to investigate and implement ways to improve the environmental performance of the Wambo Mining Complex over time; (g) a protocol for managing and reporting any: - incidents; - complaints; - non-compliances with statutory requirements; and - exceedances of the impact assessment criteria and/or performance criteria; and (h) a protocol for periodic review of the plan.	**Section 2.0** **Section 1.4** **Section 3.0** **Section 3.4** **Section 4.0** **Sections 4.0 and 6.0** **Refer SGWRP** **Section 6.2** **Section 6.5** **Section 5.0** **Refer SGWRP** **Refer SGWRP** **Section 6.1**
DA177-8-2004			
4	17	Before carrying out any development, the Applicant must prepare and implement a Soil and Water Management Plan for the development, to the satisfaction of the Director-General. This plan must include: … (b) details of the dirty water management system to be implemented for the development including measures to prevent contamination from diesel and oil spills; (c) a Surface Water Monitoring Program; and (d) a strategy for decommissioning the water management structures on the site."	**This SWMP** **Section 2.2.5** **Section 4.0** **Section 2.2.6**

* In September 2009, DP&E granted WCPL an extension to the submission date to 30/4/2010 to allow for DRE and EPA review and comment.

Table 3: Additional Surface Water Monitoring Program Requirements

Regulator	Requirements	SWMP Section
DP&E	1. The SWMP must be updated to include at least two additional surface monitoring sites within the area of the North Wambo Creek Diversion footprint to replace those to be discontinued in the old North	

Regulator	Requirements	SWMP Section
	Wambo Creek footprint i.e. SW27 & SW32 have been replaced by SW41, SW47 and SW48. 2. The company must comply with the requirements of the Department of Water and Energy (DWE) and the Department of Primary Industries (DPI) as outlined in the attached letters to the company ….	**Sections 2.2.2 and 4.1** **See below**
DPI-Water (formerly NSW Office of Water (NOW)/ Department of Water and Energy (DWE))	DWE grants approval to the detailed design plans for the constructed diversion channel, subject to the following; Monitoring of discharge flows, and calculation of bankfull discharge capacities and velocities along the channel shall occur at the first discharge event along the diversion channel, and then thereafter as directed by the DWE; Comparative performance with agreed reaches upstream and downstream of the diversion shall occur, together with agreed stable reaches of control catchments, as approved by DWE; Reporting on performance of the diversion channel shall occur annually (in AEMR).	**Section 4.1.6** **Section 4.1.6** **Section 6.2**

1.4.2 Protection of the Environment Operations Act 1997

The EPA issued EPL 529 on 27 September 2000 under the *Protection of the Environment Operations Act 1997 (*POEO Act). The EPL permits activities that may impact on surface and ground water to occur across the site, subject to the EPL conditions. In consultation with the EPA, the EPL will be modified (as required) to reflect any relevant modified development consent conditions.

Under EPL 529 and the Hunter River Salinity Trading Scheme (HRSTS), WCPL are required to monitor discharges from a designated licenced discharge point. Section 3.1 provides further information on discharge requirements under the HRSTS.

1.4.3 Water Management Act 2000

The *Water Management Act 2000* (WM Act) is intended to ensure that water resources are conserved and properly managed for sustainable use benefitting both present and future generations. It is also intended to provide formal means for the protection and enhancement of the environmental qualities of waterways and their in-stream uses as well as to provide for protection of catchment conditions.

An amendment to the WM Act (section 60I) came into effect on 1 March 2013. This amendment provides that it is *an offence for a person without an access licence to take, remove or divert water from a water source, or relocate water from one part of an aquifer to another part of an aquifer, in the course of carrying out a mining activity.* Various activities are captured by the provisions of the amendment including mining, mineral exploration and petroleum exploration.

The area covered by this SWMP is located within the Water Sharing Plan (WSP) area for the Hunter Unregulated and Alluvial Water Sources (HUA WSP), which commenced in August 2009 and regulates the interception and extraction of surface water and alluvium within the defined WSP area.

1.4.4 Hunter Unregulated and Alluvial Water Sources Sharing Plan

The HUA WSP includes the unregulated rivers and creeks and alluvial groundwater within the Hunter region and is categorised into four extraction management units (EMUs) and further broken down into water sources. The area covered by the WSP includes 39 surface water and alluvial groundwater sources.

Wambo is located predominantly within the Lower Wollombi Brook water source. WCPL currently holds one unregulated river WAL within the Lower Wollombi Brook water source of the HUA WSP (WAL No. 23897). WCPL also holds a number of regulated river WALs within the Hunter Regulated River water source of the WSP for the Hunter Regulated River Water Source (WAL No. 718, 8599, 8600, 8604).

1.5 Stakeholder Consultation

In accordance with Conditions 22C and 30, Schedule 4 of DA 305-7-2003, the SWMP has been prepared in consultation with Crown Lands and Water Division (CLWD) (formerly DPI Water and NOW), NSW Division of Resources and Geoscience (DRG, formerly the Division of Resources and Energy [DRE]) and the Environment Protection Authority (EPA), prior to submitting to the Secretary of the DP&E for approval.

Consultation on recent versions of the SWMP has included:

- Version 8 of the SWMP provided to CLWD, DRE, EPA and DP&E as part of an Extraction Plan submission in October 2015;
- Comments were received from DPE on Version 8 of the SWMP in October 2015;
- Version 9 of the SWMP was approved by DPE in November 2015;
- Comments were received from CLWD on Version 8 of the SWMP in November 2015;
- Version 10 of the SWMP was provided to CLWD and EPA in December 2016 for consultation;
- Version 10 of the SWMP was provided to CLWD, DRG, EPA and DP&E as part of an Extraction Plan submission in January 2017;
- Comments were received from DP&E on Version 10 of the SWMP in May 2017 and July 2017;
- No comments were received from CLWD, DRG or EPA on Version 10 of the SWMP.

Version 11 of the SWMP was submitted to DP&E for approval as a component of the Extraction Plan for South Bates Underground LW11-16. Following receipt of the Extraction Plan in January 2017, CLWD provided comments on the SWMP in correspondence dated 17 December 2017. In addition, in providing advice on MOD 17 to DA 305-7-2003, the Independent Expert Scientific Committee (IESC) made comments on the SWMP in correspondence dated 31 July 2017. This revision (Revision 12) addresses those comments. A Summary of Commitments has also been included in this version (refer to Appendix C).

Correspondence in relation to the SWMP is attached as Appendix B. A summary of how comments from CLWD, the IESC and DP&E have been addressed in this SWMP is also provided in Appendix B. A Summary of Commitments is included in this version (refer to Appendix C).

2.0 Existing Surface Water Conditions and Baseline Data

2.1 Description of Surface Waters – Existing Environment

2.1.1 Landforms and Watercourses

Wambo is located in the Upper Hunter Valley where the landform is characterised by gently sloping floodplains of the Hunter River and its tributaries and the undulating foothills, ridges and escarpments of the Mount Royal Range and Great Dividing Range (Heritage Computing, 2012). Elevations in the vicinity of Wambo range from approximately 60 metres (m) Australian Height Datum (AHD) at Wollombi Brook to approximately 650 m AHD at Mount Wambo within the Wollemi National Park to the west of Wambo.

The mine site is within the lower Wollombi Brook catchment near its confluence with the Hunter River. Wollombi Brook drains an area of approximately 1,950 km^2 (Gilbert and Associates, 2003) and joins the Hunter River some 5 km north- east of Wambo (**Figure 3**).

The majority of land within the WCPL's Mining Lease boundaries has surface drainage over the site area flowing to Wollombi Brook via a series of generally easterly flowing creeks including South and North Wambo Creek, Stony Creek, Waterfall Creek and Redbank Creek. South Wambo Creek and its main tributary Stony Creek rise in the Wollemi National Park escarpment south of the mine and drain the southern and south-western parts of the mining lease area. Waterfall Creek drains the north end of the mining lease area. Relatively smaller parts of the northern side of the site drain to Redbank Creek in the United Collieries lease area (Figure 3).

North Wambo Creek, which also has its headwaters in the Wollemi escarpment, drains the central parts of the mining lease. A section of North Wambo Creek has been diverted to avoid the Wambo open cut (Figure 3). The North Wambo Creek Diversion was constructed in accordance with the approved North Wambo Creek Diversion Plan (WCPL, 2007b).

The rail line also crosses numerous small ephemeral creek systems including Longford Creek and Doctors Creek, which discharge into the Hunter River. Table 4 provides the catchment areas of the creeks within WCPL Mining Lease Boundaries and in the vicinity of the WCPL rail line and Wambo rail loop.

Table 4: Catchment Areas of Local Creeks

Creek	Catchment Area (km^2)
North Wambo Creek	48.5
South Wambo Creek	43.2
Stony Creek	11.2
Redbank Creek	12.3
Waterfall Creek	5.5
Longford Creek	0.89*
Doctors Creek	1.58*

* *Source: Gilbert and Associates (2003) and Mackie Environmental Research (MER) (2002).*
*Note: * Mining operations from the Warkworth Mine will reduce the catchment size of these systems. The figure provided is the estimated catchment size.*

2.1.2 Climate and Rainfall

The area experiences a dry temperate to sub-tropical climate with hot humid summers and cool drier winters. The annual average rainfall is some 650 mm. Further information on rainfall, including a Cumulative Rainfall Departure (CRD) curve for the area, is included in the GWMP.

2.1.3 Geology

Wambo is located in the Hunter Coalfield, which occupies the north-eastern portion of the Sydney Basin. The area covered by the SWMP is underlain by the Permian Singleton Coal Measures as well as Quaternary alluvial sediments along watercourses. This is underlain by the Permian Maitland Group which consists of siltstone, sandstone and conglomerate.

Approximate boundaries of quaternary alluvial sediments in the vicinity of Wambo are shown in Figure 4 and have been derived from the Hunter Coalfields Regional Geology 1:100,000 map (NSW Department of Mineral Resources, Edition 2 1993).

A transient electromagnetic (TEM) survey (Groundwater Imaging, 2012) was carried out to investigate the extent and thickness of alluvium along the lower reaches of (South) Wambo and North Wambo Creek. The extent of alluvial sediments determined from that study is also presented on Figure 4.

Further information on the geology of the area is included in the GWMP.

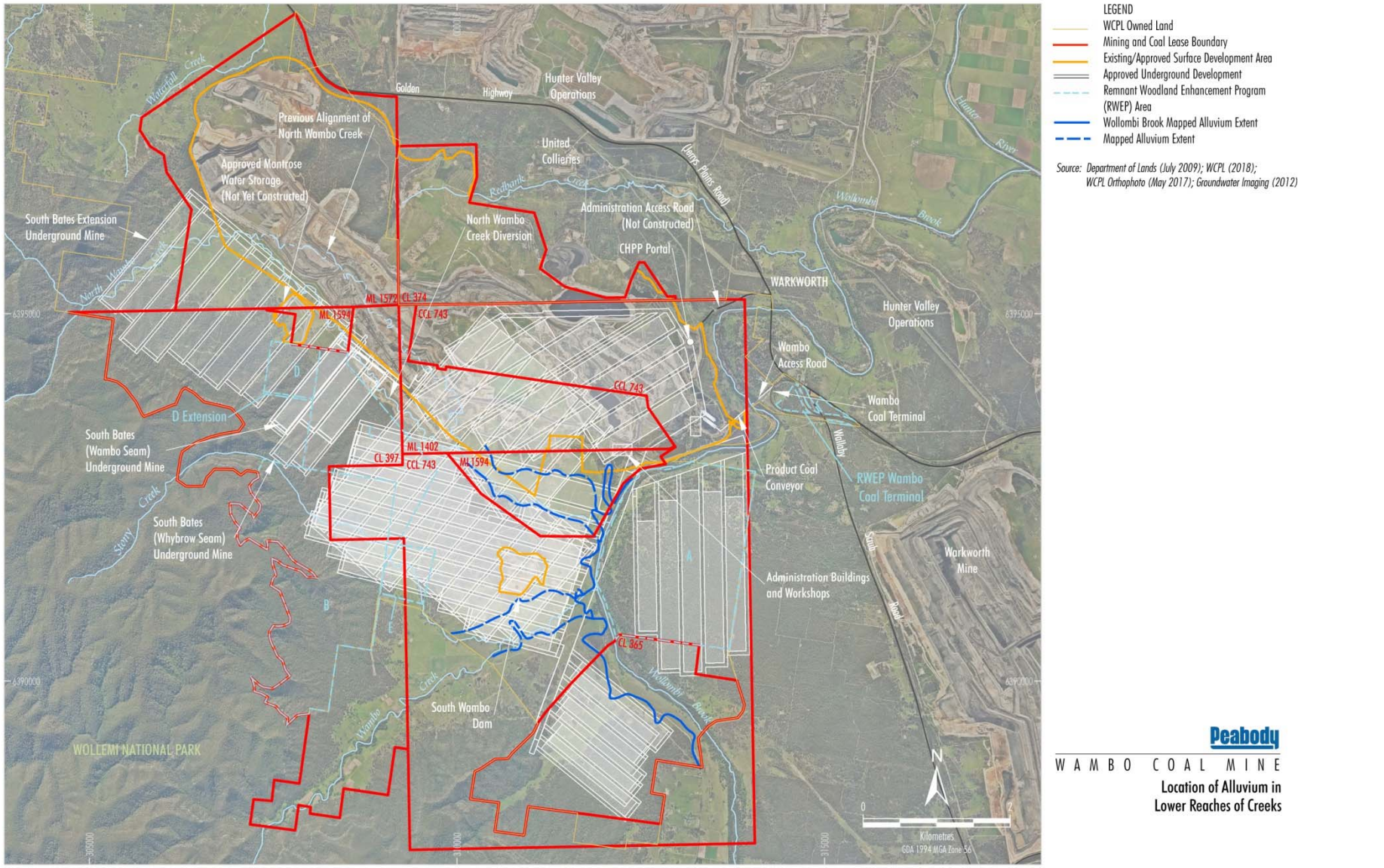


Figure 4: Location of Alluvium in Lower Reaches of Creeks

2.2 Existing Monitoring and Management

2.2.1 Mining History

Substantial coal mining activity has occurred historically and is continuing currently in the vicinity of Wambo, by a number of companies, with development across several coal seams. Coal is extracted by means of both underground and open cut mining methods. Coal mines neighbouring Wambo include United Colliery to the north and east of Wambo, Mt Thorley Warkworth to the south-east, and a number of open cut and underground mines to the north and east within the Hunter Valley Operations (Figure 3).

Open cut mining at Wambo commenced in 1969. During the 1970's1970s development consents were issued for a range of open cut and underground mining operations. The Whybrow, Redbank Creek, Wambo and Whynot Seams have primarily been mined by open cut methods at the Mine. The Wambo Seam was also mined for a short period in the Wambo No. 1 Underground Mine however was abandoned due to hydrological issues (Australian Groundwater Consultants Pty Ltd (AGC), 1989). The Whybrow Seam was also mined from the Ridge Underground in this early period.

The Wollemi Underground Mine commenced production in 1997 and was placed under care and maintenance in October 2002 after the available longwall reserves were exhausted. Open cut operations were suspended between March 1999 and August 2001. Following the closure of the Wollemi Underground Mine in October 2002, open cut operations were expanded to maintain an overall production rate of 3 Mtpa of product coal.

Development of the North Wambo Underground Mine commenced in November 2005, with longwall operations commencing in October 2007. Longwall extraction at the North Wambo Underground Mine finished in January 2016. Underground mining previously occurred both above and below the Wambo Seam at North Wambo Underground Mine. The adjacent United Colliery mined the lower Arrowfield Seam until 2010 (United Underground Mine) directly beneath portions of the North Wambo Underground Mine.

Development of the South Bates Underground Mine commenced in October 2014 and longwall mining commenced in the Whybrow Seam (Longwalls 11 to 13) in February 2016. Mining operations progressed to the Wambo Seam (Longwalls 14 to 16) in July 2017.

2.2.2 Surface Water Monitoring Network

Surface water monitoring data has been collected at Wambo since 2003. Monitoring locations have been established along a number of watercourses to monitor both water quality and flow, as summarised in Table 5. Monitoring of mine water storages is also undertaken for management purposes. Monitoring locations are shown on Figure 5.

Table 5: Surface Water Monitoring Locations

Site ID	Easting	Northing	Site Description
Surface Water Quality			
USFM1	305261	6395212	North Wambo Creek flow monitoring station – upstream
SW01	314429	6385707	Wollombi Brook - Upstream
SW02	314376	6395037	Wollombi Brook - Downstream
SW03	312509	6392866	Wollombi Brook - Pump-Out
SW04	306887	6396024	North Wambo Creek - Upstream
SW05	311927	6392157	North Wambo Creek – Downstream
SW06	309056	6389550	South Wambo Creek - Upstream
SW07	311263	6390718	South Wambo Creek – Junction with Stony Creek
SW08	308536	6392133	Stony Creek
SW14	312179	6392939	Box Cut Dam (Admin)
SW15	313055	6393097	Eagles Nest Dam – Licenced Discharge Dam (EPA ID No. 4)
SW27a	309431	6393558	North Wambo Creek – Middle-Lower
SW31	313276	6393987	Gordon Below Franklin Dam
SW32a	309905	6393191	North Wambo Creek – Pump
SW38	311750	6394190	Homestead Open Cut
SW39	307194	6398519	Waterfall Creek Midstream
SW40	311910	6391093	Wollombi Brook – Upstream of Wambo Creek
SW41	307257	6398952	Waterfall Creek Upstream
SW52	312677	6395220	C11 Void
Wombat Dam	310435	6396442	Wombat Dam
Milk Can Dam	313443	6394011	Milk Can Dam
Rug Dump	311024	6394046	Rug Dump Dam
ME1	307325	6398382	Montrose East Sediment Dam
ME2	307397	6398576	Montrose East Sediment Dam
Stream Flow			
FM1	307020	6396134	North Wambo Creek – confluence (relocated December 2017)
FM2	308181	6395028	North Wambo Creek – middle of diversion
FM3	309114	6393813	North Wambo Creek – Middle-Lower
FM4	311890	6392288	North Wambo Creek - downstream near confluence of Wollombi Brook
FM10	314228	6395064	Wollombi Brook - downstream from Wambo Coal at Warkworth*
FM11	314360	6385900	Wollombi Brook - upstream from Wambo Coal at the Bulga Village*
FM12	307611	6392832	Stony Creek Upstream (installed December 2015)
FM13	309530	6391043	Stony Creek Downstream (installed December 2015)
FM14	307730	6392246	Stony Creek Tributary (installed December 2015)
FM15	311680	6391089	South Wambo Creek (installed December 2016)
FM16	311259	6390666	South Wambo Creek (installed December 2016)
US FM1	305261	6395212	North Wambo Creek – upstream (installed December 2017)

* *Data sourced from DWE Gauging Stations on Wollombi Brook at Bulga [GS21004] and Warkworth [GS210028]*
#Survey pending
^ Coordinates unavailable

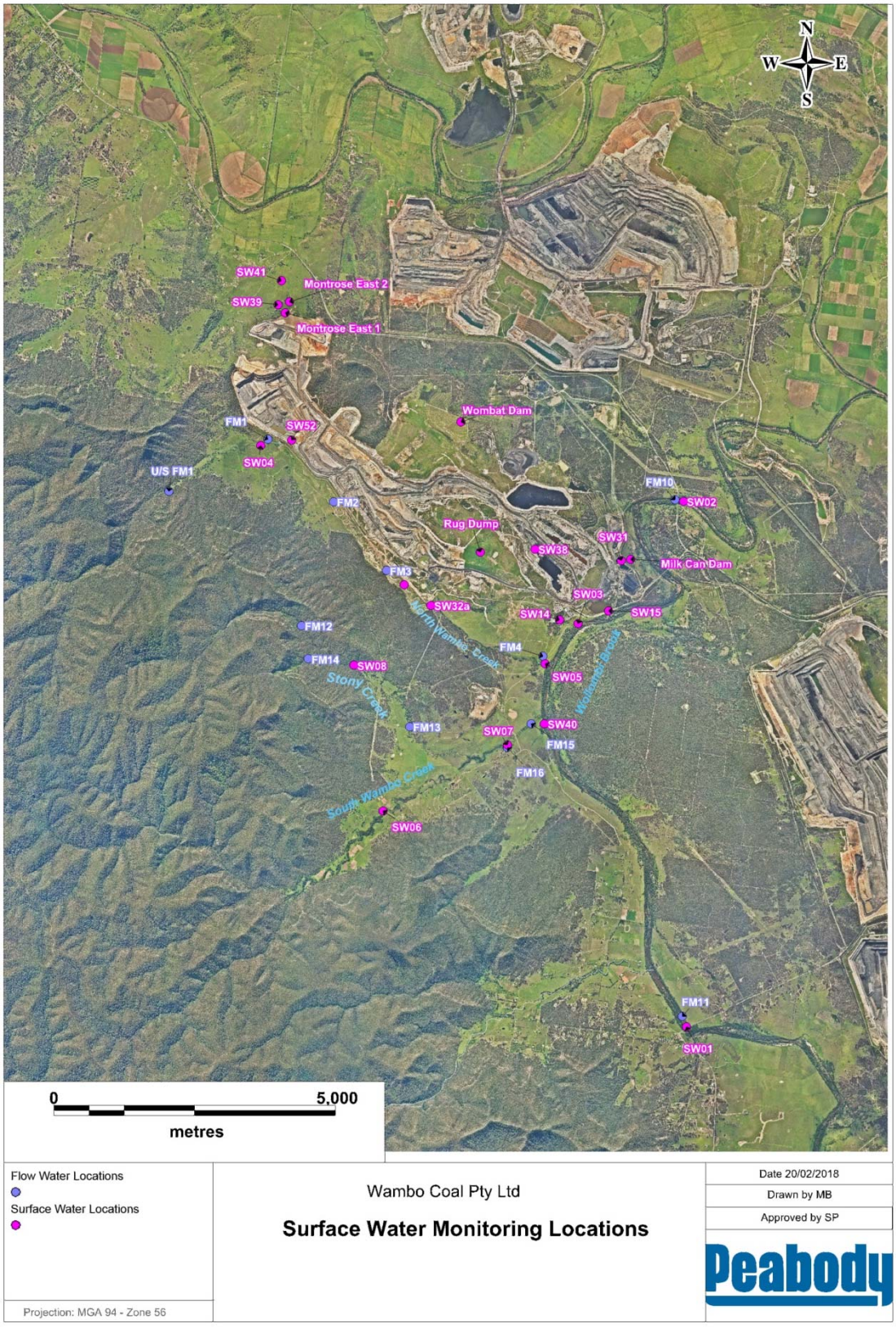


Figure 5: Wambo Surface Water Monitoring Locations

2.2.2.1 Historical Flow Monitoring Locations

From January 2004 until June 2007 WCPL monitored stream flow at four locations on South Wambo Creek (sites V1 and V2) and Stony Creeks (sites V7 and V8). Automatic data loggers recorded flow at hourly intervals. No flows were observed at sites V1, V2 and V7 between January 2004 and June 2007. The single flow record for site V8 is provided in Section 2.2.3.2 (Table 8).

Three V-notch weirs, established by United Collieries (United), have recorded flow along North Wambo Creek since mid-2002. A summary of flow records from United weir sites 1 and 2, for the period June 2002 to October 2003, is provided in Section 2.2.3.2 (Table 8).

Flow monitoring at Weir 3 (since December 2001) has generally shown the creek to be dry, except following significant rainfall. The highest flow recorded at Weir 3 was 0.1 L/sec in late May 2002 (Geoterra, 2005).

2.2.3 Review of Existing Data

2.2.3.1 Surface Water Quality

A summary of surface water quality monitoring results for July 2003 to January 2018 is presented in Table 6.

Table 6: Surface Water Quality Ranges – Local Watercourses

Sites	Count	Sampling Period	pH			EC (uS/cm)			TDS (mg/L)			TSS (mg/L)		
			Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
SW01 - Wollombi Brook Up	135	Jul 03 – Jan 18	6.45	8.80	7.59	160	1,969	742	0	1,157	403	1	128	10
SW02 - Wollombi Brook Down	137	Jul 03 – Jan 18	6.77	9.00	7.72	152	5,290	1,223	25	3,238	693	1	308	13
SW03 - Wollombi Brook Pump Out	142	Jul 03 – Jan 18	6.64	9.10	7.62	106	5,240	1,345	3	2,924	690	1	1630	64
SW04 - North Wambo Creek Up	4	Jul 03 – Jan 18	7.3	8.71	8.03	256	563	362	157	2,712	855	5	154	47
SW05 - North Wambo Creek Down	137	Jul 03 – Jan 18	6.94	8.96	7.66	111	3,200	1,698	135	3,642	1,021	1	1110	52
SW06 - South Wambo Creek	78	Jul 03 – Jan 18	6.30	9.10	7.37	119	970	508	28	440	264	1	286	17
SW07 - South Wambo/Stony Creeks	41	Jul 03 – Jan 18	6.60	9.10	7.57	159	1118	604	145	720	334	1	331	23
SW08 - Stony Creek	26	Jul 03 – Jan 18	6.20	8.44	7.16	186	479	347	58	276	186	1	15	4
SW27a - North Wambo Creek Middle Lower	46	Jul 03 – Jan 18	7.00	9.00	7.93	52	3,360	927	184	4,900	954	1	5440	477
SW32a - North Wambo Creek Pump	39	Jul 03 – Jan 18	7.30	9.20	8.05	199	6,970	861	153	4,400	779	1	4190	435
SW39 - Waterfall Creek	39	Jul 03 – Jan 18	6.60	9.30	7.64	92	1,268	337	82	2,220	514	8	2600	391
SW40 - Wollombi Brook Upstream of South Wambo Creek	97	Jul 03 – Jan 18	6.40	8.80	7.61	36	1,299	635	80	730	350	1	179	15

2.2.3.2 Stream Flow

WCPL operate ten continuous flow gauging stations, which are located along North Wambo Creek (five stations), Stony Creek (two stations) and South Wambo Creek (two stations plus another station located on a major tributary) as outlined in Table 5.The ephemeral nature of these creeks has resulted in extended no-flow periods. These gauging stations replaced the previous V-notch weir flow measurement points, which were destroyed during the June 2007 flood event.

Additionally, surface water flow monitoring data for Wollombi Brook is sourced from CLWD operated flow gauging stations, located at Warkworth (FM10) and Bulga (FM11). A summary of the stream flow data is provided in Table 7.

Table 7: Stream Flow Monitoring Data Summary

Site	Location	Period of Record	Flow Days*	Max (M/L Day)	Mean per Flow Day (ML/Day)	% Results with no Data Available
US FM1	North Wambo Creek (Upper)	Dec 2017 – 31/01/2018	No flow events were recorded since installation in December 2017			
FM1	North Wambo Creek	21/10/2008 to 01/12/2009	31	264.81	0.77	NA
		02/12/2009 to 30/06/2012	No flow data available			
		01/07/2012 to 30/06/2013	NA	1.296	0.086	16.7%
		01/07/2013 to 31/01/2014	NA	NA	NA	85.7%
		01/02/2014 to 19/08/2014	No flow data available			
		01/02/2015 to 31/01/2016	38	210	21.8	Negligible
		01/02/2016 to 31/01/2017	0	0	0	Negligible
		01/02/2017 to 31/01/18	0	NA	NA	NA
FM2	Mid way along the old North Wambo Creek Diversion	12/04/2009 to 01/12/2009	6.5	0.05	NA	NA
		02/12/2009 to 30/06/2012	No flow data available			
		01/07/2012 to 30/06/2013	9	0.39	<0.09	66.7%
		01/07/2013 to 31/01/2014	NA	18.1	0.69	0.0%
		01/02/2014 to 19/08/2014	42	22.59	1.57	Negligible
		01/02/2015 to 31/01/2016	128	160	7.3	Negligible
		01/02/2016 to 31/01/2017	82	12	1.4	Negligible
		01/02/2017 to 31/01/18	6	20.6	1.53	Negligible
FM3	Midway along the new	01/02/2015 to 31/01/2016	29	140	5.2	Negligible
		01/02/2016 to	5	3.7	0.3	Negligible

Site	Location	Period of Record	Flow Days*	Max (M/L Day)	Mean per Flow Day (ML/Day)	% Results with no Data Available
	diversion of North Wambo Creek	31/01/2017				
		1/02/2017 to 31/01/18	6	52.3	2.6	Negligible
FM4	North Wambo Creek (Upstream of the confluence of North Wambo Creek and Wollombi Brook)	21/10/2008 to 01/12/2009	391	237.14	1.36	NA
		02/12/2009 to 30/06/2012	No flow data available			
		01/07/2012 to 30/06/2013	21	200.8	86.8	58.3%
		01/07/2013 to 31/01/2014	0	0	0	14.3%
		01/02/2014 to 19/08/2014	6	291.28	59.07	Negligible
		01/02/2015 to 31/01/2016	16	14,300#	1,817.2#	Negligible
		01/02/2016 to 31/01/2017	0	0	0	Negligible
		1/02/2017 to 31/01/18	2	56	18.65	Negligible
FM12	Stony Creek	01/02/2015 to 31/01/2016	40	210	7.0	Negligible
		01/02/2016 to 31/01/2017	31	0.39	0.09	Negligible
		1/02/2017 to 31/01/18	15.7	2.75	0.59	Negligible
FM13	Stony Creek	01/02/2015 to 31/01/2016	26	180	28	Negligible
		01/02/2016 to 31/01/2017	46	26	4.4	Negligible
		1/02/2017 to 31/01/18	0	NA	NA	NA
FM14	Major tributary to Stoney Creek	01/02/2015 to 31/01/2016	33	33	1.5	Negligible
		01/02/2016 to 31/01/2017	10	0.38	0.03	Negligible
		1/02/2017 to 31/01/18	0	NA	NA	NA
FM15	South Wambo Creek	1/02/2017 to 31/01/18	0	NA	NA	NA
FM16	South Wambo Creek	1/02/2017 to 31/01/18	0	NA	NA	NA

Note: Insufficient data available for FM15 – FM16
NA – Parameter not available in data summary records.
No flow data available – Flow data not available due to damage to station or unreliable sensor responses.
 # A flow event at FM3 in April 2015 was influenced by backwater flooding from Wollombi Brook.
**number of days or part thereof where flow was recorded.*

The flow monitoring data at FM10 and FM11 (CLWD operated stations), shows that Wollombi Brook is perennial and has a persistent baseflow which maintains flows between rainfall events. In comparison site drainages are ephemeral and typically only flow in response to intense rainfall events. Flow monitoring data has been used to characterise the flow regime of the monitored watercourses.

Figure 6 shows the flow duration curves for Wollombi Brook at the CLWD gauging stations at Warkworth and Bulga (GS 210004 and GS 210028) which have been derived from flow recorded between 2003 and 2014. It is apparent that the distribution of flows in Wollombi Brook upstream and downstream of Wambo has generally been similar but with an increased frequency of low flows at the downstream station.

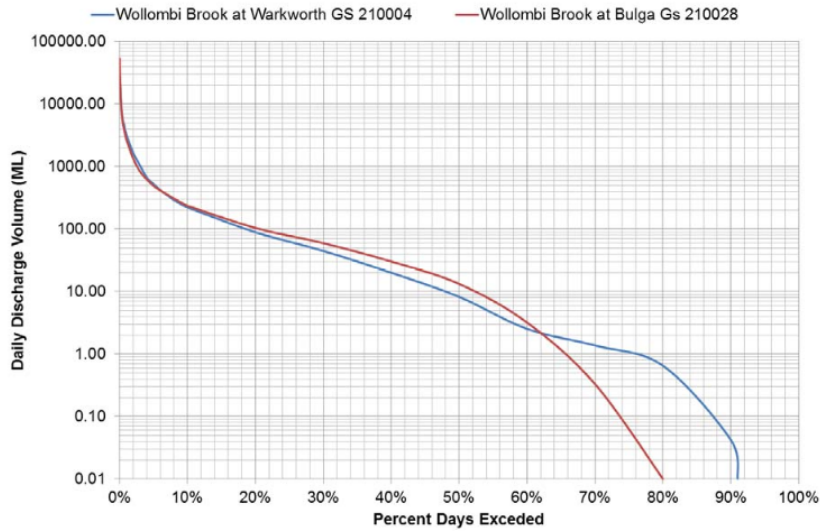


Figure 6: Flow Duration Curves Wollombi Brook Upstream and Downstream of the Mine

The available flow monitoring data for *North Wambo Creek* show that these creeks are all ephemeral and typically only flow in response to intense rainfall. This can be seen in Figure 7 and Figure 8, which show showing monitored (non-zero) daily flow data and concurrent daily rainfall measured at the Wambo climate station.

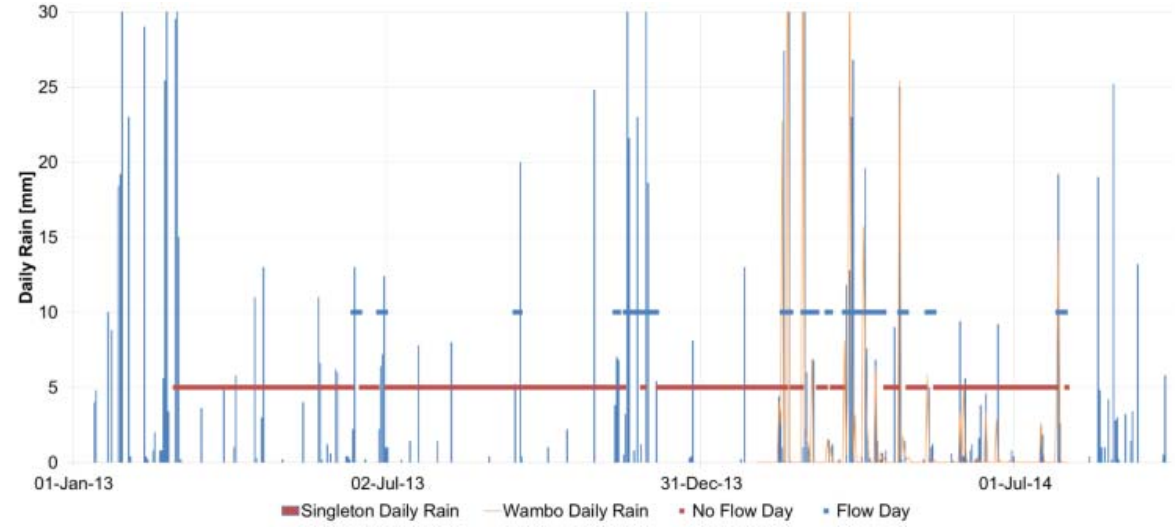


Figure 7: Recorded Daily Rainfall and Flow/No Flow Days – North Wambo Creek at FM2

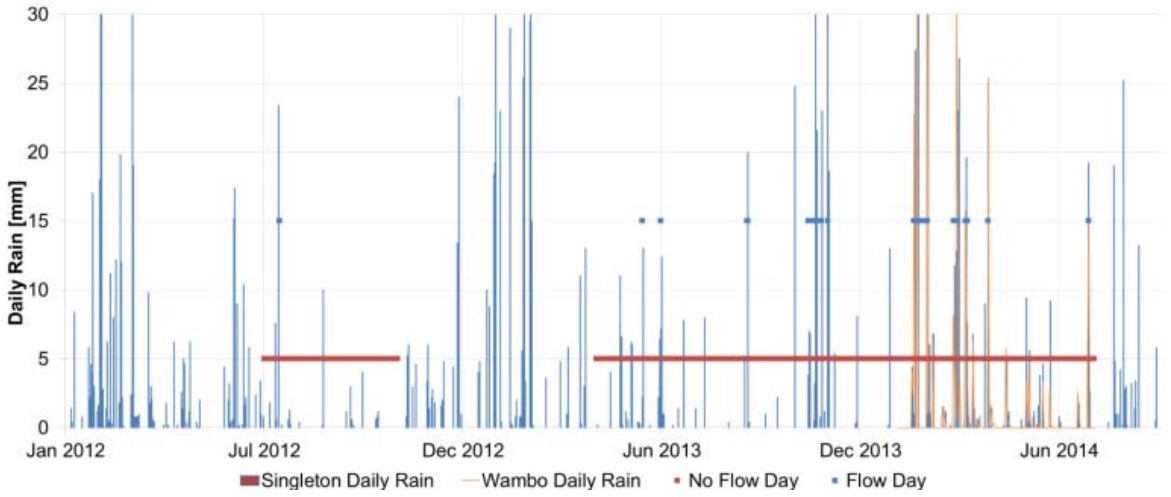


Figure 8: Recorded Daily Rainfall and Flow/No Flow Days – North Wambo Creek at FM4

Historical data for monitoring Site V8 and the two United sites (Weir 1 and Weir 2) is provided in Table 8.

Table 8: Stream Flow Summary for Historical Monitoring Sites

Site	Period of Record	Flow Days	Max (L/s Day)	Minimum (L/s)	Mean (L/s)
V8	29 Jun 2005 - 10 Aug 2005	43	216.1	0.0	17.7
Weir 1	14 Jun 2002 – 1 Oct 2003	NA	9.3	0.0	1.5
Weir 2	14 Jun 2002 – 1 Oct 2003	NA	120.0	0.0	0.9

2.2.3.3 North Wambo Creek

In accordance with Schedule 4, Condition 33A of DA 305-7-2003 (Modification 17), WCPL commissioned Alluvium Consulting Australia to undertake a pre-subsidence (baseline) survey, energy profile analysis and geomorphic context statement on North Wambo Creek (the North Wambo Creek Baseline Report). The study was completed in February 2018, on a natural section of North Wambo Creek, directly above future Longwalls 23, 24 and 25 (South Bates Extension Mine) and upstream of this area.

The reaches of North Wambo Creek and its upstream tributaries of Spring and Chalkers Creek were categorised in accordance with the River Styles Framework. The extent of North Wambo Creek is shown in
Figure 9. Energy conditions in each of the reaches were assessed to inform the broader assessment and likely future trajectory of the geomorphic character, behaviour and condition of the waterway. The results of the hydraulic model are presented in Table 9.

A copy of the North Wambo Creek Baseline Report was provided to CLWD on X April 2018.

Table 9: North Wambo Creek – Baseline Assessment Hydraulic Model Results

Parameter	Units	ARI	Diversion criteria (Alluvium, 2015)	Reach average hydraulic parameters							
				Chalkers Creek	Spring Creek	Reach 1	Reach 2	Reach 3	Diversion Stage 2	Diversion Stage 3	Downstream
Shear Stress	N/m^2	2 year	<40	85.3	84.9	75.2	35.0	30.4	29.6	50.4	37.5
		50 year	<80	127.9	113.7	104.7	72.9	40.6	43.8	68.0	68.4
Stream Power	N/m.s	2 year	35-60	213.4	208.3	179.0	58.4	49.3	57.6	106.7	74.8
		50 year	80-150	437.8	364.1	326.9	192.0	87.0	107.2	173.9	195.7
Velocity	m/s	2 year	no vegetation <1.0 with vegetation<1.5	2.5	2.5	2.3	1.4	1.3	1.2	1.9	1.1
		50 year	<2.5	3.4	3.1	3.0	2.3	1.7	1.8	2.3	1.7

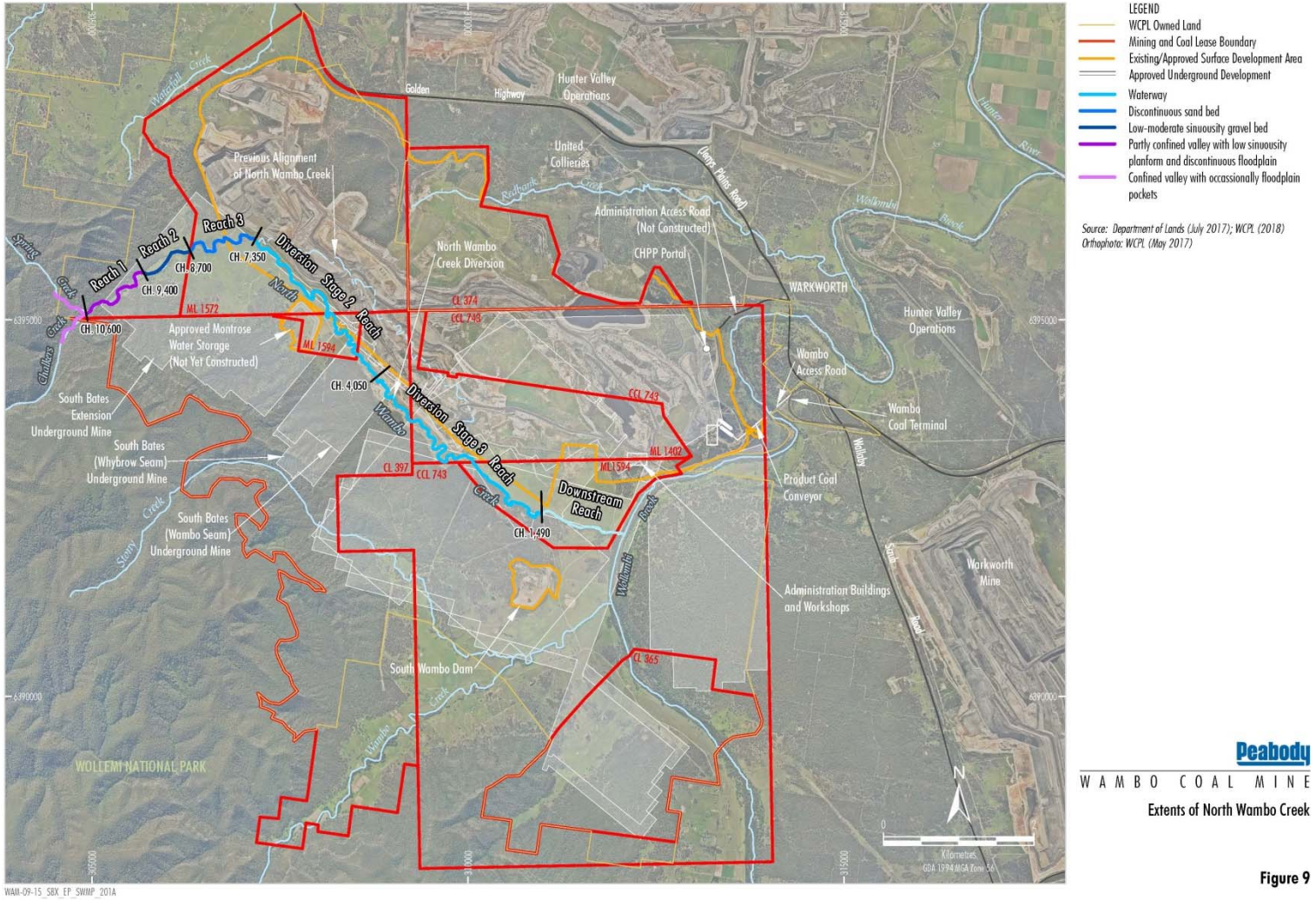


Figure 9: Extents of North Wambo Creek

2.2.4 Site Water Balance

A site water balance is undertaken annually to document the management of water at Wambo in accordance with Schedule 4, Condition 25 of DA 305-7-2003. Summary results are reported in the Annual Review report which is available on the Peabody Energy Australia website https://www.peabodyenergy.com/Operations/Australia-Mining/New-South-Wales-Mining/Wambo-Approvals,-Plans-Reports .

2.2.5 Management of the Locomotive Provisioning Facility

The 2012 modification to the Wambo Rail Spur Consent (DA 177-8-2004) allowed for the construction of a Locomotive Provisioning Facility adjacent to the WCPL rail loop. The facility includes storage and handling facilities for 100,000L diesel, 2,000L oil, sand and water. Due to the environmental risk associated with storage of hydrocarbons, the following management measures will be implemented during the operation of the facility to minimise the potential for contamination of land, or water in Wollombi Brook:

2.2.5.1 Hydrocarbon Storage and Handling

The diesel storage tank is a double skinned self bunded diesel storage tank with a capacity of approximately 100,000L (Transtank T108E) with an extended pumping bay. The tank has a capacity of 108,000L and a safe fill of 95,000L. The oil tank is integrated into the double bunded storage structure.

The refilling facility incorporates several spill prevention features including a security card to activate the pump, a refill nozzle that must be connected to the fuel tank to flow, an operator dead man switch and a cut-off valve in the event of a ruptured pipe. The refuelling hose connects to the locomotive fuel tank using a Banlaw nozzle eliminating accidental spills. Oil will be pumped via a low pressure pipeline into the locomotives via two retractable hose and trigger nozzles. These retractable hose reels will be located above spill containment grates adjacent to the rail track.

2.2.5.2 Facility Site

The design and location of the tank is designed to be compliant with AS 1940-2004 The storage and handling of flammable and combustible liquids. Spill containment kits are kept within a lockable onsite storage container.

All pumps and external equipment are locked, and a two metre high chain wire perimeter fence with lockable gate has been installed around the outside of the facility to deter unauthorised access, theft and vandalism.

Drip and spill control grates located at the two refill points and a bunded concrete area for tanker refilling are connected to a SPEL Puraceptor™ oily water management system.

2.2.5.3 Water Treatment System

The SPEL Puraceptor™ oily water management system is a full retention separator that treats flows from the three refill areas and is sized to contain more than the anticipated maximum oil and diesel spillage enabling it to be fully operational at all times. The system has a working capacity (the volume of water held before treated water discharges from the outflow) of 2050L with a treatment rate of up to 4L/s, and a spill capacity of a further 1,000L. With the small catchment area for the system (approximately 30m^2), the system is capable of treating the equivalent of over 2,000mm of rainfall per hour.

The unit has an alarm signal that notifies management (via SMS) in the event of a spillage that is in excess of 10% of the spill capacity (i.e. 100L) or when progressive spillage reaches this capacity. No visible oil and grease is permitted to leave the site. Visible oil and grease in water is considered equivalent to a criterion of 10mg/L. Treated water from the system has levels of 5mg/L or less.

2.2.5.4 Management Procedures

All personnel involved in the use of hydrocarbons on the site are trained in the appropriate use of facility and emergency response measures. Monthly inspections, servicing and maintenance of the station, in addition to visual inspections by locomotive drivers during refuelling, are undertaken.

Absorbent spill control matting located between the tracks in the refuel area (absorbs approximately 12L/m^2) will be replaced every 18 months or as required.

2.2.6 Decommissioning of Water Management Structures

It is anticipated that the post-mining area would consist of safe and stable landform features, revegetated to a mixture of woodland and pasture areas, consistent with the open cut Mining Operation Plan (MOP).

Water management structures and sediment control structures would either be retained as wetland habitat/water features or decommissioned and rehabilitated. The design, capacity and final location of these post mining water management structures will be refined and detailed in revised water management plans as the mine progresses towards mine closure (WCPL MOP, 2018). Some access roads may be retained post-mining to enable access and for use in bushfire and other land management activities.

If the Locomotive Provisioning Facility is retained until the end of Mine Life, the structures associated with the facility will be decommissioned simultaneously with the adjacent rail load out infrastructure. If decommissioning is required before the removal of the rail load out then all above-ground infrastructure will be removed, a contamination assessment completed, and the site rehabilitated to the match the landuse in the immediate surrounding area.

3.0 Surface Water Impact Assessment Criteria

Surface water impact assessment criteria have been established for the following possible project related impacts:

- Reduction in flow due to catchment excision and loss of baseflow; and
- Degradation of surface water quality.

Data from Wambo's surface water monitoring program will be compared against the established criteria. Details of the monitoring program are included in Section 4.0. Reporting requirements for this SWMP are detailed in Section 6.0.

A review of the data against the criteria will determine if the surface water impact investigation procedure or Trigger Action Response Plan (TARP) in the SGWRP should be initiated. The SGWRP provides a protocol for the investigation, notification, and mitigation of identified exceedances of these assessment criteria.

3.1 Discharge Criteria

Mine water at Wambo is discharged through the EPL 529 licensed discharge point, located at Eagles Nest Dam (water quality monitoring site SW15) (Figure 5). Water quality discharge limits are drawn from DA 305-7-2003, EPL 529 and the HRSTS, as presented in Table 10.

Table 10: Discharge Limits and Requirements

Conditions		Source
Discharge Limits	No more than 250 ML/day will be discharged from the licensed discharge point/s.	Schedule 4, Condition 24 of DA 305- 7-2003 and Condition L3.3 of EPL 529
	Discharges from any licensed discharge point must comply with the following limits: 6.5 ≤ pH ≤ 9.5; and NFR* ≤ 120 mg/L for non-filterable residues (NFR).	
Discharge Requirements	Notification from NOW of discharge opportunity must be received.	HRSTS Guidelines
	Flow of water in Wollombi Brook at the NOW Bulga Gauging Station (FM11) needs to be more than 500ML/day.	
	pH will to be measured continuously throughout the discharge with an inline instrument.	
	Conductivity (EC) will be measured continuously in µS/cm throughout the discharge with an instrument designed to measure between 0 and 10,000µS/cm.	
	TSS will be measured once a day during discharge. A representative sample will be collected every day and sent to the lab for analysis.	

**Equivalent to TSS*

3.2 Stream Flow Impact Assessment Criteria

Wollombi Brook is perennial and the impact assessment criterion for Wollombi Brook has been set to zero flow at the Warkworth gauging station.

Flow impact assessment criteria for the local mine site ephemeral creeks are based on the unexpected absence of flow in climatic situations when flows would be expected. The impact assessment criteria would be met if there was no flow recorded at the flow monitoring site either on the day or the day after the recorded rainfall was equal to or greater than the nominated amount. The resulting runoff generating rainfall values are given in Table 11.

Table 11: Surface Water Flow Impact Assessment Condition

Watercourse and flow monitoring site	Daily rainfall when flow commenced on 80% of recorded occasions
Stony Creek – FM13	20mm
South Wambo Creek – FM5	20mm
North Wambo Creek – FM4	20mm

3.3 Surface Water Quality Impact Assessment Criteria

The impact assessment criteria for surface water quality are summarised in Table 12. Where actual site specific water quality monitoring data is available (Section 2.2.3) the criteria have been set based on the 20th and 80th percentile for the available dataset. Where insufficient data is available, WCPL has adopted the applicable ANZECC default guidelines values for slightly to moderately disturbed ecosystems or the water quality objectives for the Hunter River.

The high variability in TSS concentrations poses some difficulty in the selection of appropriate assessment criteria. Given the correlation between TSS and flow, separate impact assessment criteria have been set for 'low' and 'high' flow conditions. In this context the term low flow covers recessionary flows and flows generated by small to moderate flow events up to a 1 in 1 year average recurrence interval. The term high flow covers the rising stage of flow events and medium to large flow events e.g. 1 in 20 year average recurrence interval and larger.

Table 12: Surface Water Quality Impact Criteria

Sampling Site	Parameter	Lower Limit	Upper Limit
SW02 – Wollombi Brook	pH	7.4	8.1
	EC (µS/cm)	599	1947
	TSS (mg/L)	17 (low flow) – 308 (high flow)[1]	
SW05 – North Wambo Creek	pH	7.3	7.9
	EC (µS/cm)	1155	2246
	TSS (mg/L)	53 (low flow) – 1,110 (high flow)[1]	
SW07 – Wambo Creek	pH	7.4	7.9
	EC (µS/cm)	360	724
	TSS (mg/L)	29 (low flow) – 331 (high flow)[1]	
SW08 – Stony Creek[5]	pH	6.8	7.4
	EC (µS/cm)	288	416
	TSS (mg/L)	5 (low flow) – 15 (high flow)[1]	
SW39 Waterfall Creek	pH	7.3	7.8
	EC (µS/cm)	159	429
	TSS (mg/L)	582 (low flow) – 1,922 (high flow)[1]	

Notes:
[1] An exceedance occurs when water quality results exceed the 80th Percentile Trigger Value after three consecutive sampling events or the surface flow impact assessment criteria are exceeded (refer to SGWRP for TARP)

3.4 Performance Indicators

The performance indicators in Table 13 will be used to assess the performance of the Mine against the predicted impacts.

Table 13: Performance Indicators

Performance Indicator	Number
Number of complaints received relating to surface water	Nil
Number of non-compliances relating to surface water	Nil
Number of exceedances of surface water impact assessment criteria[1]	Nil
Number of reportable environmental incidents relating to surface water	Nil

Note:

An exceedance occurs when water quality results exceed the 80th Percentile Trigger Value after three consecutive sampling events (refer to SGWRP for TARP)

WCPL will report on progress against these performance indicators in the Annual Review (Section 6.2). In the event that a complaint is received relating to surface water, it will be handled in accordance with the complaints management protocol (Section 5.0). Contingency plans for unpredicted surface water impacts are discussed in the SGWRP.

4.0 Surface Water Monitoring Program

The purpose of this SWMP is to monitor and manage surface water quality and levels to detect potential impacts on surrounding catchment users and to ensure that relevant legislative and policy requirements are met. Monitoring locations, parameters, frequency and methodology of monitoring are outlined in this section.

Data collected will:

- Be used in the continued development of surface water investigation triggers (Section 3.0); and
- Provide input to annual reviews of surface water monitoring data (Section 6.2).

4.1 Monitoring Network, Parameters and Frequency

Ongoing surface water monitoring requirements at Wambo are as follows:

- Monitoring of water quality including Wollombi Brook, North Wambo, South Wambo, and Stony Creeks (Section 4.1.1);
- Monitoring of mine water quality in three mine water storage dams and one sediment pond (Section 4.1.2);
- Monitoring of flow in the North Wambo Creek, Stony Creek and South Wambo Creek (Section 4.1.3);
- Monitoring of water quality to assess the effectiveness of erosion and sediment control measures (Section 4.1.4);
- Monitoring of riparian vegetation and creek bed stability (Section 4.1.5);
- Monitoring discharge flows through the North Wambo Creek diversion; (Section 4.1.6);
- Monitoring of subsidence impacts on the North Wambo Creek diversion (Section 4.1.7).
- Monitoring of licenced discharges under EPL 529 and the HRSTS (Section 4.1.8);
- Monitoring of inflows into the underground and open cut workings (Section 4.1.9); and
- Monitoring of water quality of sediment dams with potential for offsite discharge.

These monitoring requirements are summarised in Table 14. Monitoring locations are shown on Figure 5 (Section 2.2.2).

Water quality trigger values have been developed for a number of creeks and waterways. The results of monitoring of these creeks and waterways will be compared against the triggers in Section 3.0. Results of monitoring at the licenced discharge point will be compared against the criteria detailed in EPL 529 (Section 3.1). All required reporting will be undertaken in accordance with Section 6.0.

Mine water monitoring is undertaken for operational management purposes only. This data is not reported publicly.

Table 14: Surface Water Monitoring Program

Site Ref	Parameter[1]	Frequency[2]	Purpose
Creeks & Waterways			
SW01	pH, EC, TSS, metals and ions (including sulfates)	Monthly/Rainfall Event	Monitoring water quality of Wollombi Brook, upstream of Wambo Coal Operations, including monitoring for metals and ions (including sulfates) until March 2020 for baseline data
SW02	pH, EC, TSS, metals and ions (including sulfates)	Monthly/Rainfall Event	Monitoring water quality of Wollombi Brook, downstream of Wambo Coal Operations, including monitoring for metals and ions (including sulfates) until March 2020 for baseline data
SW03	pH, EC, TSS	Monthly/Rainfall Event	Monitoring water quality of Wollombi Brook, downstream of junction with North Wambo Creek and at Wambo Coal intake pump.
SW04	pH, EC, TSS, metals and ions (including sulfates)	Monthly/Rainfall Event	Monitoring water quality of North Wambo Creek upstream of North Wambo Creek Diversion, including monitoring for metals and ions (including sulfates) until March 2020 for baseline data
SW05	pH, EC, TSS	Monthly/Rainfall Event	Monitoring water quality of North Wambo Creek downstream of Wambo Coal Operations
SW06	pH, EC, TSS, metals and ions (including sulfates)	Monthly/Rainfall Event	Monitoring water quality of South Wambo Creek upstream of Wambo Coal former operations, including monitoring for metals and ions (including sulfates) until March 2020 for baseline data
SW07	pH, EC, TSS	Monthly/Rainfall Event	Monitoring water quality of South Wambo Creek downstream of Wambo Coal former operations and junction with Stony Creek
SW08	pH, EC, TSS, metals and ions (including sulfates)	Monthly/Rainfall Event	Monitoring water quality of Stony Creek, including monitoring for metals and ions (including sulfates) until March 2020 for baseline data
SW27a	pH, EC, TSS	Monthly/Rainfall Event	Monitoring water quality at North Wambo Creek (middle of diversion)
SW32a	pH, EC, TSS	Monthly/Rainfall Event	Monitoring water quality at North Wambo Creek Pump
SW39	pH, EC, TSS	Monthly/Rainfall Event	Monitoring water quality of Waterfall Creek Midstream
SW40	pH, EC, TSS	Monthly/Rainfall Event	Monitoring water quality of Wollombi Brook, upstream of junction with South Wambo Creek
SW 41	pH, EC, TSS	Monthly/Rainfall Event	Monitoring water quality of Waterfall Creek Downsteam
US FM1	pH, EC, TSS, metals and ions (including sulfates)	Monthly/Rainfall Event	Monitoring water quality of upper reaches of North Wambo Creek, including monitoring for metals and ions (including sulfates) until March 2020 for baseline data
Licensed Discharge Point			
SW15	pH, EC	Monthly Continuous during discharge[3]	Monitoring water quality of Eagles Nest Dam – licensed discharge dam licensed under HRSTS and EPL 529 (EPA ID No. 4)
	TSS	Monthly Daily during discharge[4]	
	Discharge Volume	Continuous[5]	Monitoring discharge from the licenced discharge point
Mine Water			
SW14	pH, EC,	Monthly	Monitoring water quality of Box Cut Dam (Admin)
SW31	pH, EC	Monthly	Monitoring water quality of Gordon Below Franklin Dam
SW38	pH, EC	Monthly	Monitoring water quality of Homestead Open Cut
SW52	pH, EC	Monthly	Monitoring water quality of C11 Void

Site Ref	Parameter[1]	Frequency[2]	Purpose
Sediment Dams with Discharge Potential			
Montrose East 1	pH, EC, TSS	Monthly	Monitoring water quality of Montrose East Sediment Dam during discharge, rainfall event sampling or monthly sampling
Montrose East 2	pH, EC, TSS	Monthly	Monitoring water quality of Montrose East 2 Sediment Dam during discharge, rainfall event sampling or monthly sampling
Milk Can Dam	pH, EC, TSS	Monthly	Monitoring water quality of Milk Can Dam during discharge, rainfall event sampling or monthly sampling
Other Sediment Dams			
Wombat Dam	pH, EC, TSS	Monthly	Monitoring water quality of Wombat Dam
Rug Dump Dam	pH, EC, TSS	Monthly	Monitoring water quality of Rug Dump Dam
Flow Monitoring			
FM1	Flow	Continuous	Monitoring of flow in North Wambo Creek – confluence
FM2	Flow	Continuous	Monitoring of flow in North Wambo Creek – middle of diversion
FM3	Flow	Continuous	Monitoring of flow in North Wambo Creek
FM4	Flow	Continuous	Monitoring of flow in North Wambo Creek - downstream near confluence of Wollombi Brook
FM10	Flow	Continuous	Monitoring of flow in Wollombi Brook - downstream from Wambo Coal at Warkworth*
FM11	Flow	Continuous	Monitoring of flow in Wollombi Brook - upstream from Wambo Coal at the Bulga Village*
FM12	Flow	Continuous	Stony Creek Upstream
FM13	Flow	Continuous	Stony Creek Downstream
FM14	Flow	Continuous	Stony Creek Tributary
FM15	Flow	Continuous	South Wambo Creek
FM16	Flow	Continuous	South Wambo Creek
US FM1	Flow	Continuous	North Wambo Creek - upstream

Notes:

[1] *Sampling of the creek water systems will only be undertaken during periods of flow*

[2] *Rainfall event – Following >20 mm rainfall on a 24 hour calendar day. Actual timing of rainfall event based monitoring to be dependent on site accessibility and flow*

[3] *pH to be sampled using in-line instrument, EC to be sampled using a probe designed to measure the range 0-10,000 µS/cm (in accordance with EPL 529 Condition M2.3)*

[4] *Grab sample*

[5] *Volume to be measured using in line instrumentation (in accordance with EPL 529 Condition M7.1))*

4.1.1 Surface Water Quality

Sampling is undertaken at sites, including Wollombi Brook, North Wambo, South Wambo, and Stony Creeks. Monitoring site locations are shown in Figure 5 and provided in Table 14. Surface water quality monitoring is undertaken on a monthly basis and/or following a significant rainfall event (20 mm within 24 hours, midnight to midnight), with a new rainfall event considered to have commenced if there has not been a rainfall event in the previous 48 hours. Sampling is only undertaken during flow periods to ensure that increased solute concentration (caused by evaporation) does not cause incorrect sample results.

Water quality monitoring sites are generally located upstream and downstream of WCPL's operations, to distinguish mining impacts from natural water quality fluctuations. Redbank Creek is not monitored by WCPL, as downstream creek flow is used by United Collieries for operational purposes. Monitoring in Waterfall Creek (SW39 on Figure 5) commenced in July 2007 to enable the collection of sufficient baseline data prior to the commencement of any potential mining within that catchment.

In response to comments from the IESC (July 2017), WCPL increased the sampling schedule to include monthly monitoring of metals and ions at six surface water monitoring locations (as outlined in Table 5). The locations were chosen as representative sites surrounding WCPL operations, including upstream and downstream locations. The additional monitoring will be conducted until March 2020 to collect baseline data.

4.1.2 Mine Water Quality

A number of mine water storage dams and pits are sampled monthly for water pH and EC (Table 14). Data from this monitoring is used for operational purposes and is reported internally as required.

4.1.3 Surface Water Flows

WCPL monitors flow in the North Wambo Creek, Stony Creek and South Wambo Creek using continuous flow monitoring stations. Surface water flow monitoring data for Wollombi Brook is sourced from CLWD operated flow gauging stations, located at Warkworth (FM10) and Bulga (FM11).

The ephemeral nature of these creeks often results in extended no-flow periods. Available data from this monitoring is reported in the Annual Review (Section 6.2).

4.1.4 Erosion and Sediment Control

As well as collecting background water quality data and identifying potential mining impacts, surface water quality monitoring sites are strategically located so as to enable the effectiveness of erosion and sediment control measures (implemented in accordance with the WCPL Erosion and Sediment Control Plan (ESCP)) to be assessed. Inspection, maintenance and management of erosion and sediment control structures is undertaken in accordance with the requirements of the ESCP, including:

- Inspections of sediment dams during construction at a frequency proportional to the level of risk.
- Inspections of sediment dams to verify dam walls, drainage channels, etc have been successfully stabilised by revegetation methods.

- Inspections of sediment control structures and sediment dams on a monthly basis and/or following rainfall events ≤20 mm/day (midnight to midnight).

A complete review of the ESCP will occur:

- When there are changes to consent or licence conditions related to any aspect of this ESCP;
- Where there are significant changes to erosion and sediment control structures;
- Following significant erosion and sediment control related incidents at WCPL;
- Following an independent environmental audit which requires ESCP review; or
- If there is a relevant change in technology, practice or legislation.

4.1.5 Riparian Vegetation and Creek Bed Stability

Localised bed and bank instability is a natural phenomenon in alluvial creeks, which contributes to the dynamic geomorphology of fluvial systems. Creek beds are also susceptible to subsidence induced erosion, due to the variable depth of subsidence associated with underground longwall mining.

The Baseline Riparian Vegetation and Bed Bank Stability Monitoring Program commenced in October 2006 to monitor for potential subsidence impacts. The program aims to distinguish natural erosion from mine subsidence associated instability, through pre-mining and post-mining survey of North Wambo Creek, South Wambo Creek and Stony Creeks.

A program to monitor riparian vegetation corridors along North Wambo, South Wambo and Stony Creeks has also been implemented. Details of both programs are presented in the WCPL Biodiversity Management Plan (BMP) and North Wambo Creek Diversion Rehabilitation Plan (for North Wambo Creek only)

4.1.6 Monitoring of Discharge Flows in the North Wambo Creek Diversion

Monitoring and reporting of discharge flows in the North Wambo Creek Diversion (NWCD) will be undertaken in accordance with CLWD requirements. These requirements include the:

- Calculation of bankfull discharge flow capacities and velocities for the first discharge event following NWCD completion, and thereafter as directed by CLWD;
- Assessment of diversion stability performance, compared with selected stable reaches of North Wambo Creek and other control catchments, as approved by CLWD; and
- Reporting of NWCD monitoring data in the Annual Review (Section 6.2).

4.1.7 Diversion and Subsidence Monitoring Program

Operational Monitoring

An operational monitoring program for the NWCD will be implemented from 2017.

The program will provide an assessment of the condition and condition trajectory of North Wambo Creek and the NWCD above the underground mining areas and adjacent upstream and downstream reaches. The outcomes of the monitoring program will inform

recommendations to manage any identified issues with the condition of the NWCD, in particular management issues that may affect downstream receiving waters or WCPL infrastructure.

The first round of collection of monitoring data in 2017 will form the baseline for future monitoring.

The operational monitoring requirements are summarised in Table 15. Monitoring locations are shown on **Figure 10**.

The results of the operational monitoring program and the geomorphic condition of the NWCD will be reviewed annually. This review will include an assessment of the efficacy of subsidence management or rehabilitation works and maintenance requirements.

Construction/Rehabilitation Monitoring

Monitoring will be undertaken during and immediately after construction of mitigation or rehabilitation works along the NWCD to confirm that works have been undertaken to specification and/or meet design intent.

The following records will be maintained following the implementation of mitigation or rehabilitation works:

- Descriptions of the design activities completed.
- Photographs of the works taken during construction and immediately after the work is finished. Where possible photographs should be taken from fixed photo points, with details such as date, time and weather conditions noted.
- Aerial photography within 12 months after works are completed to accurately display the extent of change and provide a baseline reference for changes that may occur in the future.

Relinquishment Monitoring

If the operational monitoring program indicates the operation of the NWCD is operating in dynamic equilibrium at or before mine closure, a relinquishment monitoring program would be developed.

With the implementation of planned remediation works, it is anticipated this will not be required as the diversion should have been operating for a minimum of 10 years and had flow events of sufficient frequency and magnitude to test the performance of the diversion and its response to subsidence.

Table 15: Diversion and Subsidence Monitoring Program – Operational Monitoring

Component	Locations	Parameters	Frequency
• Index of Diversion Condition (IDC)	• Upstream reach (U1 – U4). • NWCD Stage 2 (Div1 – Div5). • NWCD Stage 3 (Div 6 – Div11). • Above completed North Wambo Underground (WS1 – WS6). • Downstream reach (D1 – D2).	• Geomorphic Index* – based on: width of high flow channel, active channel and low flow channel; bank condition; piping of banks; bed condition; spoil piles; recovery; and in-stream structures. • Riparian Index* – based on: width of riparian zone; structural intactness; regeneration; and longitudinal continuity. • Six photos at each monitoring point: • Upstream, cross-stream, downstream and away from stream – with the monitoring peg in the lower centre of the frame (where possible). • In-channel bed upstream and downstream – from the centre of the creek bed (or as near as possible).	• Annually. #
• Landscape Function Analysis (LFA)	• NWCD Stage 2 (17R, 19 R, 21R, 23R). • NWCD Stage 3 (28R, 27R, 26R, 25R).	• Landscape Organisation Index (LOI) (as outlined in the Biodiversity Management Plan). • Soil Surface Assessment (as outlined in the Biodiversity Management Plan).	• Annually.
• Riparian Vegetation	• Same as IDC monitoring points.	• Vegetation structure and extent.	• Annually. #
	• North Wambo Creek (8A, 9A, 10A, 11A, 12A, 13A, 14A, 15A).	• Rapid Appraisal of Riparian Condition (RARC) index (as outlined in the Biodiversity Management Plan).	• Annually.
• Aerial Photography	• Full reach of NWCD and North Wambo Creek downstream.	• Changes to channel form compared to previous aerial photographs.	• Annually. #

Component	Locations	Parameters	Frequency
• Long And Cross-Section Surveys (Bed and Bank Stability Monitoring).	• Extracted from LiDAR or aerial photogrammetry survey data captured over NWCD and North Wambo Creek downstream.	• Changes to channel form compared to previous surveys.	• Annually. #
• Surface Water Quality Data	• As per Section 4.1.1.	• As per Section 4.1.1.	• As per Section 4.1.1.
• Flow Event Data	• As per Section 4.1.3.	• As per Section 4.1.3.	• As per Section 4.1.3.

* Based on ID&A Pty Ltd (2001).
# Frequency may be reduced following the completion of subsidence from the South Bates Underground Mine.

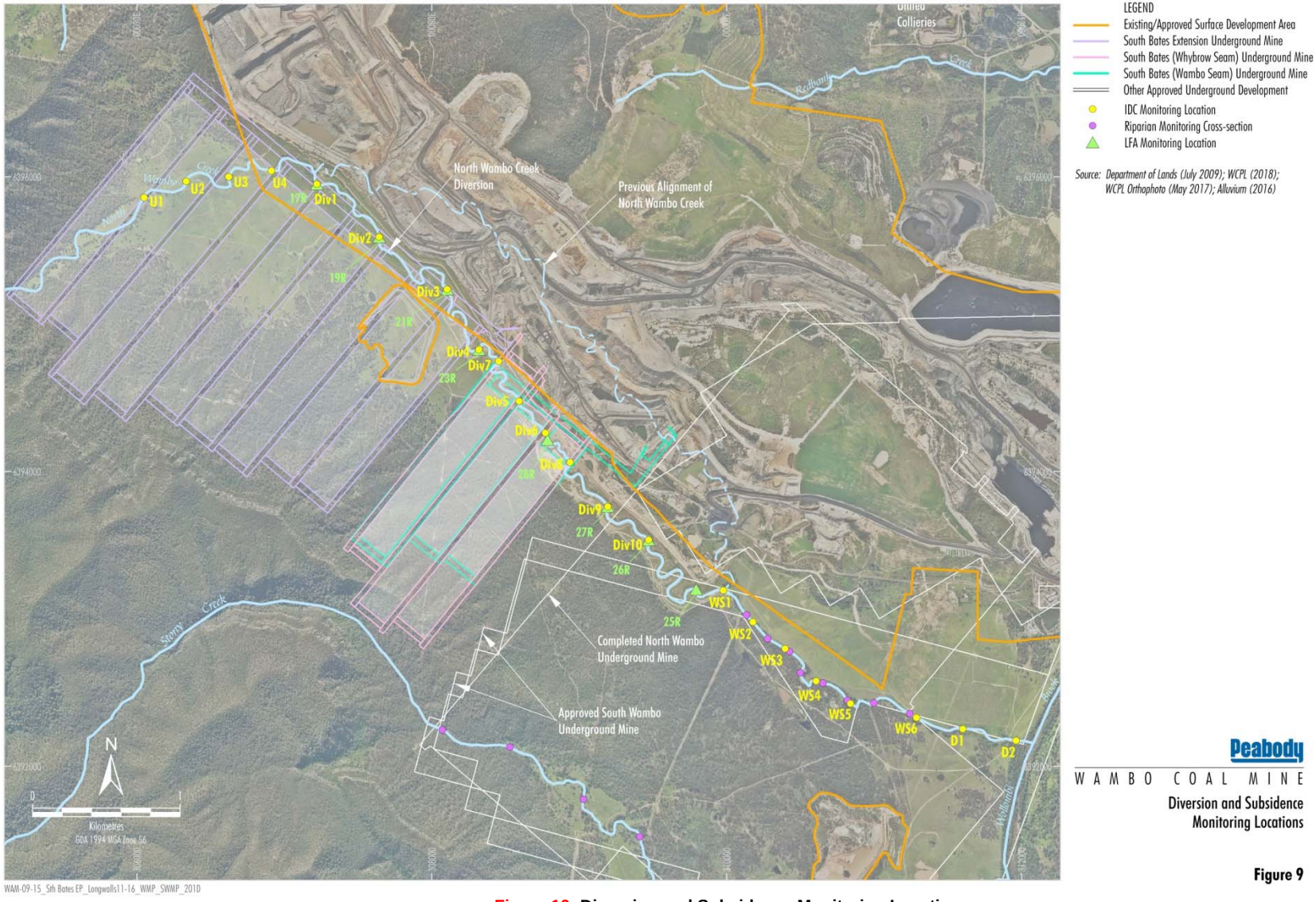


Figure 10: Diversion and Subsidence Monitoring Locations

4.1.8 Monitoring of Licensed Discharges under EPL 529 and the HRSTS

Wambo are required to monitor water quality and volume for licensed discharges at monitoring location SW15 (EPL ID No. 4) in accordance with the licensed discharge limits and requirements detailed in Table 10 and relevant monitoring conditions of EPL 529 and the HRSTS.

4.1.9 Monitoring of Flows into Underground and Open Cut Workings

The water quality of inflows to the underground workings and the open cut are measured indirectly through monthly water quality monitoring of mine water storages. This is the most practical method to routinely sample for water quality. An unexpected increase in water make or change in water quality of mine water storages would be investigated by Wambo. If warranted, direct measurement of water quality at the source of inflow may be conducted.

A visual assessment of flows to the open cut workings is undertaken by site personnel during regular site inspections. These flows are not quantified however if it is noted that there is a notable increase in seepage to the open cut pit then the response plan in the SGWRP is followed.

Data from this monitoring is used for operational purposes and is reported internally as required. A Site Water Balance is completed each year for the Annual Review.

4.2 Methodology

Surface water quality sampling and analysis is conducted in accordance with Approved Methods for Sampling and Analysis of Water Pollutants in New South Wales (DEC, 2004); Australian Standard/New Zealand Standard (AS/NZS) 5667:1998 Parts 1, 4 and 6; and the requirements of the HRSTS.

4.3 Data Management Procedures

Validated data from the monitoring program will be entered into a digital database by an Environmental Advisor. This renders the data in a form suitable for analysis.

WCPL will record the following details for all surface water monitoring samples:

- The date(s) on which the sample was taken;
- The point at which the sample was taken; and
- The name of the person who collected the sample.

In the event of an apparently anomalous result, WCPL will conduct a re-test as soon as is practicable to do so.

4.4 Data Review and Investigation

Upon receipt of monitoring results, the following review processes will be undertaken:

- Data will be compared to the impact assessment criteria where applicable (Section 3.0).
- If result(s) do not meet impact assessment criteria a response procedure will be initiated in accordance with the SGWRP.

WCPL will undertake an annual review of monitoring data and compare the results to the surface water impact assessment criteria detailed in Section 3.0. Results of the review will be included in the Annual Review (Section 6.2).

When monitoring results exceed the impact assessment criteria or the annual review identifies surface water impacts, an investigation appropriate for the situation will be launched to determine the cause. The investigation will include comparison of monitoring results, meteorological patterns, mining activities and changes to land use. Further details outlining these response procedures are outlined in the SGWRP.

5.0 Community Complaint Response

All surface water related community complaints received by WCPL will be recorded within the Community Complaints Register. The E&C Manager will investigate the complaint, which will include, where possible, contacting the complainant within 24 hours to discuss the complaint. A review of the effectiveness of the corrective or preventative actions will be conducted within a month of the complaint and the relevant work procedures updated if required.

Preliminary investigations will commence as soon as practicable upon receipt of a complaint to establish if WCPL is responsible. All efforts will be made to determine the likely causes contributing to the complainants concerns.

WCPL will attempt to address the complainants concerns such that a mutually acceptable outcome is achieved. However, if required, the Independent Dispute Resolution Process would be referred to (Appendix A).

Details of all community complaints will be included in the Monthly Environment Monitoring Report. WCPL will retain a copy of the Community Complaints Register for at least four years. The E&C Manager will ensure the latest Community Complaints Register is posted on the WCPL website.

6.0 Review and Reporting

6.1 Review

The performance of the surface water monitoring program outlined in the SWMP is to be reviewed annually by the E&C Manager. A complete review of the SWMP will occur:

- Every two years;
- When there are changes to consent or licence conditions relating to surface water monitoring;
- Prior to new underground mining areas being developed;
- Following significant surface water related incidents at WCPL;
- Following continual exceedance of the impact assessment criteria;
- Following an independent environmental audit which requires SWMP review; or
- If there is a relevant change in technology, practice or legislation.

The revised SWMP will be re-submitted to the Secretary for approval as required by Condition 30, Schedule 4 of DA305-7-2003.

6.2 Annual Review

Prior to the end of March each year, WCPL will review the environmental performance of the Mine and submit an Annual Review report to the DP&E. This report will:

- Describe the development (including any rehabilitation) that was carried out in the past year, and the development that is proposed to be carried out over the next year;
- Include a comprehensive review of the monitoring results and complaints records of the Project over the past year, which includes a comparison of these results against the:
    - Relevant statutory requirements, limits or performance measures/criteria
    - Monitoring results of previous years; and
    - Relevant predictions in the EA;
- Identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;
- Identify any trends in the monitoring data over the life of the Project;
- Identify any discrepancies between the predicted and actual impacts of the Project, and analyse the potential cause of any significant discrepancies; and
- Describe what measures will be implemented over the next year to improve the environmental performance of the Project.

Reporting on the performance of the North Wambo Creek diversion channel will also be included in the Annual Review, in accordance with CLWD requirements (Table 3).

6.3 EPL 529 Annual Return

WCPL will prepare and submit an Annual Return comprising a certified Statement of Compliance and a signed Monitoring and Complaints Summary to the EPA at the end of each EPL reporting period.

The Annual Return for the reporting period will be supplied to the EPA by registered post not later than 60 days after the end of each reporting period. WCPL will retain a copy of the Annual Return for a period of at least four years after the Annual Return was due to be supplied to the EPA.

6.4 Website Updates

A comprehensive summary of the surface water monitoring results will be made publicly available at WCPL website:

Information on the website will be updated regularly as required by DA305-7-2003.

WCPL will also ensure that any information relevant to surface water monitoring is uploaded to the website (and kept up to date). This includes:

- Current statutory approvals;
- Approved strategies, plans or programs required under the DA305-7-2003;
- A community complaints register;
- Minutes of Community Consultative Committee (CCC) meetings;
- Annual Reviews;
- A copy of any Independent Audits and WCPL's response to any recommendations in any audit; and
- Any other matter required by the Secretary.
-

6.5 Reportable Environmental Incidents

All reportable incidents will be reported via the EPA's Environmental Line on **131 555** by the E&C Manager in accordance with WCPL's Pollution Incident Response Management Plan (PIRMP).
In accordance with the PIRMP, WCPL must notify all relevant authorities of incidents causing or threatening material harm to the environment immediately after the person becomes aware of the incident in accordance with the requirements of *Part 5.7* of the *POEO Act.*
For all other incidents that do not cause threatening material harm to the environment associated with the Project, WCPL will notify the Secretary and any other relevant agencies as soon as practicable after WCPL becomes aware of the incident.
Within 7 days of the date of the incident, WCPL will provide the Secretary and any relevant agencies with a detailed report on the incident to include:

- The cause, time and duration of the event;
- Where possible the type, volume and concentration of every pollutant discharged as a result of the event;

- The name, address and business hours telephone number of employees or agents of the licensee who witnessed the event;
- The name, address and business hours telephone number of every other person (of whom the licensee is aware) who witnessed the event, unless the licensee has been unable to obtain that information after making reasonable effort;
- Action taken by the licensee in relation to the event, including any follow-up contact with any complainants;
- Implement remediation measures as directed by the Secretary, to the satisfaction of the Secretary;
- Details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event; and
- Any other relevant matters.

7.0 RESPONSIBILITIES

Table 16 below summarises responsibilities documented in the SWMP. Responsibilities may be delegated as required.

Table 16: Surface Water Monitoring Program Responsibilities

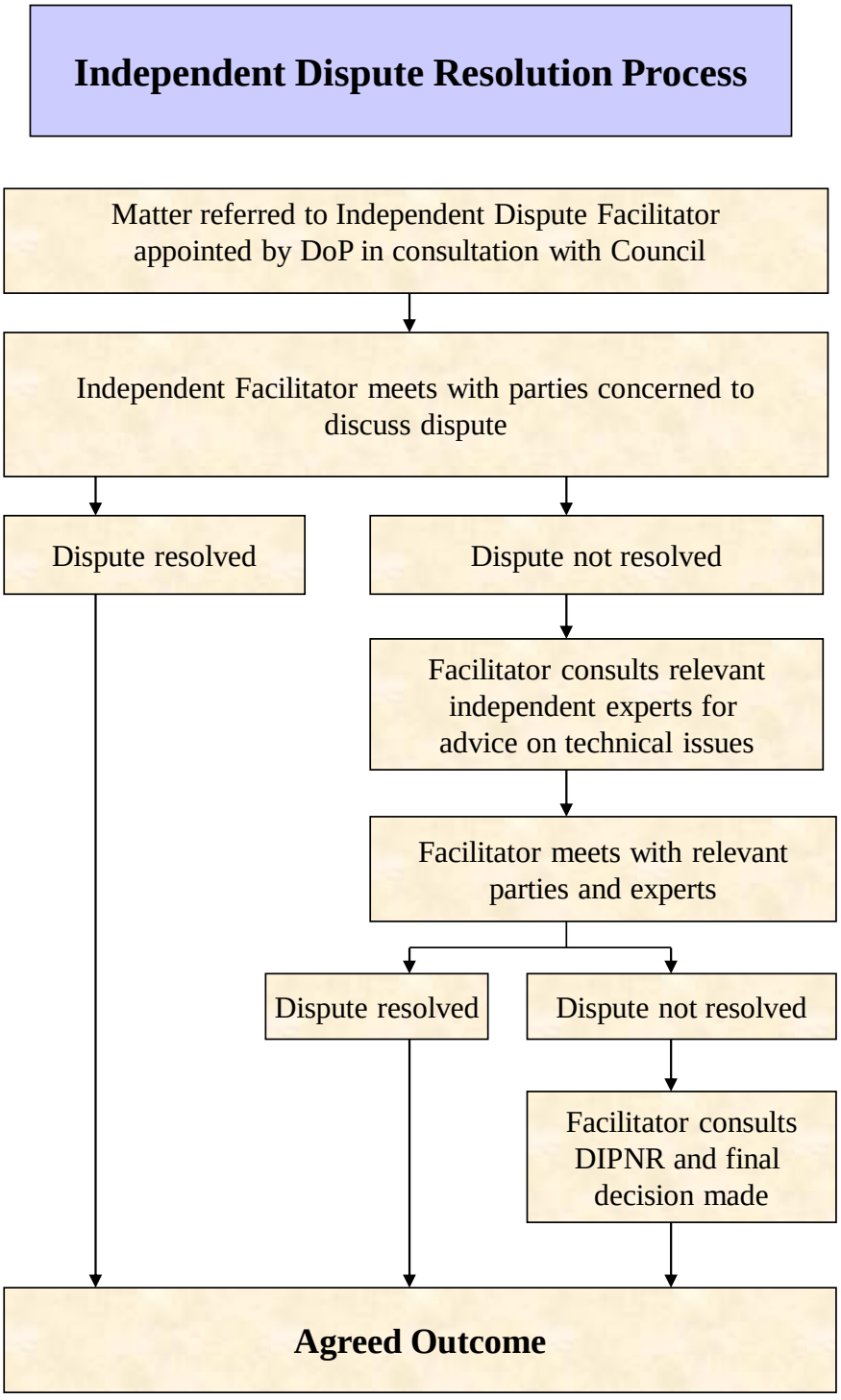
No	Task	Responsibility	Timing
1	Ensure surface water monitoring is undertaken in accordance with Section 4.0.	Environmental Advisor	As required
2	Assess surface water monitoring data against relevant criteria listed in Section 3.0	Environmental Advisor	As required
3	Review SWMP in accordance with Section 6.0.	Environmental Advisor	Annually
4	Undertake internal surface water reporting.	Environmental Advisor	Monthly/Quarterly
5	Notify government departments if an incident occurs in accordance with Section 6.5	E&C Manager	As required
6	Submit updated SWMP to DP&E.	E&C Manager	As required
7	Surface water related complaints to be responded to in accordance with Section 5.0	E&C Manager	As required
8	Annual Review to include surface water monitoring results, complaints, mitigation measures undertaken and a review of the monitoring undertaken	E&C Manager	Annually
9	Regulator review to be undertaken of the SWMP	E&C Manager	As required
10	Prepare investigation reports and implementation of corrective actions in accordance with Section 6.5	E&C Manager	As required

8.0 References

- AECOM (2018) Report on Flow Events along North Wambo Creek, South Wambo and Stoney Creeks for the period 1 February 2017 to 31 January 2018
- Alluvium (2018) North Wambo Creek baseline assessment geomorphic context statement by Alluvium Consulting for Wambo Coal Pty Ltd.
- Development Consent (DA305-7-2003)
- Development Consent (DA177-8-2004)
- Wambo Development Project Environmental Impact Statement (EIS), July 2003
- Resource Strategies Pty Ltd (2003) Wambo Coal Mine Project Environmental Impact Statement. Report prepared for Wambo Coal Pty Ltd
- Wambo Environment Protection Licence (529)
- Water Management Act 2000
- Environmental Planning and Assessment Act 1979
- Hunter Unregulated and Alluvial Water Sources Water Sharing Plan
- Glen, R.A. and Beckett, J. (1993) Newcastle Coalfields Regional Geology 1:100,000 map, (Second Edition), NSW Department of Mineral Resources, Sydney.
- Groundwater Imaging Pty Ltd (2012) A Transient Electromagnetic Investigation of the Extent of the Wollombi Brook Alluvium at the Wambo Coal Mine Site.
- HLA-Envirosciences Pty Ltd (1999) Effect of Longwall Panel 9 Mining on Surface and Groundwater – Homestead Underground Mine Warkworth NSW.
- Worley Parsons (2014) OPSIM Water Balance Model Initial Investigations – January 2014.
- Australian and New Zealand Environment and Conservation Council (ANZECC) (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Canberra.
- Department of Urban Affairs and Planning (DUAP) (1997) Upper Hunter Cumulative Impact Study and Action Strategy.
- Geoterra (2005) United Collieries Pty Ltd Surface and Groundwater Monitoring to December 31 2004.
- Gilbert and Associates (2005) Wambo Development Project Surface Water Impact Assessment.
- Hunter Catchment Management Trust (2003) Wollombi Brook Catchment. Fact Sheet. http://hcmt.org.au/factsheets/sub_catchments/wollombi_brook.htm
- Mackie Environmental Research (MER) (2002), Extension of Warkworth Coal Mine Assessment of Environmental Impacts Surface & Groundwater Management Studies, on behalf of Warkworth Mining Limited.
- Resource Strategies (2003) Wambo Development Project Aquatic Assessment.
- Resource Strategies (2003) Wambo Development Project Environmental Impact Statement.
- Strata Engineering (2005) Subsidence Impact Assessment for First Workings Development Associated with LW 1 at the Proposed Wambo Seam Punch Mine.
- WCPL (2008) North Wambo Creek Subsidence Response Strategy
- WCPL (2018) Mining Operations Plan

- Wells Environmental Services (2011) Modification of DA 177-8-2004, Environmental Assessment, Locomotive Refuelling Station - Wambo Coal Rail Loop
- ID&A Pty Ltd (2001) Monitoring & Evaluation Program for Bowen Basin River Diversions. Australian Coal Association Research Program (ACARP) Project C9068.

APPENDIX A
INDEPENDENT DISPUTE RESOLUTION PROCESS


Independent Dispute Resolution Process
Matter referred to Independent Dispute Facilitator appointed by DoP in consultation with Council
Independent Facilitator meets with parties concerned to discuss dispute
Dispute resolved
Dispute not resolved
Facilitator consults relevant independent experts for advice on technical issues
Facilitator meets with relevant parties and experts
Dispute resolved
Dispute not resolved
Facilitator consults DIPNR and final decision made
Agreed Outcome

APPENDIX B
CORRESPONDENCE WITH REGULATORY AGENCIES

Summary of Comments Received from CLWD on the WMP (Revision F, Revision 11) December 2017

Comment	Consideration of Comment
CLWD	
…CL&W recommends the following is undertaken prior to the Department of Planning's endorsement of the WMP	
The Department of Planning and Environment engages an independent expert to advise if leakage from South Wambo Dam has resulted in contamination of the alluvial aquifer of South Wambo Creek;	Noted.
In consultation with Crown Lands and Water, WCPL expands the observation bore network within and beneath the area of alluvial aquifers and mapped GDEs. This is to ensure that future groundwater model revisions can capture and predict important localised impacts;	Addressed in The Groundwater Monitoring Program (WA-ENV-MP-509.1), a component of the site Water Management Plan.
The WMP set a requirement to measure water quality for water seeping into the open cut and underground mine workings	The water quality of inflows to the underground workings and the open cut are measured indirectly through monthly water quality monitoring of mine water storages. This is the most practical method to routinely sample for water quality. An unexpected increase in water make or change in water quality of mine water storages would be investigated by Wambo. If warranted, direct measurement of water quality at the source of inflow may be conducted. (Refer to Section 4.1.9.)
The Surface and Ground Water Trigger Action Response Plan must link to monitoring bores with defined thresholds listed in the Groundwater Monitoring Plan. Observation sites listed for North Wambo Creek alluvium have no defined triggers that hold WCPL accountable to impacts and the licensable take of water.	Addressed in The Surface and Ground Water Trigger Action Response Plan (WA-ENV-MP-509.4), a component of the site Water Management Plan

Summary of comments received from the Independent Expert Scientific Committee (IESC) on the SWMP (Revision 11)

Comment	Consideration of Comment
IESC – 31 July 2017	
Monthly monitoring of metals and ions (including sulfate) is needed to establish a baseline and to develop suitable trigger values. After this period, event-based monitoring (including multiple samples to capture different stages of the hydrograph such as the rising and falling limbs), and regular monitoring at a frequency which captures the natural variability of the system as identified from the baseline data, will need to continue to allow prompt identification and investigation of exceedances of the trigger values.	WCPL will increase the sampling program to include monthly monitoring of metals and ions on six surface water monitoring locations (as outlined in Table 14) until March 2020. Representative sites surrounding WCPL are as follows: USFM01 – upstream North Wambo Creek SW01- located upstream of Wambo Coal Operations; SW02- located downstream of Wambo Coal Operations; SW04 - North Wambo Creek upstream of North Wambo Creek Diversion; SW06 - South Wambo Creek upstream of Wambo Coal former operations; and SW08 - Stony Creek.
The data used to calculate trigger values should be provided. The IESC is concerned that data from impacted sites was used to set trigger values. Data and associated metadata should be presented to show that only pre-impact data has been used in the calculation of the trigger values.	It is noted that mining first commenced in the Wambo area in 1969. Therefore, while the use "pre-impact" data to characterise baseline conditions is ideal, it is not feasible at Wambo.
Water quality monitoring in the upstream reach of North Wambo Creek has historically occurred infrequently (i.e. four samples collected over 13 years) due to the intermittent nature of North Wambo Creek in this reach. Suitable reference sites need to be identified and monitored by the proponent to enable the calculation of appropriate trigger values for incorporation into TARPs. The reference sites must not be impacted by mining. The current trigger values represent water quality which has been impacted by mining, making these unsuitable for identifying potential mining impacts.	Monitoring site SW04 referred to in the IESC's comments is located upstream of Wambo and has not been directly impacted by mining to date. It is noted that the IESC's suggestion to establish a reference site comparable to the upstream reaches of North Wambo Creek would encounter similar practical difficulties associated with obtaining a suitable number of samples in a highly ephemeral system with a high proportion of sub-surface flow. Quality monitoring will commence at US FM1 (upper reaches of North Wambo Creek). No additional monitoring sites are proposed at this stage.
Trigger values should be calculated using the 20th and 80th percentiles as outlined in the ANZECC/ARMCANZ Guidelines (2000), not the less conservative 10th and 90th percentiles used by the proponent. Trigger values and associated TARPs should be initiated based on a single recorded exceedance of the 20th or 80th percentile values and not multiple exceedances over numerous months. A subsequent consecutive exceedance should initiate another level of the TARP.	Although ANZECC and ARMCANZ (2000) recommend 80th percentile values as being suitable for trigger values, a trigger would be initiated 20 percent of the time due to natural causes. Therefore, for the trigger to be a meaningful indicator of a possible mining effect, an investigation is to be triggered when the 90th percentile value is exceeded on two consecutive monitoring events.
Further information regarding the water management system is needed. The water management plan should include this information and an up-to-date version of the water management system schematic.	This information is presented in Site Water Balance Revision 2 (WA-ENV-MNP-509.5), a component of the Site Water Management Plan.

Comment	Consideration of Comment
While the proponent has committed to updating the water balance annually it is unclear if this includes a commitment to update any other models that underpin the predictions of the water balance model. These should be regularly reviewed and updated as needed.	Regular reviews and updates to the numerical model have been undertaken as part of modifications to the Wambo Coal Mine. A site water balance was completed in support of the Extension of the Approved South Bates Mine (DA305-7-203, MOD 17, February 2017). Details on the assumptions of the model are included in the United Wambo Open Cut Coal Mine Project Site Water Balance (JV SWB), a component of the Surface Water Assessment completed in July 2016. The WCPL Site Water Balance document (WA-ENV-MNP-509.5, approved by DP&E in 2015) will be revised to incorporate the findings of the JV SWB and resubmitted for consultation and approval. A review of the site water balance against model predictions is undertaken annually and presented in the Annual Review.

NSW GOVERNMENT | Planning & Environment

Contact: Scott Brooks
Phone: 6575 3401
Fax: 6575 3415
Email: scott.brooks@planning.nsw.gov.au
Our ref: 305-7-2003

The General Manager
Wambo Mine
PMB 1
SINGLETON NSW 2330

Attention: Steve Peart

Dear Steve

Wambo Coal – Approval of Water Management Plan

Thank you for forwarding the Wambo Water Management Plan and all its parts as required under project approval DA 305-7-2003 for the Department's consideration.

The Water Management Plan is required by Condition 30 Schedule 4 and the following 5 components of the Plan were reviewed:

- Site Water Balance (30)
- Erosion and Sediment Control Plan (32)
- Surface Water Monitoring Program (33)
- Ground Water Monitoring Program (34)
- Surface and Ground Water Response Plan (35).

The Department has reviewed these plans, and is satisfied that they generally address the requirements set out in the relevant conditions of the project approval. Consequently, I would like to advise you that the Secretary has approved the plans.

These plans come into force on the 30th November 2015 and remains in force until replaced by any future updated approved Plans.

I am aware that DPI Water are expected to comment on the Extraction Plan for the South Bates U/G (Wybrow seam) LW 11-13. Should this comment require significant changes to any component of the Water Management Plan, I ask if these changes could be made and the plans resubmitted for review and approval.

Could you please forward finalised copies of the above plan (preferably in PDF format with a copy of this approval letter appended) for the Department's records by the end of November 2015.

If you require further information or clarification in this matter please contact Scott Brooks on 6575 3401 or by email to scott.brooks@planning.nsw.gov.au.

Yours sincerely

Scott Brooks
Investigations (Lead), Compliance
27 - 11 - 2015
As Nominee for the Secretary, Planning & Environment

From: Scott.Brooks@planning.nsw.gov.au [mailto:Scott.Brooks@planning.nsw.gov.au]
Sent: Wednesday, 21 October 2015 1:22 PM
To: Peart, Steven D
Subject: RE: 3 of 3

Steve,
I had no comment on the EE&SC Plan

Scott

Scott Brooks
Investigations (lead), Compliance
Planning Services, Resources Assessments
Planning & Environment
Suite 14, Level 1, 1 Civic Av
PO Box 3145
Singleton NSW 2330
http://www.planning.nsw.gov.au
E: scott.brooks@planning.nsw.gov.au
P: 02 6575 3401 | | **Office:** 6575 3405
M: 0419 970924 **F:** 02 6575 3415

Please consider the environment before deciding to print this e-mail.

From: Peart, Steven D [mailto:SPeart@peabodyenergy.com]
Sent: Wednesday, 21 October 2015 12:50 PM
To: Scott Brooks
Subject: RE: 3 of 3

Cheers Scott

The only other one was the Erosion and Sediment Control Plan if you had any comments on it.

Thanks again

Steven Peart
Manager: Environment & Community

Wambo Coal Pty Ltd
Peabody Energy Australia
PMB 1, Singleton NSW 2330
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Mob: +61 (0)448 082 987
Email: speart@peabodyenergy.com
www.peabodyenergy.com.au
Please consider the environment before printing this email.

From: Scott.Brooks@planning.nsw.gov.au [mailto:Scott.Brooks@planning.nsw.gov.au]
Sent: Wednesday, 21 October 2015 11:46 AM
To: Peart, Steven D
Subject: RE: Wambo Coal_WMP's 1 of 3

Steve,
Comments on the 3 water management plans.

Please note we will need some type of water balance, and the info for the evaporation sprays if you want to use them.

Scott

Scott Brooks
Investigations (lead), Compliance
Planning Services, Resources Assessments
Planning & Environment
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Plan	Section	DP&E Comment
Surface and Ground Water Response Plan (WA-ENV-MNP-509.4) Version 8	2.7 North Wambo Creek Diversion Performance Criteria	Given the problems with the NWCD this section should refer to other management plans of have a section referring to erosion and the potential for sediment generation and loss from the system.
Surface Water Monitoring Program (WA-ENV-MNP-509.2) Version 8	1.4.1 Environmental Planning & Assessment Act 1979 (Table 3)	(NOW) Currently called DPI Water
	2.2.3.2 Stream Flow (Table 7)	(No flow data available) Is this because the SWC never runs?
	4.1 Monitoring Network, Parameters and Frequency	(Mine water monitoring is undertaken for operational management purposes only. This data is not reported publicly). This would appear to conflict with Schedule 6 Condition 12 requiring the publishing of monitoring results.
	4.1.5 Riparian Vegetation and Creek Bed Stability	The NWCD has its own rehab management plan. This management plan should refer to it and it may need to be updated.
	4.1.6 Monitoring of Discharge Flows in the North Wambo Creek Diversion	What did NOW ask for. This should be included.
	6.1 Review	(Review every two years) Usually 3 years
Groundwater Monitoring Program (WA-ENV-MNP-509.1) Version 9	2.2.3.1 Alluvial Water Sources	(Investigation into increase in EC) This will need to be reported in the AEMR
	3.1.3 Permian Monitoring Locations	Need to discuss why we monitor if the results cannot result in action.
	3.2 Trigger Values for Groundwater Quality	(Bi-monthly monitoring) This will need to be defined. Twice a month or every 2 months
	4.1.6 Chitter Dam and Wambo South Water Dam Monitoring Program	Need some comment here if the dam will be recommissioned if it is found to be leaking.

Plan	Section	DP&E Comment
	6.1 Review	(Review every two years) Review is normally every 3 years.

From: Joanna Webster [mailto:jwebster@ResourceStrategies.com.au]
Sent: Wednesday, 17 June 2015 1:05 PM
To: Jessie Evans; Brendan Liew
Cc: Joshua Hunt; Howard Reed; Alexander, Micheal G; Peart, Steven D
Subject: RE: Wambo 10A Extraction Plan - NOW comments
Importance: High

Hi Jessie/Brendan,

On behalf of Wambo Coal, please find attached a response to the recommendations made by NSW Office of Water.

Also attached is a revised Groundwater Monitoring Program that has been updated to address the recommendations made by the Office of Water.

Please consider Attachment 3 of the Water Management Plan for North Wambo Underground Mine Longwalls 8 to 10A Extraction Plan to be replaced by the attached revised Groundwater Monitoring Program.

Please don't hesitate to call if you would like to discuss.

Regards
Joanna Webster
Senior Environmental Manager
e jwebster@resourcestrategies.com.au
m 0414 664 532

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From: Jessie Evans [mailto:Jessie.Giblett@planning.nsw.gov.au]
Sent: Thursday, 4 June 2015 8:42 AM
To: Joanna Webster
Cc: Joshua Hunt; Howard Reed; Brendan Liew
Subject: RE: Wambo 10A Extraction Plan - NOW comments

Hi Joanna,

The Department has received comments from NOW in regards to the Wambo LW 8-10A Extraction Plan. I have attached these for your careful consideration and response. NOW has raised a number of issues, and in particular has concerns regarding the Groundwater Management Plan.

Could you please provide a response to NOWs concerns at your earliest possible convenience.

Thanks
Jessie

North Wambo Underground Mine Extraction Plan Longwalls 8 to 10A
Response to NSW Office of Water Comments (Dated 3 June 2015)

NOW Recommendation	Response
Groundwater Management It is recommended with respect to the exceedance of groundwater level triggers: • WCPL must investigate the drivers for declining water levels (rather than omitting bores from the monitoring program when bores go dry). Notification to the Office of Water is required as part of the response procedure within 3 months of such an event.	Five bores are proposed to be removed from the groundwater monitoring program (GW14, GW18, GW19, P5 and P6). Only two samples (August 2011 and December 2011) have been obtained from GW14 since its installation in 2011 (these samples may have been associated with groundwater levels stabilising following drilling). This bore is located to the east of Wollombi Brook and is far removed from mining activities associated with the Wambo Coal Mine. Only one sample (August 2010) has been obtained from GW18. GW19 has been consistently dry since installation and no valid samples have been obtained from this bore. GW18 and GW19 are located immediately downstream and upstream of the North Wambo Creek Diversion, respectively. The alluvial flow in North Wambo Creek has been altered by the historical and existing mining operations including the removal of alluvium across the full width of the channel with consequent desaturation of the adjacent upstream and downstream alluvium associated with the approved and constructed North Wambo Creek Diversion. Bores P5 and P6 have been covered by the approved Wambo Coal Mine waste rock emplacement. WCPL considers removal of these five bores from the groundwater monitoring program is justified as outlined above. Trigger levels are not proposed for a further four bores along North Wambo Creek (GW08, GW09, GW16 and GW17). WCPL has initiated an investigation for bores GW08 and GW09 as outlined further below. Trigger levels will not be developed for these bores until this investigation is complete. GW16 and GW17 are located upstream of the North Wambo Creek Diversion and in close proximity to the approved open cut. There are no groundwater users located in the vicinity of North Wambo Creek upstream of the North Wambo Creek Diversion. Therefore, a trigger level for these two bores is not considered warranted.

NOW Recommendation	Response
• Where the driver for declining shallow bore water levels exceeding trigger levels can not be linked to the prevailing climatic influence or miscellaneous sampling error, additional groundwater modelling is required to re-assess if there is a change in the predicted take of water from the Lower Wollombi Brook Water Source from mining related activities. As part of WCPL's response procedure, a report summarising the assessment is to be submitted to the Office of Water.	WCPL has initiated an investigation into the monitored declining water levels in GW08 and GW09. As described in Section 6.1.3 of the revised GWMP, a preliminary investigation report will be provided to the DP&E and NOW by 30 September 2015. This report will include preliminary conclusions regarding the potential licensing implications and a process and timetable for any further investigation work (including potential additional numerical hydrogeological modelling work).
• Where the updated modelled aquifer interference take of water from the Lower Wollombi Brook Water Source (encapsulating Wambo and North Wambo Creek) exceeds the estimates as predicted in WPCL's Groundwater Impact Assessment by 100% or more, WCPL must re-evaluate the associated ecological impacts and any influence on a low flow cease to pump criteria specified in the relevant WSP. The reference value triggering this response procedure must be clearly documented in the GWMP.	As described in Section 6.1.3 of the revised GWMP, Where the investigation for GW08 and GW09 indicates a revised predicted take from alluvial water sources that exceeds the previous estimates by more than 100%, WCPL would consider other potential associated impacts (e.g. on ecology) and any influence on a low flow cease to pump criteria specified in the HUA WSP.
• The trigger levels in Table 11 of the GWMP outlines a minimum and maximum depth to water level. These values, plus any new bores added to the list, and the bores proposed to be dropped, must be presented in Australian Height Datum.	Table 11 of the GWMP has been revised to include trigger levels presented in Australian Height Datum.
<u>It is recommended with respect to the exceedance of groundwater quality triggers</u> • Appropriate water quality baseline data has not been captured and presented in way that can be used for before and after impact. Salinity data for a number of bores has fluctuated considerably which is not consistent with a more stable groundwater environment. The use of major ion analysis and QA/QC procedures should be reviewed to inform if the salinity measurements reported are accurate and if so the drivers to cause such variability in the results.	The GWMP has been revised to include annual comprehensive analysis of major ions standpipe bores. A description of data management procedures has been included in Section 5.3.2.
• Due to the concerns with the potential for cross aquifer interconnection, water quality performance measures are essential to the impact assessment. Water quality performance measures should be defined and added to the GWMP.	The GWMP has been revised to include groundwater quality trigger levels in Section 5.4.
<u>It is recommended with respect to the exceedance of predicted mine inflows</u> • There is a discrepancy between the GWMP which outlines a monthly measurement and annual assessment of mine inflows, whilst the 'Subsidence Response Strategy' indicates metering of weekly dewatered volumes. It should be consistently reported weekly, in the GWMP as this will improve the understanding of inflow and assist with groundwater management and the triggers for exceedance.	Section 5.2.5 of the GWMP has been updated to clarify that dewatering values are recorded internally on a daily basis (during active pumping). As outlined in the North Wambo Creek Subsidence Response Strategy, these values are reviewed weekly for any indication that pumping rates are higher than normal (which would trigger an investigation). Dewatering values are also reviewed annually (as outlined in the GWMP) to determine the inflows from groundwater sources and to verify whether WCPL holds sufficient groundwater licence entitlements.

NOW Recommendation	Response
• Where the annual assessment for mine inflows exceeds the peak estimate as predicted in WCPL's Groundwater Impact Assessment by 50% or more, WCPL shall: – investigate if there is a change in the predicted take of water from the Lower Wollombi Brook Water Source from mining related activities; – where there is an increased take from the Lower Wollombi Brook Water Source, investigate any influence on a low flow cease to pump criteria specified in the relevant WSP. – define the mine inflow volume value triggering this response procedure within the GWMP. – As part of WCPL's response procedure, a report summarising the assessment is to be submitted to the Office of Water.	Section 5.2.5 of the GWMP has been updated to include the recommended response procedure. The mine inflow volume that would response procedure has been defined in the GWMP (563 ML/annum, which is 50% more than the peak estimate predicted by HydroSimulations (2014) [375 ML/annum] for the North Wambo Underground Mine).
• WCPL must notify the Office of Water as soon as practicable on become aware of any take of water in excess of its licensed entitlement	Section 5.2.5 of the GWMP has been updated to include this statement.
It is recommended with respect to monitoring leakage from dams • The closest bore to South Dam is Piezometer 114 representative of Wambo Creek alluvium. South Dam contains produced water from the mine and P114 shows a sharp rise in salinity to a level on par with water in the dam. This indicates probable leakage occurring from the dam that warrants further investigation. However, as the proponent proposes not to utilise water quality as a performance measures, no direct response is proposed. Significant leakage to the nearby alluvial aquifer could risk a change in the beneficial use of the aquifer. Trigger levels with regard to salinity must be set to investigate and determine if remediation is required.	WCPL has initiated an investigation into the monitored increasing salinity levels in P114. Wambo South Water Dam is currently not in use for the period of secondary extraction for Longwall 9, Longwall 10 and Longwall 10A at the North Wambo Underground Mine. Wambo South Water Dam has been drained as far as practical since January 2015. Therefore, any possible leakage mechanism that may have impacted bore P114 may no longer be present.
A report summarising any special assessment for the above recommendations should be provided within 6 months.	As described in Section 6.1.4 of the revised GWMP, a preliminary investigation report will be provided to the DP&E and NOW by 30 November 2015.
Surface Water Management • The Office of Water recommends the proponent and the Department of Planning and Environment develop a consultation process with affected landholders to address existing and potential degradation which occurs as a result of mining subsidence. This should focus on incorporating natural processes for channel recovery particularly using large timber controls to maintain bed level (bed sills), bank toe protection (timber bank revetment) and creation of scour pools by using 'forced' controls such as engineered log jams as an adjunct to revegetation of both banks of both watercourses.	All land above the North Wambo Underground Mine is owned by WCPL. Therefore there are no other affected landholders associated with the North Wambo Underground Mine Extraction Plan for Longwalls 8 to 10A. Advisian (2015) concluded it is unlikely Wambo Creek and Stony Creek would experience adverse impacts from the North Wambo Underground Mine, and mitigation measures are unlikely to be required. In the unlikely event that any mitigation measures are required, these would be developed in consultation with the Department of Planning and Environment and the NSW Office of Water, and would aim to incorporate natural processes for channel recovery.

Summary of Comments Received on the SWMP

Comment	Consideration of Comment
Department of Planning and Environment – 25 May 2017 and 5 July 2017	
Update the SWMP to reflect the modified layout for LWs 14-16 and the most up-to-date and recommended monitoring regime provided in Technical Report 3.	The SWMP has been revised to reflect the latest layout for LWs 14-16 (e.g. see Figure 3) and to reflect the monitoring regime recommended by Alluvium in Technical Report 3 of the Extraction Plan (see Section 4.1.7).
Replace Figure 3 with the approved longwall layout for LWs 11-16 (as approved by the Extraction Plan on 16 May 2017).	Figure 3 has been revised.
Provide evidenced of consultation with DRG and DPI-Water in relation to this version of the SWMP, and indicate how many matters raised have been addressed.	Section 1.5 and this Appendix have been revised to include further detail on consultation.
Replace Figure 4 with the location of the approved longwall layout for LWs 11-16. Include the location and labelling of surface waters.	Figure 4 has been revised to show the location of mapped alluvium in the lower reaches of the creeks over the latest approved underground mine layout.
Update Section 2.2.1 to include a discussion of the latest approved mining operations in the South Bates Underground Mine.	Section 2.2.1 has been revised to discuss the latest status of mining at Wambo.
Update Figure 5 and Table 5 to reflect the monitoring points approved in the Extraction Plan.	Figure 5 and Table 5 have been revised to show the latest monitoring locations.
Update the data summaries in Section 2.2.3 (Tables 6 & 7 and Figures 6 & 7) to include the last 3 years of data.	The data in Table 6 (Surface Water Quality Ranges) was used to generate the surface water impact assessment criteria. It is not considered appropriate to continue to update baseline data during mining operations, as it may skew the impact assessment criteria. Monitoring results during operations are presented in Annual Reviews. Notwithstanding, Table 7 has been revised to include more recent flow monitoring data.
Discuss the surface water quality impact criteria in Table 11 with the Department and DPI-Water.	The surface water impact assessment criteria for EC and TSS have been developed for low flow conditions based on 80th percentile of recorded concentrations and for high flow conditions based on maximum recorded concentrations. This is considered appropriate. The high salinity observed in the downstream section of North Wambo Creek (site SW05) was also observed in the 2003 Environmental Impact Statement for the Wambo Development Project. WCPL considers that the surface water quality impact assessment criteria in the SWMP are appropriate triggers for determining unanticipated changes to water quality at site SW05.
Indicate on Figure 5 and in Section 3.1 that the LDP is SW15.	Figure 5 and Section 3.1 have been revised.
Confirm the number and location of monitoring sites and make the information in Section 4.1, Table 13 and Figure 5 consistent.	Section 4.1, Table 13 and Figure 5 are now consistent.
Provide a summary of the bank and bed stability monitoring program applicable to the LW11 to 16 subsidence areas (Note: this may require an update of the programs in the FFMP).	The bed and bank stability monitoring program has been in operation at Wambo since 2006, and includes monitoring along natural creek lines (North Wambo Creek, Wambo Creek and Stony Creek) and the North Wambo Creek Diversion (including areas above Longwalls 11 to 16). Section 4.1.5 has been revised to refer to the latest Biodiversity Management Plan (which is proposed to address the requirements of the FFMP). Section 4.1.7 presents further detail on the specific monitoring that will occur for Longwalls 11 to 16.
Refer to actions above.	See above.
Provide a program to monitor the effectiveness of the ESCP.	Section 4.1.4 has been revised.

Comment	Consideration of Comment
DPI Water – 6 November 2015	
DPI Water notes that WCPL states that it currently holds two water access licences (WAL No. 23897 and 718) within the Wollombi Brook water source, however WAL 718 is within the Hunter Regulated River water source.	Section 1.4.4 has been revised to outline the surface water entitlements held by WCPL, including WAL 23897, WAL 718 and regulated river licences. Groundwater entitlements are described in the GWMP.
DPI Water requested further detail on the comments in Table 7 of the SWMP regarding "NA" and "No flow data available".	WCPL has included the following notes to Table 8 (previously Table 7) of the SWMP: *NA – Parameter not available in data summary records.* *No flow data available – Flow data not available due to damage to station or unreliable sensor responses.* WCPL has recently updated its data management procedures for the flow gauging stations to improve data capture and recording.
DPI Water recommends that SWMP performance indicators should include exceedance of the stream flow impact assessment criteria in addition to the "number of exceedances of surface water impact assessment criteria".	Footnote 1 to Table 12 has been revised as follows to clarify that the performance indicators refer to both the surface water quality and surface water flow impact assessment criteria: *An exceedance occurs when water quality results exceed the 80th Percentile Trigger Value after three consecutive sampling events or the surface flow impact assessment criteria are met (refer to SGWRP for TARP)*
DPI Water recommends that after detection of an exceedance during one surface water quality sampling event, the frequency of monitoring is increased to weekly and that contingency actions be implemented following two further exceedances. DPI Water notes that sampling could return to monthly once sampling indicates that parameters are within trigger levels.	The impact assessment criteria for surface water quality have been set based on the 20th and 80th percentile of the available dataset for each site. The surface water quality impact assessment criteria seek to identify persistent statistical variation from baseline data, and therefore there are triggers for two and three consecutive exceedances of the criteria. Initiating additional monitoring in response to one exceedance would add significant additional monitoring burden for reasonably regular events that could be associated with natural water quality variations. The majority of watercourses at Wambo are ephemeral, which also makes this recommendation impractical. Increasing monitoring frequency following two consecutive exceedances has been addressed in the SGWRP.
DPI Water notes that the nearest flow monitoring site downstream of Longwalls 11 to 13 on North Wambo Creek appears to be at the confluence to Wollombi Brook. DPI Water recommends that WCPL investigate options to install a flow monitoring site immediately downstream of the predicted area of subsidence in order to monitor accurately the surface water losses as a result of Longwalls 11 to 13 (and separate these losses from other sources).	WCPL has a monitoring site immediately downstream of Longwalls 11 to 13 (site FM3). The SWMP includes site FM3 in the monitoring program.

APPENDIX C
SUMMARY OF COMMITMENTS

Surface Water Monitoring Program – Summary of Commitments

SWMP Section	Commitment	Timing
Surface Water Monitoring Plan (SWMP) Version 12		
2.2.2.3	A copy of the North Wambo Creek baseline assessment to be provided to CLWD once complete.	April 2017
2.2.5	Continue monitoring at locations described in Table 5 and shown on Figure 5.	Ongoing
	Implement management measures in Section 2.2.5.1 to 2.2.5.4 to address the risk of hydrocarbon storage at the Locomotive Provisioning Facility	As required
	Complete monthly inspections, servicing and maintenance of the locomotive station along with visual inspections completed by locomotive drivers during refuelling	Monthly
	Replace absorbent spill control matting located between the tracks in the refuel area approximately every 18months or as required.	As Required
2.2.6	Refine and detail the design, capacity and final location of post mining water management structures in revised water management plans, as the mine progresses towards mine closure.	Towards mine closure
3.1	Mine water is discharged through the EPL 529 licensed discharge point, in accordance with the water quality discharge limits and requirements presented in Table 9	Ongoing
3.4	WCPL will report against the following performance indicators in the Annual Review : • Number of complaints relating to surface water; • Number of non-compliances relating to surface water; • Number of exceedances of surface water impact assessment criteria (as detailed in Tables 9 and 11); • Number of reportable environmental incidents relating to surface water.	Annually
4.0	Data collected will: • Be used in the continued development of surface water investigation triggers; and • Provide input to annual reviews of surface water monitoring data.	As required
4.1	Surface water monitoring will be conducted as outlined in Table 13.	Ongoing
	Monitoring results from creeks and waterways will be compared against the triggers in Section 3.	Ongoing
	The results of monitoring at the licenced discharge point will be compared against the EPL 529 criteria.	Following discharge
	Mine water monitoring is for operational purposes only and is not reported publicly.	Ongoing
4.1.1	Surface water quality monitoring will be conducted during flow periods, monthly and following more than 20mm of rainfall in 24hours.	As required
4.1.3	Data from the surface water monitoring is reported in the Annual Review.	Annually
4.1.4	Inspections of erosion and sediment control structures will be completed as outlined in the ESCP.	As required
4.1.5	Monitoring of riparian vegetation corridors and bed bank stability along North Wambo, South Wambo and Stony Creeks will be completed as outlined in the Biodiversity Management Plan (BMP).	Annually or as required
4.1.6	Monitoring and reporting of discharge flows in the North Wambo Creek Diversion (NWCD) will be completed in accordance with CLWD requirements and reported in the Annual Review.	Annually

SWMP Section	Commitment	Timing
4.1.7	The Diversion and Subsidence Monitoring Program (Table 14) will be implemented from 2017, the outcomes of which will inform recommendations to manage any identified issues with the condition of the NWCD.	As required
	Results of the operational monitoring program and the geomorphic condition of the NWCD will be reviewed annually.	Annually
	During implementation or mitigation rehabilitation works, records will be maintained including: • Description of activities; • Photographs (preferably from fixed photo points); and • Aerial photography within 12 months after works are completed.	Ongoing
4.1.9	WCPL will investigate any unexpected increase in water make or change in water quality of mine water storages and if warranted, commence direct measurement of water quality at the source of inflow.	As required
	Visual assessment of flows into the open cut workings will be completed during regular site inspections	Ongoing
4.3	Validated data from the monitoring program will be entered into a digital database by an Environmental Advisor.	Ongoing
4.4	Monitoring results will be compared to impact assessment criteria and if they do not met the criteria, a response procedure will be initiated.	Ongoing
5.0	Surface water related community complaints will be recorded within the Community Complaints Register.	As required
6.1	The performance of the surface water monitoring program will be reviewed annually by the E&C Manager	Annually
6.3	An Annual Return will be submitted to the EPA, comprising a certified Statement of Compliance and a signed Monitoring and Complaints Summary to the EPA	Annually
6.4	Surface water monitoring results will be made publicly available on WCPL website.	Monthly
6.5	All reportable incidents will be reported via the EPA's Environmental Line on 131 555 by the E&C Manager in accordance with WCPL's Pollution Incident Response Management Plan (PIRMP).	As required
6.5	Prepare investigation reports and implementation of corrective actions in accordance with Section 6.5.	As required

ATTACHMENT 3

WAMBO COAL PTY LIMITED
GROUNDWATER MONITORING PROGRAM

WAMBO COAL
GROUNDWATER MONITORING PROGRAM

Document No. WA-ENV-MNP-509.1
April 2018

DRAFT

Document Control

Document No.	WA-ENV-MNP-509.1
Title	Groundwater Monitoring Program
General Description	Groundwater Monitoring at WCPL
Document Owner	Environment & Community Manager

Revisions

Rev No	Date	Description	By	Checked	Signature
0	August 2005	Original Draft	AGE	JT/TS	
1	August 2005	Revision 1	AGE	JT/TS	
2	March 2006	Revision 2	WCPL	JT	
3	June 2007	Revision 3	WCPL	SW	
4	July 2008	Revision 4	WCPL	RP	
5	January 2010	Revision 5	WCPL	SB	
6	September 2014	Revision 6	GHD/WCPL	TF	
7	April 2015	Revision 7	WCPL	TF	
8	June 2015	Revision 8	WCPL	PJ/SB	
9	September 2015	New management plan format and revision	WCPL/Palaris	SP	
10	October 2015	Revised following receipt of comments from DP&E on Rev 9	WCPL/Palaris	SP	
11	July 2017	Revised to address DPE comments, submitted as a component of LW11-16 EP	WCPL		
12	April 2018	Revised to address CLWD and IESC comments following MOD17 approval	WCPL		

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LIST OF APPENDICES

1.0 Introduction

1.1 Background

The Wambo Coal Mine (the Mine) is situated approximately 15 kilometres west of Singleton, near the village of Warkworth, New South Wales (**Figure 1**). Wambo is owned and operated by Wambo Coal Pty Limited (WCPL), a subsidiary of Peabody Energy Australia Pty Limited.

Several open cut and underground mine operations have been conducted at WCPL since mining operations commenced in 1969. Mining under the current Development Consent (DA 305-7-2003) commenced in 2004 and permits both open cut, underground operations and associated activities to be conducted.

The approved run-of-mine (ROM) coal production rate is 14.7 million tonnes per annum (Mtpa) and all product coal is transported from WCPL by rail. A summary of the approved Wambo Coal Mine is provided in **Table 1**.

Table 1: Summary of the Approved Wambo Coal Mine components

Component	Approved Wambo Coal Mine[1,2]
Life of Mine	Wambo Coal may carry out mining operations at the Wambo Mining Complex until 31 December 2039, except for open cut coal extraction, which may only be undertaken until 31 December 2020.
Open Cut Mining	Open cut mining at a rate of up to 8 Mtpa of ROM coal from the Whybrow, Redbank Creek, Wambo and Whynot Seams
	An estimated total open cut ROM coal reserve of 98 million tonnes (Mt)
	Open cut mining operations under current approved Mining Operations Plan (MOP)
	Open cut mining operations up to 31 December 2020
Underground Mining	Underground mining of up to 9.75 Mtpa of ROM coal from the Whybrow, Wambo, Woodlands Hill and Arrowfield Seams. Underground ROM coal reserves are estimated at 161.3 Mt. Underground mining operations up to 31 December 2039
Subsidence commitments and management.	The subsidence performance measures listed in Conditions 22 and 22A of the Development Consent (DA305-7-2003).
ROM Coal Production Rate	Up to 14.7 Mtpa of ROM coal
Total ROM Coal Mined	259.3 Mt
Waste Rock Management	Waste rock deposited in open cut voids and in waste rock emplacements adjacent open cut operations
Total Waste Rock	640 million bank cubic metres (Mbcm)
Rail and Train Loading Infrastructure	Construction and operation of a rail spur, rail loop, coal reclaim area, product coal conveyor and train load out bin to enable the transport of coal (DA 177-8-2004)
Coal Washing	Coal handling and preparation plant (CHPP) capable of processing approximately 1,800 tonnes per hour (tph)
Product Coal	Production of up to 11.3 Mtpa of thermal coal predominantly for export
CHPP Reject Management	Coarse rejects and tailings would be incorporated, encapsulated and/or capped within open cut voids in accordance with existing Wambo management practices
Total CHPP Rejects	Approximately 40.3 Mt of coarse rejects and approximately 24.5 Mt of tailings
Water Supply	Make-up water demand to be met from runoff recovered from tailings storage areas, operational areas, dewatering, licensed extraction from Wollombi Brook and Hunter River
Mining Tenements	Coal Lease (CL) 365, CL374, CL397, Consolidated Coal Lease (CCL) 743, Mining Lease (ML) 1402, ML1572, ML1594, Authorisation (A) 444, Exploration Licence (EL) 7211.

Note: [1] Development Consent DA305-7-2003 (as modified December 2017) [2] Development Consent DA177-8-2004

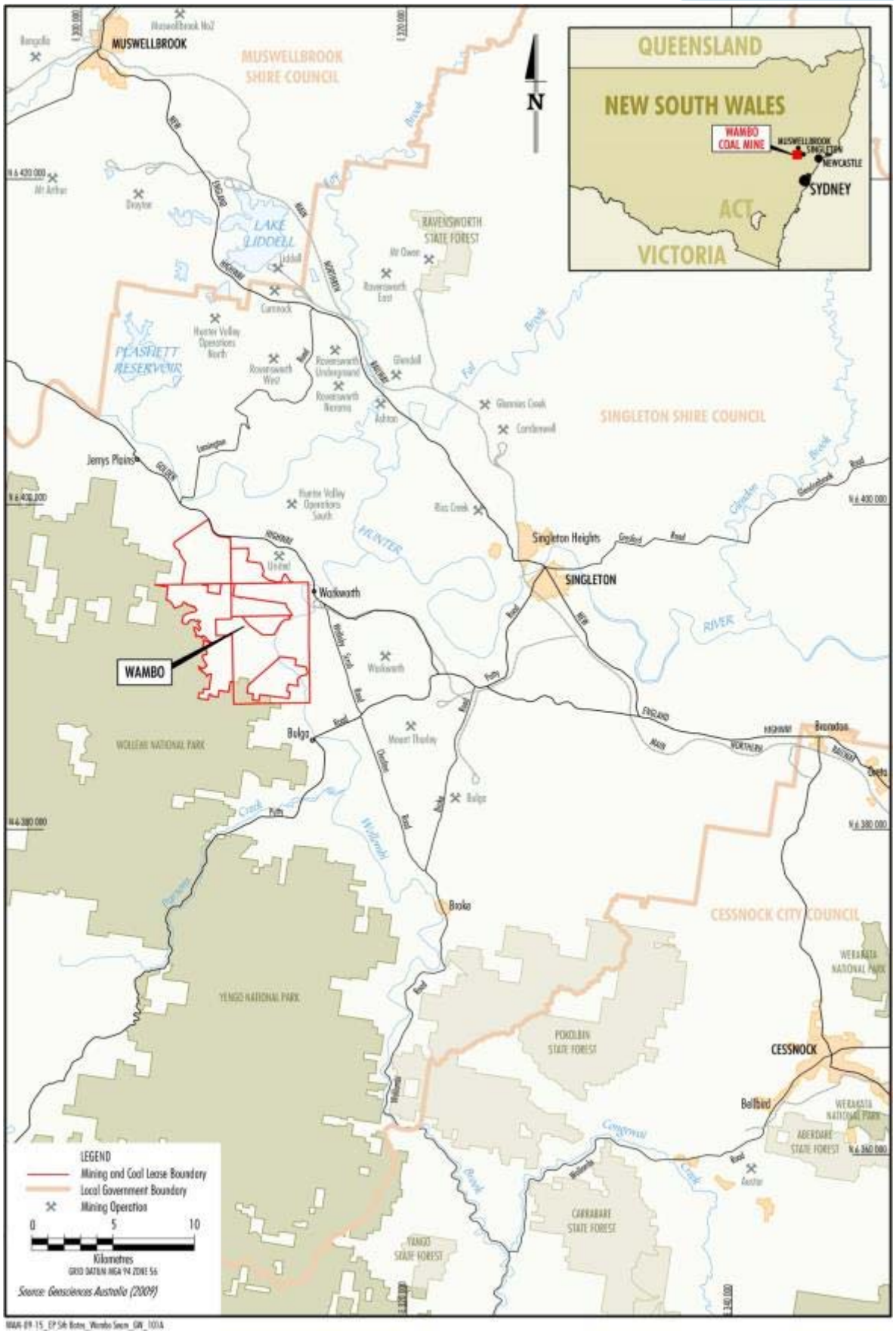


Figure 1: Wambo Coal Regional Location

In accordance with Schedule 4, Condition 30 of DA305-7-2003, WCPL are required to prepare a Site Water Management Plan (SWMP). This Groundwater Monitoring Program (GWMP) is a component of the WCPL Site Water Management Plan. **Figure 2** shows the components of the WCPL Site Water Management Plan. This GWMP should be read in conjunction with the other components of the WCPL Site Water Management Plan, in particular the Surface and Ground Water Response Plan (SGWRP).

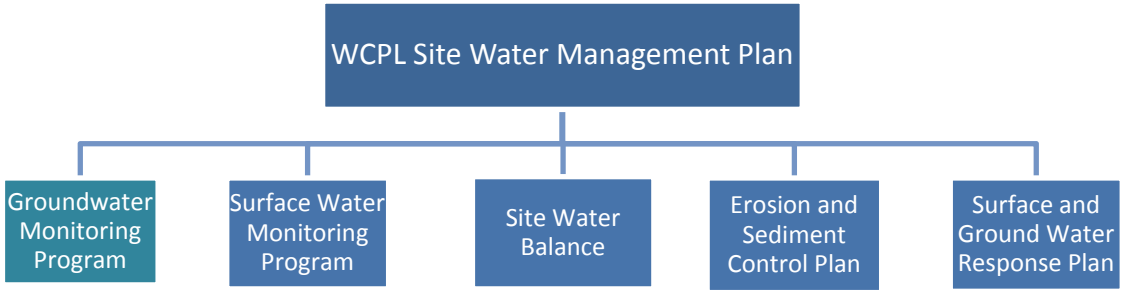


Figure 2: WCPL Site Water Management Plan

In accordance with WCPL's continuous improvement and review processes and Conditions 4 & 6, Schedule 6 of DA305-7-2003, a review of the GWMP has been undertaken to ensure that groundwater monitoring at the Mine continues to be undertaken in a manner that ensures compliance and that groundwater impacts from the Mine are minimised where possible.

1.2 Purpose

This GWMP has been developed to address the relevant requirements of DA305-7-2003. In accordance with Condition 34, Schedule 4 of DA305-7-2003, WCPL have prepared this GWMP to provide:

- Detailed baseline data on groundwater levels and quality, based on statistical analysis, to benchmark the pre-mining natural variation in groundwater levels and quality;
- Groundwater impact assessment criteria;
- A comprehensive and detailed program to monitor the volume and quality of groundwater seeping into the open cut and underground mining workings;
- A detailed program to monitor regional groundwater levels and quality in the alluvial and overburden aquifers; and
- A program to investigate and monitor potential water loss from the Chitter Dump Dam and South Wambo Dam (also known as Wambo South Water Dam), and Montrose East Dam (not yet constructed), including potential migration of stored water toward Wollombi Brook.

The GWMP has also been prepared in accordance with Schedule 6, Condition 4 of DA305-7-2003. There are no conditions relevant to groundwater monitoring in DA177-8-2004 or WCPL's Environment Protection Licence (EPL) 529.

1.3 Scope

This GWMP applies to all groundwater monitoring activities undertaken within WCPL's mining authorisations and approved mining areas (**Figure 3**) as well as regional groundwater bores. This GWMP has been prepared to monitor groundwater impacts from the Mine on local groundwater systems. This GWMP forms part of WCPL's Environmental Management System (EMS).

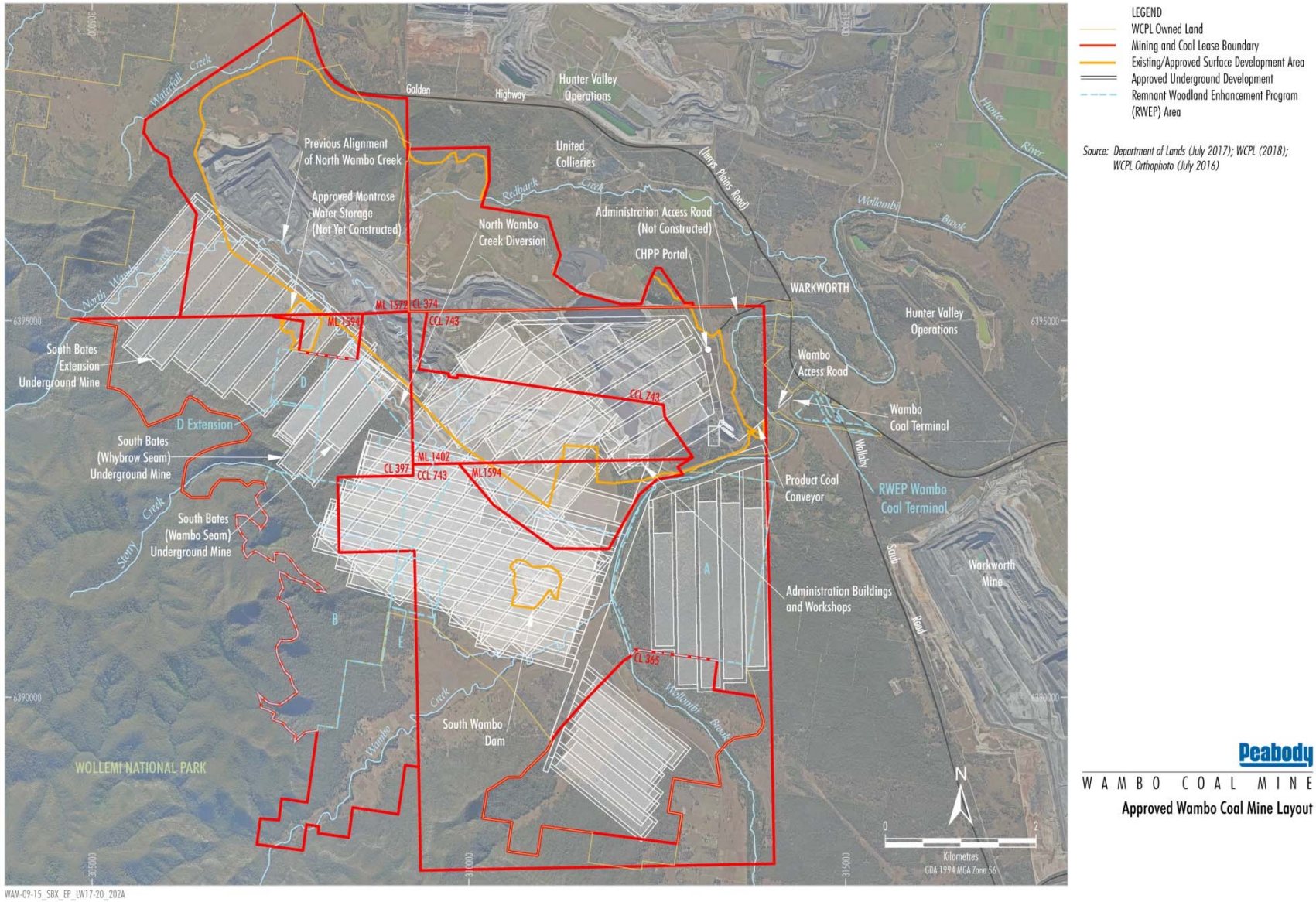


Figure 3: Approved Wambo Coal Mine Layout

1.4 Statutory Requirements

This GWMP has been prepared to fulfil the requirements of DA305-7-2003 and various groundwater licences (**Table 2** and **Table 3**). There are no conditions relevant to groundwater monitoring or management in DA177-8-2004 or WCPL's EPL 529.

1.4.1 Environmental Planning & Assessment Act 1979

WCPL received Development Consent (DA305-7-2003) in accordance with the *Environmental Planning & Assessment Act 1979* (EP&A Act) from the NSW Department of Planning and Environment (DP&E), formerly NSW Department of Planning, on 4 February 2004. Conditions within DA305-7-2003 relevant to groundwater monitoring at the Mine are summarised in **Table 2**.

Table 2: DA305-7-2003 Requirements for the Groundwater Monitoring Program

Schedule	Condition	DA 305-7-2003	GWMP Section
4	29	The applicant must: … (e) monitor regional ground water levels and quality in the alluvial and overburden aquifers during the development and at least 10 years after mining; and	**Section 4.1.1**
		(f) periodically assess groundwater pressure response in the coal measures; to the satisfaction of the EPA, CLWD and the Secretary.	**Section 4.4**
4	30	Before carrying out any development, the Applicant must prepare a Site Water Management Plan for the development in consultation with DRE and CLWD, and to the satisfaction of the Secretary. This plan must include: … (f) a Ground Water Monitoring Program;	**This GWMP**
4	34	The Ground Water Monitoring Program must include: (a) detailed baseline data on ground water levels and quality, based on statistical analysis, to benchmark the pre-mining natural variation in groundwater levels and quality;	**Section 2.0**
		(b) ground water impact assessment criteria;	**Section 2.1.7**
		(c) a comprehensive and detailed program to monitor the volume and quality of ground water seeping into the open cut and underground mining workings;	**Sections 4.1.4 and 4.1.5**
		(d) a detailed program to monitor regional ground water levels and quality in the alluvial and overburden aquifers; and	**Section 4.1.1**
		(e) a program to investigate and monitor potential water loss from the Chitter Dump Dam and South Wambo Dam, and Montrose East Dam, including potential migration of stored water toward Wollombi Brook.	**Section 4.1.6**
4	34A	Prior to submitting the first Extraction Plan for the Longwall Domains, the Applicant must revise the Groundwater Monitoring Program to: (a) include the installation of paired monitoring bores for the South Wambo Underground Mine, in consultation with CLWD, to assess potential fracture interconnections between surface water resources, alluvial and hardrock aquifers; and (b) provide detailed information on the groundwater levels within the alluvial and hardrock aquifers within the Longwall Domains.	**Table 8** (P316, P319, P320) **Prior to South Wambo Underground**
4	34B	Within 3 months of the approval of Modification 17, or as otherwise agreed with the Secretary, the Applicant must revise the Groundwater Monitoring Program, in consultation with CLWD, to include the installation of: (a) clustered monitoring bores for the South Bates Extension Area, located in proximity to the Hunter Lowland Redgum Forest along North Wambo Creek, and characterise the geological and hydrogeological systems in the vicinity of this vegetation community, including an assessment of the presence and extent of any shallow groundwater; and (b) monitoring vibrating wire piezometers, located above the South Bates Extension Area, both within and beyond the areas with potential for	**Table 8** (GW23, GW 24, GW25, GW26) **Table 8** (P317, UG139)

Schedule	Condition	DA 305-7-2003	GWMP Section
		connective cracking. The Applicant must complete the installation of the bores and piezometers required under this condition and establish a program to continually monitor them within 12 months of the Secretary's approval of the revised Ground Water Monitoring Program.	
4	36A	Within 12 months of the approval of Modification 17, or as otherwise agreed with the Secretary, the Applicant must commission and provide to the Secretary for approval, a Groundwater Dependent Ecosystem Study report. This study must: (a) be prepared by suitably qualified and experienced person/s whose appointment has been endorsed by the Secretary; (b) be developed in consultation with CLWD; (c) adopt any available data collected from the revised Ground Water Monitoring Program; (d) provide advice on the likely level of groundwater dependence of the vegetation in the South Bates Extension Area given current groundwater levels and expert knowledge of the vegetation communities in the region; (e) in the event it is considered that vegetation communities in the vicinity of the South Bates Extension Area are groundwater dependent (either entirely or partially), provide advice on the likelihood that subsidence associated with the South Bates Extension Area could cause adverse impacts and how any such impacts would manifest; (f) consider to what degree the cumulative impacts of adjacent mining operations may have already impacted groundwater dependent vegetation across the South Bates Extension Area; (g) provide any recommendations regarding the revised Ground Water Monitoring Program required under condition 34B, and in particular provide any recommendations that would assist in assessing the potential fracture interconnections between surface water resources and hard rock aquifers that may impact on groundwater dependent vegetation; and (h) include a management and/or remediation program that describes measures that could be implemented to ensure compliance with the performance measures in Table 14A for any groundwater dependent endangered ecological community.	**By December 2018**
4	36B	The Applicant must take into account the findings of the Groundwater Dependent Ecosystem Study and not less than 2 years of monitoring results obtained under condition 34B in the preparation of any Extraction Plan for Longwalls 23 – 25.	**2 years prior to the development of EP for LW23-25**
6	3	**Adaptive Management** The Applicant must assess and manage project-related risks to ensure that there are no exceedances of the criteria and/or performance measures in schedule 4. Any exceedance of these criteria and/or performance measures constitutes a breach of this consent and may be subject to penalty or offence provisions under the EP&A Act or EP&A Regulation. Where any exceedance of these criteria and/or performance measures has occurred, the Applicant must, at the earliest opportunity: (a) take all reasonable and feasible steps to ensure that the exceedance ceases and does not recur; (b) consider all reasonable and feasible options for remediation (where relevant) and submit a report to the Department describing those options and any preferred remediation measures or other course of action; and (c) implement remediation measures as directed by the Secretary, to the satisfaction of the Secretary.	**Refer SGWRP**
6	4	**Management Plan Requirements** The Applicant must ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include: (a) detailed baseline data; (b) a description of: - the relevant statutory requirements (including any relevant consent, licence or lease conditions); - any relevant limits or performance measures/criteria;	**Section 2.0** **Section 1.4** **Section 3.3**

Schedule	Condition	DA 305-7-2003	GWMP Section
		- the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;	**Section 3.3**
		(c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/ criteria;	**Section 4.0**
		(d) a program to monitor and report on the: - impacts and environmental performance of the Wambo Mining Complex;	**Sections 4.0 and 6.0**
		- effectiveness of any management measures (see c above);	
		(e) a contingency plan to manage any unpredicted impacts and their consequences;	**Refer SGWRP**
		(f) a program to investigate and implement ways to improve the environmental performance of the Wambo Mining Complex over time;	**Section 6.2**
		(g) a protocol for managing and reporting any: - incidents;	**Section 6.4**
		- complaints;	**Section 5.0**
		- non-compliances with statutory requirements; and	**Refer SGWRP**
		- exceedances of the impact assessment criteria and/or performance criteria; and	**Refer SGWRP**
		(h) a protocol for periodic review of the plan.	**Section 6.1**

1.4.2 Water Act 1912

The *Water Act 1912* governs access, trading and allocation of licences associated with both surface and underground water for water sources where a Water Sharing Plan (WSP) has not commenced. The elements to which the *Water Act 1912* applies include extraction of water from a river, extraction of water from underground sources, aquifer interference and capture of surface runoff in dams.

The Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources (NFPR WSP) commenced for the Permian and Triassic hard-rock units on 1 July 2016. WCPL's licences under the Water Act 1912 are in the process of being converted to licences under the *Water Management Act 2000*.

1.4.3 Water Management Act 2000

The *Water Management Act 2000* (WM Act) is intended to ensure that water resources are conserved and properly managed for sustainable use benefitting both present and future generations. It is also intended to provide formal means for the protection and enhancement of the environmental qualities of waterways and their in-stream uses as well as to provide for protection of catchment conditions.

An amendment to the WM Act (section 60I) came into effect on 1 March 2013. This amendment provides that it is *an offence for a person without an access licence to take, remove or divert water from a water source, or relocate water from one part of an aquifer to another part of an aquifer, in the course of carrying out a mining activity.* Various activities are captured by the provisions of the amendment including mining, mineral exploration and petroleum exploration.

The area covered by this GWMP is located within the Water Sharing Plan (WSP) area for the Hunter Unregulated and Alluvial Water Sources (HUA WSP), which commenced in August 2009 and regulates the interception and extraction of surface water and alluvium within the defined WSP area. Any interference and extraction of alluvial groundwater throughout the GWMP area generally requires a water access licence (WAL) under the WM Act.

The NFPR WSP commenced on 1 July 2016. This WSP regulates the interception and extraction of water from the Permian and Triassic hard-rock units, including coal seams. **Table 3** includes a list of groundwater entitlements held by WCPL. Surface water entitlements are outlined in the SWMP.

Table 3: WCPL Groundwater Entitlement and Licences

Licence Number	Description	Expiry Date	Entitlement	Category	Nominated Work	Expiry date	Comment
Hunter Unregulated and Alluvial Water Sources (Lower Wollombi Brook Water Source)							
WAL 23897 (20BL167737)	Well No. 2	Perpetuity	70 unit shares	Aquifer	20WA211372	31/7/2022	-
North Coast Fractured and Porous Rock Groundwater Sources (Sydney Basin - North Coast Groundwater Source)							
WAL 39735 (20BL168643)[1]	Dewatering Bore	Perpetuity	40 unit shares	Aquifer	20MW065010	-	-
WAL 39738 (20BL132753)1	Old Well No. 1	Perpetuity	243 unit shares	Aquifer	20MW065010	-	-
WAL 39803 (20BL166910)1 (20BL173032)1 (20BL173033)1 (20BL173034)1 (20BL173035)1	Dewatering (Bore No. 1)	Perpetuity	450 unit shares	Aquifer	20MW065010	-	-
WAL41494 (20BL168017)[1] (20BL172061)[#1] (20BL173040)[1]	Dewatering (Bore No. 2 and 2a)	Perpetuity	750 unit shares	Aquifer	20MW065010	-	WaterNSW to confirm conversion status and release WAL. DoI Water to confirm nominated work number.
WAL41532 (20BL172156)[1]	Dewatering	Perpetuity	98 unit shares	Aquifer	20MW065010	-	-
WAL41528 20BL167738[#1]	Dewatering Bore	11/09/15	57 ML/year	NA	20MW065010	-	-
WAL41520 20BL173844[1]	Dewatering Bore	Perpetuity	9 unit shares	Aquifer	20MW065010	-	-
20BL168997	Piezometer	Perpetuity	Groundwater monitoring	NA	-	-	DoI Water to confirm conversion status.
20BL168998	Piezometer	Perpetuity	Groundwater monitoring	NA	-	-	DoI Water to confirm

Licence Number	Description	Expiry Date	Entitlement	Category	Nominated Work	Expiry date	Comment
							conversion status.
20BL168999	Piezometer	Perpetuity	Groundwater monitoring	NA	-	-	DoI Water to confirm conversion status.
20BL169000	Piezometer	Perpetuity	Groundwater monitoring	NA	-	-	DoI Water to confirm conversion status.
20BL170638	Piezometer	Perpetuity	Groundwater monitoring	NA	-	-	DoI Water to confirm conversion status
20BL172237	Monitoring Bore (GW14, GW18, GW21)	Perpetuity	Groundwater monitoring	NA	-	-	DoI Water to confirm conversion status.
20BL172238	Monitoring Bore (GW12)	Perpetuity	Groundwater monitoring	NA	-	-	DoI Water to confirm conversion status.
20BL172240	Monitoring Bore (GW15)	Perpetuity	Groundwater monitoring	NA	-	-	DoI Water to confirm conversion status.
20BL172242	Monitoring Bore (GW16, GW17)	Perpetuity	Groundwater monitoring	NA	-	-	DoI Water to confirm conversion status.
20BL172244	Monitoring Bore (GW20)	Perpetuity	Groundwater monitoring	NA	-	-	DoI Water to confirm conversion status.
20BL172255	Monitoring Bore (GW22)	Perpetuity	Groundwater monitoring	NA	-	-	DoI Water to confirm conversion status.
20BL172256	Monitoring Bore (GW13)	Perpetuity	Groundwater monitoring	NA	-	-	DoI Water to confirm conversion status.
20BL172257	Monitoring Bore (GW19)	Perpetuity	Groundwater monitoring	NA	-	-	DoI Water to confirm conversion status.
20BL172332	Piezometer	Perpetuity	Groundwater monitoring	NA	-	-	DoI Water to confirm conversion status.
20BL173032	Monitoring		Groundwater monitoring	NA		30 Nov 2021	-
20BL173290	Monitoring Bore	Perpetuity	Groundwater monitoring	NA	-	-	DoI Water o confirm conversion status.
20BL173291	Monitoring Bore	Perpetuity	Groundwater monitoring	NA	-	-	DoI Water to confirm conversion status.
20BL173292	Monitoring Bore	Perpetuity	Groundwater monitoring	NA	-	-	DoI Water to confirm conversion status.
20BL173293	Monitoring Bore	Perpetuity	Groundwater monitoring	NA	-	-	DoI Water to confirm conversion status.
20BL173946	Monitoring	Perpetuity		NA			
20BL009818	Bore	Perpetuity	Stock	NA	-	-	DoI Water to confirm conversion status.
20BL009819	Bore	Perpetuity	Stock	NA	-	-	DoI Water to confirm conversion status.

Licence Number	Description	Expiry Date	Entitlement	Category	Nominated Work	Expiry date	Comment
20BL009820	Bore	Perpetuity	Stock	NA	-	-	DoI Water to confirm conversion status.
20BL009821	Bore	Perpetuity	Stock	NA	-	-	DoI Water to confirm conversion status.
20BL143779	Bore	Perpetuity	Stock/Domestic	NA	-	-	DoI Water to confirm conversion status.

WAL = water access licence, ML/year = megalitres per year. Former licence numbers

Renewal lodged.

1. In mid-2015, WCPL applied to the Department of Primary Industries – Water (DPI-Water) (now DoI Water) to combine all of its groundwater licences that contained an extraction entitlement into a single licence. The purpose of this licence was to streamline mining activities and simplify the reporting of extraction against licensed entitlements. As such, WCPL was licensed to extract a total of 1,647 ML from all groundwater sources under the *Water Act 1912*. This combined licence was confirmed to be active by DPI-Water in correspondence received on the 18 February 2016, the status of its' conversion to licences under the *Water Management Act 2000* is yet to be advised by DPI-Water.

20BL prefix bore licences are no longer valid and those with allocations are being replaced with Water Access Licences (WALs).

1.4.4 Hunter Unregulated and Alluvial Water Sources Sharing Plan

The HUA WSP includes the unregulated rivers and creeks and alluvial groundwater within the Hunter region and is categorised into four extraction management units (EMUs) and further broken down into water sources. The area covered by the WSP includes 39 surface water and alluvial groundwater sources.

Wambo is located predominantly within the Lower Wollombi Brook water source. At the commencement of the WSP in August 2009, the groundwater (alluvial) entitlement within the Lower Wollombi Brook water source was 5,071 megalitres per year (ML/year) shared between 38 licences. WCPL currently holds one alluvial aquifer licence (WAL 23897, Licence 20AL211371, 70 shares) within the Lower Wollombi Brook water source of the HUA WSP as shown in **Table 3**. Surface water entitlements held by WCPL are outlined in the Surface Water Monitoring Program.

1.4.5 North Coast Fractured and Porous Rock Groundwater Sources

WCPL's licences under the *Water Act 1912* are in the process of being converted to licences under the NFPR WSP, which commenced on 1 July 2016. Although physical conversion of some of the licences has not yet occurred, DoI Water has confirmed that WCPL holds 1,647 ML of entitlements under the NFPR WSP.

1.4.6 Policies

1.4.6.1 NSW Aquifer Interference Policy

The NSW Aquifer Interference Policy (AIP) was finalised in September 2012 and clarifies the water licensing and approval requirements for aquifer interference activities in NSW, including the taking of water from an aquifer in the course of carrying out mining. Many aspects of this Policy will be given legal effect in the future through an Aquifer Interference Regulation. Stage 1 of the Aquifer Interference Regulation commenced on 30 June 2011.

This Policy outlines the water licensing requirements under the *Water Act 1912* and WM Act:

A water licence is required whether water is taken for consumptive use or whether it is taken incidentally by the aquifer interference activity (such as groundwater filling a void) even where that water is not being used consumptively as part of the activity's operation.

Under the WM Act, a water licence gives its holder a share of the total entitlement available for extraction from the groundwater source. The WAL must hold sufficient share component and water allocation to account for the take of water from the relevant water source at all times.

Sufficient access licences must be held to account for all water taken from a groundwater or surface water source as a result of an aquifer interference activity, both for the life of the activity and after the activity has ceased. Many mining operations continue to take water from groundwater sources after operations have ceased. This take of water continues until an aquifer system reaches equilibrium and must be licensed.

The AIP requires that potential impacts on groundwater sources, including their users and Groundwater Dependent Ecosystems (GDEs), be assessed against minimal impact considerations, outlined in Table 1 of the Policy. If the predicted impacts are less than the Level 1 minimal impact considerations, then these impacts will be considered as acceptable.

The Level 1 minimal impact considerations for less productive groundwater sources are relevant to the groundwater sources at Wambo and are as follows:

- **Water table**: less than or equal to 10% cumulative variation in the water table, allowing for typical climatic 'post-water sharing plan' variations, 40 m from any high priority groundwater dependent ecosystem or high priority culturally significant site listed in the schedule of the relevant WSP. A maximum of a 2 m decline cumulatively at any water supply work unless make good provisions should apply.
- **Water pressure**: a cumulative pressure head decline of not more than 40% of the 'post-water sharing plan' pressure head above the base of the water source to a maximum of a 2 m decline at any water supply work.
- **Water quality**: any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity. For alluvial water sources, there should be no increase of more than 1% per activity in the long-term average salinity in a highly connected surface water source at the nearest point to the activity.

1.4.6.2 NSW State Groundwater Policy

The objective of the NSW State Groundwater Policy Framework Document (NSW Government 1997) is to manage the State's groundwater resources so that they can sustain environmental, social and economic uses for the people of NSW. NSW groundwater policy has three component parts:

- NSW Groundwater Quantity Protection Policy.
- NSW Groundwater Quality Protection Policy.
- NSW Groundwater Dependent Ecosystems Policy.

The principles of the NSW Groundwater Quantity Protection Policy include:

- Maintain total groundwater use within the sustainable yield of the aquifer from which it is withdrawn;
- Groundwater extraction shall be managed to prevent unacceptable local impacts; and
- All groundwater extraction for water supply is to be licensed. Transfers of licensed entitlements may be allowed depending on the physical constraints of the groundwater system.

The criteria and management plan developed as part of this document will seek to follow the principles of this policy.

The objective of the NSW Groundwater Quality Protection Policy is the ecologically sustainable management of the State's groundwater resources so as to:

- Slow and halt, or reverse any degradation in groundwater resources;
- Direct potentially polluting activities to the most appropriate local geological setting so as to minimise the risk to groundwater;

- Establish a methodology for reviewing new developments with respect to their potential impact on water resources that will provide protection to the resource commensurate with both the threat that the development poses and the value of the resource; and
- Establish triggers for the use of more advanced groundwater protection tools such as groundwater vulnerability maps or groundwater protection zones.

Groundwater triggers will be developed as part of this management plan where they will seek to follow the objectives of this policy.

The NSW Groundwater Dependent Ecosystem Policy was designed to protect ecosystems which rely on groundwater for survival so that, wherever possible, the ecological processes and biodiversity of these dependent ecosystems are maintained or restored for the benefit of present and future generations.

1.4.7 Guidelines

1.4.7.1 Draft Groundwater Monitoring Guidelines

The former NSW Department of Infrastructure, Planning and Natural Resources (DIPNR) developed the 'Draft Groundwater Monitoring Guidelines for Mine Sites within the Hunter Region' in September 2003. This draft guideline is still used by DoI Water as the benchmark for groundwater monitoring programs at mine sites within the Hunter Region.

1.5 Stakeholder Consultation

Several applications to modify DA 305-7-2003 were sought and approved by the DP&E in June and August 2009, for the construction of the Chitter Dam and Wambo South Water Dam respectively. To address additional consent requirements resulting from the recent approved modifications, a review of the GWMP was completed in May 2015. The GWMP was then revised to reflect the new WCPL management plan format in September 2015.

In accordance with Conditions 22C and 30, Schedule 4 of DA 305-7-2003, the GWMP has been prepared in consultation with DoI Water (formerly NOW, DPI-Water & CLWD), NSW Division of Resources and Geoscience (DRG, formerly the Division of Resources and Energy [DRE]) and the Environment Protection Authority (EPA), prior to submitting to the Secretary of the DP&E for approval.

Consultation on recent versions of the GWMP has included:

- Version 9 of the GWMP provided to DPI Water, DRE, EPA and DP&E as part of an Extraction Plan submission in October 2015;
- Comments received from DP&E on Version 9 of the GWMP in October 2015;
- Version 10 of the GWMP approved by DP&E in November 2015;
- Comments received from DPI Water on Version 9 of the GWMP in November 2015;
- Version 10 of the GWMP provided to DPI Water and EPA in December 2016 for consultation;
- Version 10 of the GWMP was provided to DPI Water, DRG, EPA and DP&E as part of an Extraction Plan submission in January 2017;

- Comments received from DP&E on Version 10 of the GWMP in May 2017 and July 2017. No comments were received from DPI Water, DRG or EPA on Version 10 of the GWMP.

Revision 11 of the GWMP included:

- Updating the format and layout of the GWMP, consistent with WCPL's current document management procedures and templates;
- Reflecting the latest underground mine layout; and
- Addressing comments received from DPI Water (Revisions 8 and 9) and DP&E (Revision 10) on the GWMP.

Version 11 of the SWMP was submitted to DP&E for approval as a component of the Extraction Plan for South Bates Underground LW11-16. Following receipt of the Extraction Plan in January 2017, CLWD provided comments on the SWMP in correspondence dated 17 December 2017. In addition, in providing advice on MOD 17 to DA 305-7-2003, the Independent Expert Scientific Committee (IESC) made comments on the SWMP in correspondence dated 31 July 2017. This review of the GWMP (Revision 12) addresses those comments.

Correspondence in relation to the GWMP is attached as **Appendix B**. A summary of how comments from DoI Water, the IESC and DP&E have been addressed in this GWMP is also provided in **Appendix B**.

2.0 Groundwater Conditions

2.1 Baseline conditions

Baseline conditions are defined by the constant (at the timescale relevant to the project) environmental framework (geology, geomorphology etc.) and circumstances controlled by climatic conditions manifest in records up to September 2014 for rainfall and stream flows, and to April 2015 for groundwater levels and groundwater quality. Climate and borefield information included in analyses up to September 2014, while part of this categorisation, is also available for ongoing (post baseline) analyses. Given the commencement of mining operations at the Mine in 1969, and the proximity of laterally and vertically adjacent mining by other companies, no true baseline is possible in the sense of defining “pre-mining” conditions.

2.1.1 Landforms and Watercourses

Wambo is located in the Upper Hunter Valley where the landform is characterised by gently sloping floodplains of the Hunter River and its tributaries and the undulating foothills, ridges and escarpments of the Mount Royal Range and Great Dividing Range (Heritage Computing, 2012).

Elevations in the vicinity of Wambo range from approximately 60 metres (m) Australian Height Datum (AHD) at Wollombi Brook to approximately 650 m AHD at Mount Wambo within the Wollemi National Park to the west of Wambo.

Watercourses in the vicinity of Wambo Mine include Wollombi Brook, North Wambo Creek, (South) Wambo Creek, Stony Creek, Longford Creek and Doctors Creek. These creeks are tributaries of the Hunter River. North Wambo Creek has been diverted in accordance with the approved modification to its development consent (DA305-7-2003 MOD 5). The locations of these watercourses are shown in **Figure 3 (Section 2.1.4).**

2.1.2 Rainfall

A continuous daily rainfall dataset was obtained as SILO Patched Point Data from the Queensland Climate Change Centre of Excellence (QCCCE), which is based on historical data from a particular Bureau of Meteorology (BoM) station with missing data ‘patched’ in from interpolations from nearby stations. SILO data was obtained for the BoM Jerry’s Plains Post Office Station (station number 61086). Daily rainfall records from January 1901 to September 2014 were utilised.

Key statistics for the rainfall dataset are as follows:

- Minimum annual rainfall – 316.3 mm in 1957.
- Average annual rainfall – 648.5 mm.
- Median annual rainfall – 658.6 mm.
- Maximum annual rainfall – 1191.2 mm in 1950.

Monthly rainfall averages ranged from 36.9 mm in August to 76.2 mm in January.

The SILO dataset was also used to generate a Cumulative Rainfall Departure (CRD) curve. CRD is the monthly accumulation of the difference between the observed monthly rainfall and long-term average monthly rainfall.

The CRD over the period 1901 to 2014 is shown in **Figure 4**. Any increase in the CRD reflects above average rainfall while a decrease in CRD reflects below average rainfall. The CRD curve only deviates from zero due to atypical (above and below average) rainfall. The most prominent features are a severe drought from the mid-1930s to the late-1940s, with alternating wet and dry periods since 1969 when mining commenced; there is little evidence of the Millennium Drought after 2000.

While the CRD is a simple indicator of climate trends, it also provides an opportunity for conceptualising the dependence of groundwater levels on rainfall or other mechanisms. Where rainfall recharge is significant, a good correlation between a groundwater hydrograph and the CRD curve can be expected. Deviations from the correlation, over time, can be indicative of mining effects.

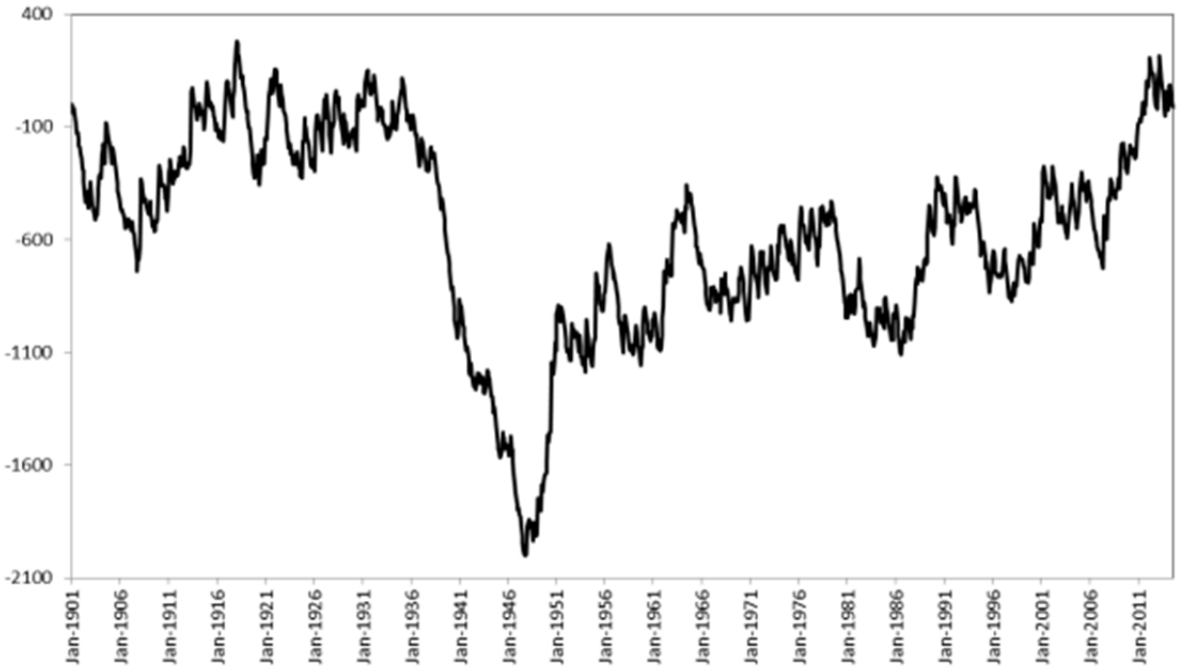


Figure 4: CRD Curve for Jerry's Plains Post Office (1901-2014)*

*(Latest available data to 17 Apr 2014)

2.1.3 Geology

Wambo is located in the Hunter Coalfield, which occupies the north-eastern portion of the Sydney Basin. The area covered by the GWMP is underlain by the Permian Singleton Coal Measures as well as Quaternary alluvial sediments along watercourses. This is underlain by the Permian Maitland Group which consists of siltstone, sandstone and conglomerate.

The stratigraphy at Wambo is summarised in **Table 4**. This information has been sourced from the Hunter Coalfield Regional Geology 1:100,000 map (NSW Department of Mineral Resources, Edition 2, 1993). The target coal seams at Wambo are all within the Jerry's Plains Subgroup of the Wittingham Coal Measures.

Table 4: Stratigraphic Sequence

Period	Supergroup	Group	Subgroup	Lithology
Quaternary				Alluvium
Permian	Singleton	Newcastle	Glen Gallic Subgroup	

Period	Supergroup	Group	Subgroup	Lithology
	Supergroup	Coal Measures (Wollombi Coal Measures)	Doyle's Creek Subgroup	
			Horseshoe Creek Subgroup	
			Apple Tree Flat Subgroup	
			Watts Sandstone	Medium to coarse-grained sandstone
		Wittingham Coal Measures	Denman Formation	Sandstone siltstone laminite
			Jerry's Plains Subgroup	Whybrow Seam Redbank Creek Seam Wambo Seam Whynot Seam Blakefield Seam Woodlands Hill Seam Arrowfield Seam Bowfield Seam
			Archerfield Sandstone	Well sorted quartz lithic sandstone
			Vane Subgroup	
			Saltwater Creek Formation	Sandstone, siltstone, minor coaly bands

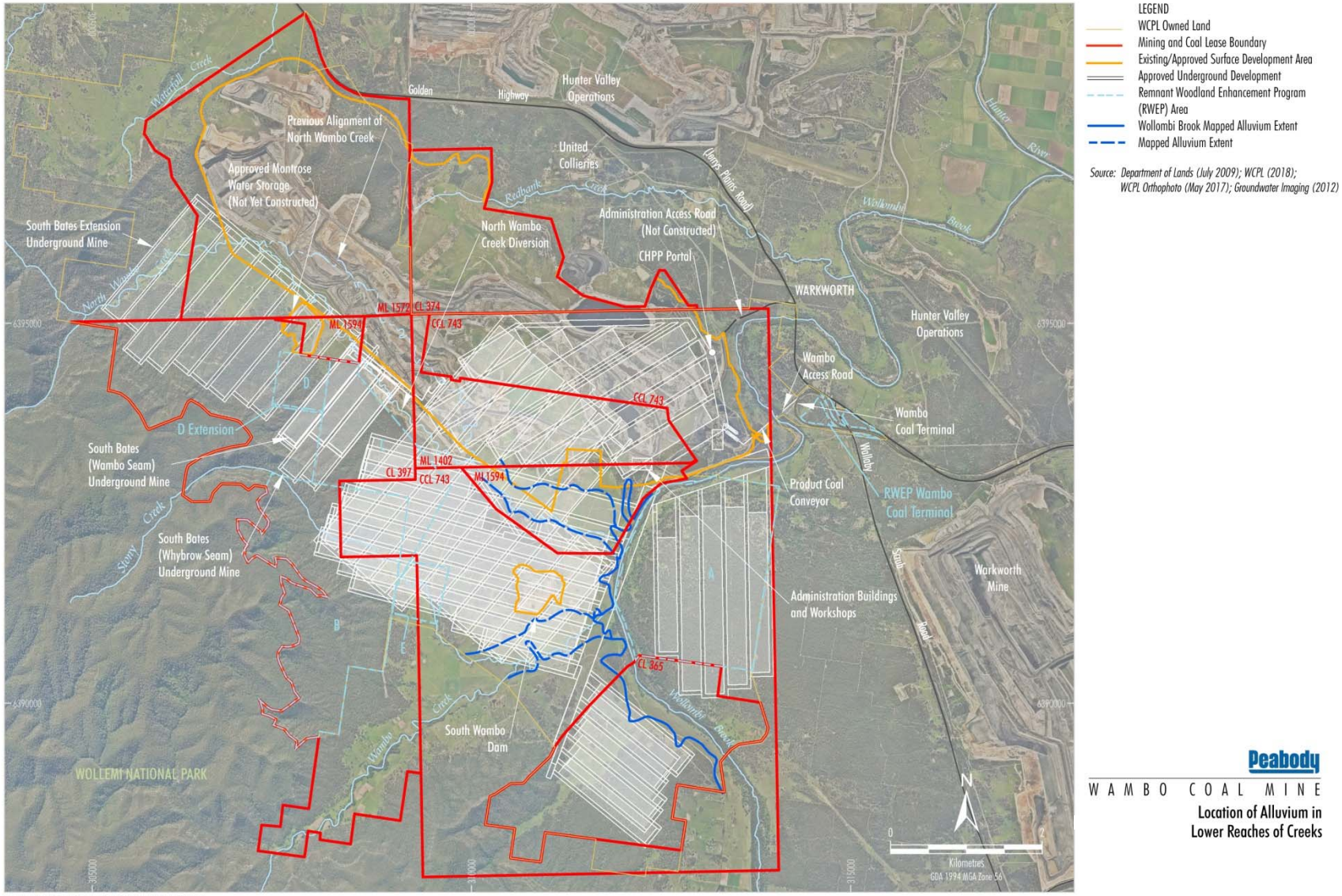
Approximate boundaries of Quaternary alluvial sediments in the vicinity of Wambo are shown in **Figure 5 (Section 2.1.4)** and have been derived from the Hunter Coalfield Regional Geology 1:100,000 map (NSW Department of Mineral Resources, Edition 2, 1993). The coal measures are overlain by the Triassic Narrabeen Group which outcrops to the south and west of Wambo but is not present within the mining lease area (Heritage Computing, 2012).

A transient electromagnetic (TEM) survey (Groundwater Imaging, 2012) was carried out to investigate the extent and thickness of alluvium along the lower reaches of (South) Wambo Creek and North Wambo Creek. The extent of alluvial sediments determined from that study is also presented on **Figure 5.**

2.1.4 Hydrogeology

The hydrogeological regime of the Wambo area and surrounds comprises two main systems (HydroSimulations, 2014):

- Quaternary alluvial aquifer system of channel fill deposits associated with Wollombi Brook, North Wambo Creek, Wambo Creek and Stony Creek.
- Underlying Permian strata consisting of:
  - hydrogeologically "tight" and hence very low yielding to essentially dry sandstone and lesser siltstone; and
  - low to moderately permeable coal seams, which are the prime water-bearing strata within the Permian measures.



WAM-09-15_Sth Bates EP_Longwalls11-16_WMP_SWMP_203B

Figure 5: Location of Alluvium in Lower Reaches of Creeks

2.1.4.1 Alluvial Water Sources

The alluvium in the vicinity of the GWMP area forms an unconfined shallow aquifer. The alluvium within the Wambo area is generally less than 15 m thick (Heritage Computing, 2012). Previous studies indicate that the alluvium of Wambo Creek is 4 to 7 m deep and is discontinuous, probably due to bedrock highs (HLA-Envirosciences, 1999). The alluvium of North Wambo Creek near its confluence with Wollombi Brook was found to vary between 7 and 19 m (GHD, 2007). The extent of alluvium interpreted from the TEM study is typically of a narrower alluvial body along both the lower reaches of (South) Wambo Creek and North Wambo Creek than is mapped in the publicly available mapping (HydroSimulations, 2014).

A section of North Wambo Creek has been diverted to skirt the Wambo Open Cut. The alluvial flow in North Wambo Creek has been altered by the historical and existing mining operations including the removal of alluvium across the full width of the channel with consequent partial desaturation of the adjacent upstream and downstream alluvium.

Based on a review of groundwater quality and the results of the search of the NSW Bore Database (**Section 2.1.5.1**) the typical yield of the alluvial aquifer is likely to be less than 5 litres per second (L/s) and the salinity varies from low to very high. Based on this information the environmental value of the alluvial groundwater is considered to be 'primary industry' (specifically stock watering) and potentially irrigation.

2.1.4.2 Permian Groundwater Sources

The fractured and porous groundwater sources within the Permian strata consist of both the coal seams and the interburden layers. It is considered that pre-mining piezometric head in the Permian groundwater sources would have closely resembled topographic levels. Previous and ongoing open cut and underground mining within the Wambo area and adjoining mining operations has resulted in a regional zone of depressurisation within the Permian coal measures (HydroSimulations, 2014).

The permeability of the Permian rock units is generally low and decreases with depth. This is due to a decrease in weathering and tightening of joints between rock units as depth increases. The coal seams generally have higher permeability than the interburden layers. Overall, the Permian groundwater sources are low yielding and brackish to saline.

2.1.5 Groundwater Receptors

2.1.5.1 NSW Bore Database Search

A search of the NSW Bore Database (in 2014) was undertaken to identify registered bores within a 5 km radius of Wambo at the time of establishing baseline conditions. The search identified 72 bores, with the majority (44) registered as monitoring/test bores and located within WCPL tenement boundaries (namely ML 1402, CL 743 and ML 1594). There were 10 bores identified as mining/dewatering bores and 3 bores were of unknown use. The remainder are registered for irrigation, domestic and/or stock use (15).

Bore details are outlined in **Table 5** and approximate bore locations are shown in **Figure 6.**

Table 5: Results of NSW Bore Database Search (at 2014)

Figure 6 Ref.	Bore No.	Licence No.	Location		Use	Depth (m)	SWL (bgl)	Salinity (ppm)	Yield (L/s)	Aquifer
			mE	mN						
1	GW080963	20BL170103	315994	6397210	Monitoring	84	60		5	Gravel Clay
2	GW047240	20CA209896	316826.7	6397095	Irrigation	12.7				
3	GW200621	20BL168887	312857	6395909	Monitoring	37	24.89	5695		
4	GW200622	20BL168887	312901	6395806	Monitoring	30	29.95	4050		
5	GW200943	20BL167947	312332	6395760	Test	30	27			
6	GW200942	20BL167947	312325	6395750	Test	37	32			
7	GW200623	20BL168887	312982.1	6395319	Monitoring	31	13.84	11500		
8	GW080516	20BL168883	312898.8	6394954	Test	15	7.11	950		Sandy Clay
9	GW060750	20BL132130	314309.8	6394923	Domestic	24.4	7.8		1.25	
10	GW080952	-	314643	6394905	Unknown	1.6	1.59			Sandy Clay / Gravel / Clay
11	GW080951	-	314619	6394878	Unknown	3.1	3.14			
12	GW079060	-	314595.5	6394852	Unknown	14.6				
13	GW079059	20BL153300	314595.5	6394852	Monitoring	0		5147		
14	GW080513	20BL168880	312345	6394818	Test	10	7.53			
15	GW080515	20BL168882	313418	6394794	Monitoring	8.1	5.7	8690		
16	GW080517	20BL168884	313572.7	6394742	Monitoring	15	7.24	3600		
17	GW200835	20BL172256	308424	6394517	Monitoring	11				
18	GW005327	20BL009540	314682.9	6394498	Stock	10.4	6.1	Excellent	0.13	
19	GW200616	20BL168886	313473.4	6394446	Monitoring	8.5	5.68	8360		
20	GW080514	20BL168881	310973	6394353	Monitoring	55	42.7	6300		Coarse Sand
21	GW200615	20BL168886	313434	6394246	Monitoring	11.5	7.49	7160		
22	GW080518	20BL168885	313585.8	6394232	Monitoring	10.8	6.95	53000		
23	GW080519	20BL168885	313622.4	6394161	Test	10.5	7.42	6490		
24	GW200620	20BL168888	310489.4	6394097	Monitoring	49	39.09	4700		
25	GW200617	20BL168888	309987.4	6393974	Monitoring	9	4.75	710		
26	GW079780	-	309588.9	6393932	Monitoring	0				
27	GW037184	-	309685	6393911	Test	21				
28	GW038579	-	309737.7	6393882	Test	20.9				
29	GW060328	-	314205.2	6393534	Mining	10	7			
30	GW060327	-	314180.8	6393442	Mining	9.8	6.7	0-500		
31	GW200829	20BL172237	308641	6393376	Monitoring	36				
32	GW200625	20BL168940	310901	6393375	Mining	270				

Figure 6 Ref.	Bore No.	Licence No.	Location		Use	Depth (m)	SWL (bgl)	Salinity (ppm)	Yield (L/s)	Aquifer
			mE	mN						
33	GW060326	-	314104.3	6393348	Mining	9.8	6.7			
34	GW200828	20BL172237	310061	6393206	Monitoring	11.5				
35	GW060364	-	311636.3	6392808	Mining	5.1				
36	GW043676	-	311479.9	6392805	Test	10.6				
37	GW200830	20BL172240	313335	6392745	Monitoring	16.8				
38	GW037999	-	311481.6	6392713	Irrigation	13.7				
39	GW060365	-	311690.8	6392686	Irrigation	6.6				
40	GW200624	20BL168939	310165.9	6392650	Dewatering	260	6			
41	GW060366	-	311195.9	6392646	Irrigation	5.2				
42	GW038000	-	311457.3	6392620	Irrigation	9.4				
43	GW037998	-	311589.4	6392530	Irrigation	10.9				
44	GW043675	-	311432.9	6392527	Test	8.5				
45	GW043674	-	311302.6	6392525	Test	8.2				
46	GW060329	-	311903.5	6392474	Mining	6.4				
47	GW043673	-	311486.3	6392467	Test	9.4				
48	GW060363	20BL132753	311697.8	6392317	Mining	6.3				
49	GW200361	20BL170638	311832.9	6392209	Test	0	3.12			
50	GW060330	-	311726.7	6392163	Mining	6.2	3.8	0-500		
51	GW200827	20BL172237	312505	6391469	Monitoring	9				
52	GW017462	20BL008224	315339.2	6391460	Farming	0				
53	GW200634	20BL168999	311470	6391252	Monitoring	20		13000		
54	GW200635	20BL168999	311659	6391236	Monitoring	20		23300		
55	GW200638	20BL168999	311452	6391103	Monitoring	20	5.18			
56	GW200637	20BL168999	311662	6391094	Monitoring	15	8.45	17900		
57	GW200636	20BL168999	311749	6391078	Monitoring	20		4790		
58	GW200641	20BL168999	311761	6390921	Monitoring	20	7.01	1210		
59	GW200640	20BL168999	311638	6390920	Monitoring	50		1210		Coarse Sand
60	GW200639	20BL168999	311455	6390889	Monitoring	20				
61	GW065117	-	311153.9	6390735	Irrigation	6				
62	GW200642	20BL168999	311696	6390688	Monitoring	20	15.12	6230		
63	GW200643	20BL168999	311454	6390685	Monitoring	15				
64	GW066606	-	311207.2	6390674	Domestic	2.5				
65	GW078574	20BL167170	309174.3	6390605	Farming	12				

Figure 6 Ref.	Bore No.	Licence No.	Location		Use	Depth (m)	SWL (bgl)	Salinity (ppm)	Yield (L/s)	Aquifer
			mE	mN						
66	GW078055	-	310104.9	6390490	Test	198.5		1660	3-May	
67	GW080502	20BL168017	308897	6390160	Mining	250	105			Coarse Sand
68	GW078577	20WA208559	309968.7	6389973	Domestic	10				
69	GW078576	20BL167172	309763.7	6389784	Farming	7				Gravel, Shale Grey Siltstone, Sandstone Conglomerate
70	GW078575	20BL167171	309504.8	6389687	Farming	12				
71	GW200834	20BL172257	313695	6389546	Monitoring	15				Shale, coal, fractured, with fragments of quartz
72	GW200833	20BL172255	311340	6389530	Monitoring	54				Fractured Shale, Coal

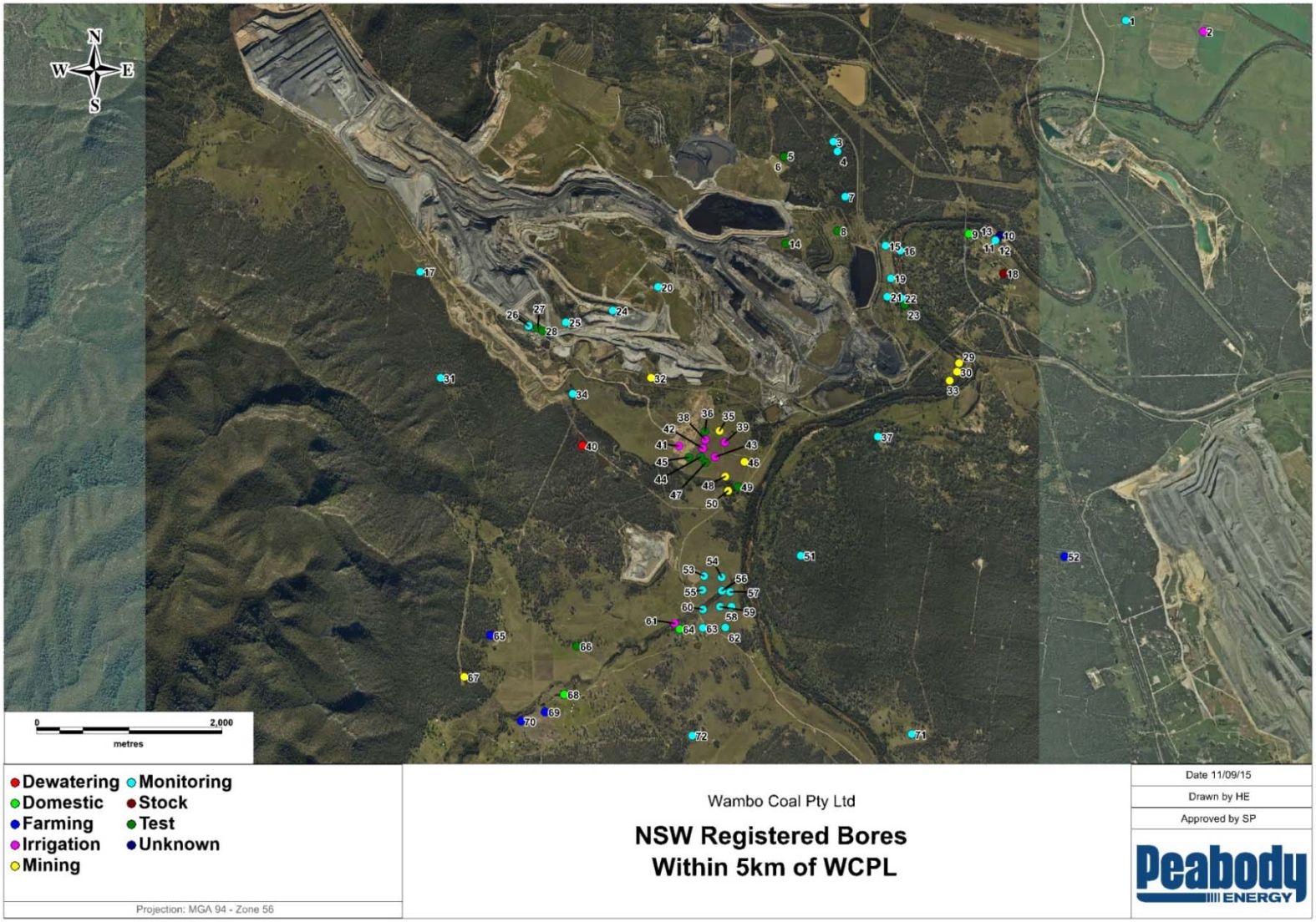


Figure 6: NSW Bore Database Search Results (at 2014)

2.1.5.2 Groundwater Dependent Ecosystems

The potential vegetation GDEs within the vicinity of Wambo have been mapped by BoM in the Groundwater Dependant Ecosystem Atlas. They include ecosystems that rely on the surface presence of groundwater and ecosystems that rely on the subsurface presence of groundwater.

Ecosystems that potentially rely on the surface presence of groundwater include various vegetation types, namely:

- Grey Box-Red Gum-Grey Ironbark.
- White Box-Ironbark-Red Gum.
- Hunter Roughbarked Apple-Red Gum.
- Roughbarked Apple-Forest Oak.
- Grey Gum - Grey Myrtle.
- Yellow Bloodwood-Stringybark.
- Yellow Bloodwood-Narrowleaved Apple.
- Blackbutt-Sydney Peppermint-Smoothbarked Apple.
- Grey Gum-Scribbly Gum.
- Grey Gum-Stringybark-Apple.
- Turpentine-Oak-Myrtle.

The Wollombi Brook and the Hunter River were also identified in the search of the Groundwater Dependant Ecosystem Atlas as being habitats for GDEs. It is considered that all or parts of the listed communities are potentially GDEs. The mapped locations of potential GDEs generally correspond with the surrounding watercourses, the neighbouring national park or the Remnant Woodlands Enhancement Program (RWEP) areas.

Further investigations into the likely level of groundwater dependence of the vegetation in the South Bates Extension Area will be conducted as required under Schedule 4, Condition 36A of DA305-7-2003.

2.1.6 Mining History

Substantial coal mining activity has occurred historically and is continuing currently in the vicinity of Wambo, by a number of companies, with development across several coal seams. Coal is extracted by means of both underground and open cut mining methods. Coal mines neighbouring Wambo include United Colliery to the north and east of Wambo, Mt Thorley Warkworth to the south-east, and a number of open cut and underground mines to the north and east within the Hunter Valley Operations, as shown in **Figure 3.**

Open cut mining at Wambo commenced in 1969. During the 1970s, development consents were issued for a range of open cut and underground mining operations. The Whybrow, Redbank Creek, Wambo and Whynot Seams have primarily been mined by open cut methods at the WCPL Coal Mine. The Wambo Seam was also mined for a short period in the Wambo No. 1 Underground Mine, however was abandoned due to hydrological issues (Australian Groundwater Consultants Pty Ltd (AGC), 1989). The Whybrow Seam was also mined from the Ridge Underground in this early period.

The Wollemi Underground Mine commenced production in 1997 and was placed under care and maintenance in October 2002 after the available longwall reserves were exhausted. Open cut operations were suspended between March 1999 and August 2001. Following the closure of the Wollemi Underground Mine in October 2002, open cut operations were expanded to maintain an overall production rate of 3 Mtpa of product coal.

Development of the North Wambo Underground Mine commenced in November 2005, with longwall operations in the Wambo Seam commencing in October 2007. Longwall extraction at the North Wambo Underground Mine finished in January 2016. Underground mining previously occurred both above and below the Wambo Seam at North Wambo Underground Mine. The adjacent United Colliery mined the lower Arrowfield Seam until 2010 (United Underground Mine) directly beneath portions of the North Wambo Underground Mine.

Development of the South Bates Underground Mine commenced in October 2014 and longwall mining commenced in the Whybrow Seam (Longwalls 11 to 13) in February 2016. Mining operations progressed to the Wambo Seam (Longwalls 14 to 16) in July 2017.

Approval was granted in December 2017 (MOD17) for mining of nine additional longwall panels in the Whybrow seam at the South Bates Extension Underground (Longwalls 17 to 25), with extraction of these longwalls scheduled to commence in September 2018.

2.1.7 Review of Baseline Data

2.1.7.1 Alluvial/Shallow Water Sources

Most groundwater levels at Wambo have been recorded manually. As the limit of reading of the measuring tape is about 10 mm, groundwater monitoring is unlikely to detect changes in groundwater level of less than 10 mm at a particular bore from one manual monitoring round to the next.

For the baseline period, a HARTT (Hydrograph Analysis: Rainfall and Time Trends) analysis was undertaken for each alluvial dataset and three shallow interburden bores (up to June 2014) to establish the relationship between groundwater levels and rainfall and to detect underlying trends in groundwater level that are independent of rainfall (GHD 2014). The HARTT statistical output for each alluvial hydrograph is given in **Table 6**.

Table 6: HARTT Analysis Results for Shallow Monitoring Bores

Bore	R^2	Rainfall Coeff. *a* (m/mm)	P rain	Time Coeff. *b* (m/month)	P time	*c* (m)
ALLUVIUM/WEATHERED REGOLITH						
P106	0.400	0.006	0.000	-0.005	0.365	54.751
P109	0.587	0.003	0.000	-0.002	0.446	58.690
P114	0.734	0.003	0.000	-0.004	0.005	57.173
P116	0.541	0.000	0.483	0.015	0.000	52.859
P315	0.313	0.005	0.002	-0.003	0.671	89.304
GW02	0.411	0.005	0.000	-0.012	0.000	79.447
GW08	0.643	0.000	0.273	-0.015	0.000	56.869
GW09	0.811	0.000	0.241	-0.024	0.000	64.339
GW11	0.601	0.003	0.000	0.005	0.111	75.982
GW12	0.765	0.010	0.004	-0.169	0.000	82.760
GW13	0.354	0.012	0.002	-0.113	0.010	65.201
GW15	0.360	0.002	0.006	-0.005	0.307	51.836
GW16	0.701	0.011	0.000	-0.064	0.000	108.256

GW17	0.660	0.011	0.000	-0.050	0.001	102.559
GW18	0.988	0.020	0.014	-0.581	0.006	78.010
P16	0.367	0.001	0.000	-0.008	0.000	53.445
P20	0.388	0.002	0.000	-0.017	0.000	55.512
PERMIAN						
P202	0.254	0.001	0.273	0.010	0.001	52.021
P203[#]	0.802	0.003	0.001	0.031	0.000	40.476
P301	0.149	0.000	0.950	-0.015	0.013	77.220

Also known as P206

The R^2 value (coefficient of determination) of the HARTT regression line gives a measure of the quality of fit of the non-linear regression line to the observed hydrograph. This value was greater than 50% for 12 of the 22 alluvial hydrographs analysed, indicating that over half of the hydrographs can be reasonably modelled by the HARTT variables (CRD and linear time trends) alone. A lower R^2 value indicates that the bore is situated at a location where the hydrograph cannot be adequately modelled by the HARTT variables and that other factors are affecting groundwater levels.

The p-value for the rainfall variable *a* is less than 0.05 for 17 of 22 bores, indicating that there is a significant relationship between groundwater level and CRD at most alluvial monitoring locations. The rainfall coefficient suggests that alluvial groundwater levels generally respond by 1 – 10 mm per mm of CRD (or atypical rainfall).

The p-value for the time variable *b* is less than 0.05 for the datasets of 17 of the 22 alluvial bores at Wambo, indicating statistically significant linear time trends (independent of rainfall) in groundwater levels at these locations. Where the p-value is greater than 0.05, time trends are statistically insignificant and the time coefficient *b* cannot be relied upon to describe historical trends or predict future groundwater levels.

Of the 17 bores displaying statistically significant time trends, only three indicated an increasing trend. As shown in **Figure 7** these three bores (P116, P202 and P203) are all located near the confluence of Wambo Creek and Wollombi Brook. Bores P202 and P203 are screened within the Whybrow Seam interburden. It is considered that recovering water levels within the underlying previously mined Homestead workings and/or seepage from the South Wambo Water Dam may be attributable to these increasing trends.

At 2014, the decreasing trends in groundwater levels at a number of the alluvial bores were considered possibly attributable to mining related activities. The decreasing trends in groundwater levels within North Wambo Creek alluvium at bores GW16 and GW17 were considered most likely attributable to the open cut operations at Wambo, while decreasing trends in lower North Wambo Creek alluvium at GW08 and GW09 were considered attributable to upstream impacts as well as underlying secondary extraction within the United Colliery mine and dewatering operations in the Whybrow Seam above the North Wambo Underground Mine.

Minor decreasing downward trends in groundwater at bores P16, P20 and GW13 within Wollombi Brook alluvium were considered less likely to be attributable to mining operations. The HARTT regression for these bores has a lower R^2 value which suggests that other recharge or discharge mechanisms may be affecting these locations.

Dewatering of the old Homestead Underground Mine via dewatering bores 2 and 2A may have been responsible for the slight decreasing trend in groundwater levels within Wambo

Creek alluvium at GW02. It was noted, however, that there was no statistically significant trend at adjacent bore GW11.

Time series plots of groundwater pH and EC reported at alluvial monitoring bores at Wambo were presented in GHD (2014). Based on a visual assessment of the time series plots, EC appeared to be following a falling trend at most monitoring locations from 2007 to 2014. This may be attributable to increased rainfall from 2007.

Between February 2011 and June 2014 at monitoring bore P114, EC increased from below 1,000 microSiemens per centimetre (µS/cm) to almost 7,000 µS/cm. This bore is located to the east of South Wambo Dam water storage which receives mine water from the open cut and underground mining operations. As the average EC in the dam was 7,350 µS/cm between July 2011 and October 2013 (Worley Parsons 2014), it was posited that the increase in EC at P114 might be due to seepage from this water storage, however this was discounted[1]. The variation in EC over the same time period at neighbouring bore P116 indicated a much smaller increase in EC that is within the range reported prior to construction of the dam, while EC at alluvial bore P106 and Whybrow Seam interburden bore P203 had been steady over the same time period. At Whybrow Seam interburden bore P202, groundwater EC increased from 3,490 µS/cm in October 2011 to 6,610 µS/cm in June 2014.

2.1.7.2 Permian Groundwater Sources

According to Ferdowsian *et al.* (2001), the HARTT method is generally limited to the analysis of relatively shallow groundwater from unconfined aquifers, and so does not provide information for deeper lithologies. For Permian hydrographs, qualitative comparison of groundwater hydrographs with the CRD curve is sufficient to allow inference of dependence on weather or the effects of mining.

2.1.7.3 Groundwater Attribute Statistics

A statistical summary of baseline (to April 2015) groundwater levels and quality is shown in **Table 9**, including the maximum, minimum, median and 10th and 90th percentiles. This table includes the bores screened within both alluvium and underlying Permian interburden.

EC has a wide range at alluvial sites, from about 300 to about 12,000 µS/cm with an overall median of about 700 µS/cm. By contrast, the median at Permian sites is about 5,000 µS/cm (excluding outlier GW12). Since 2007, EC at Permian sites has been very stable with little variation.

pH is consistently between 6 and 8 at the majority of alluvial monitoring locations, with an overall median of 7.1. At Permian sites, pH is reasonably constant with minimum and maximum recorded values ranging between 5.8 and 8.6 at all locations with an overall median of 7.3.

The overall median depths to groundwater are about 7 m at alluvial sites and about 13 m at Permian sites. The range of variation (from 10th to 90th percentiles) varies from 0.6 to 4.7 m at alluvial sites, and from 1.8 to 5.5 m at Permian sites.

[1] The results of an investigation were reported in the 2016 Annual Review (HS 2016a). HydroSimulations did not find any evidence supporting the seepage of saline mine water from South Wambo Dam towards Wollombi Brook.

Table 7: Bore Groundwater Level and Quantity (baseline data to April 2015)

Bore	pH					Conductivity (µS/cm)					Depth to Groundwater (mBTOC[1])				
	Min	Max	Median	10th	90th	Min	Max	Median	10th	90th	Min	Max	Median	10th	90th
ALLUVIUM//WEATHERED REGOLITH															
P106	6.2	8.6	6.9	6.7	7.9	391	1072	593	454	941	4.7	15.1	9.3	6.6	10.7
P109	6.2	8.7	6.8	6.5	7.6	431	1164	616	525	694	4.3	9.0	6.1	4.6	6.7
P114	6.3	8.7	7.1	6.5	7.8	509	7180	611	550	6141	5.2	8.1	6.7	5.4	7.6
P116	6.1	8.0	7.1	6.6	7.5	454	6570	1710	673	5972	4.2	8.3	6.3	4.8	7.3
P315	3.7	7.7	6.4	6.0	7.4	257	758	405	298	552	3.8	9.4	7.6	4.4	9.1
GW02	6.3	8.4	7.0	6.7	7.4	439	908	588	481	715	4.7	9.5	6.8	5.8	8.5
GW08	5.7	8.4	7.1	6.8	7.7	1371	2248	1864	1749	1972	2.8	5.9	3.4	3.0	5.1
GW09	6.5	8.8	7.7	7.2	8.4	287	1937	1140	420	1800	2.5	7.1	3.7	3.0	6.3
GW11	6.6	8.2	7.1	6.8	7.5	372	691	529	433	592	3.7	7.6	4.8	4.0	6.5
GW13	6.8	7.3	7.0	6.9	7.1	575	4820	3630	3240	4370	4.8	12.9	5.1	4.8	5.4
GW15	6.3	7.5	6.9	6.7	7.2	521	879	627	599	730	10.0	11.4	10.9	10.4	11.1
GW16	7.1	8.1	7.5	7.3	7.8	294	889	666	454	823	4.3	9.7	7.2	4.9	8.9
GW17	6.9	7.6	7.1	7.0	7.3	4610	5480	5160	4812	5304	6.9	11.8	10.9	8.3	11.5
P16	5.1	8.1	7.4	7.0	7.7	6700	12100	9545	7697	10832	6.3	8.2	7.4	7.1	7.8
P20	5.5	8.1	7.3	7.0	7.6	6500	12390	9515	8504	10625	5.4	8.1	7.8	7.1	8.2
PERMIAN															
P202	6.4	7.9	7.3	6.7	7.7	2650	10520	4687	3552	8172	3.3	8.7	8.8	7.8	9.6
P203	6.8	8.6	7.6	7.3	8.1	213	2672	2410	2160	2630	12.9	22.8	18.8	16.1	21.6
P301	5.8	7.6	6.6	6.1	7.2	461	9270	6430	2420	9199	7.2	19.9	13.2	11.1	15.5
GW12	6.6	6.9	6.8	6.6	6.8	19400	22300	21350	19670	22210	9.8	12.9	10.8	9.9	12.9

1. mBTOC = metres below top of casing

2.2 Current Monitoring and Management

2.2.1 Groundwater Monitoring Network

Groundwater monitoring data has been collected at Wambo since 1994. The groundwater monitoring network currently consists primarily of standpipe monitoring bores installed in the alluvial groundwater sources and the Permian groundwater sources. The bores are generally monitored bi-monthly for groundwater levels and quality (pH and electrical conductivity [EC]), although there are some bores that contain a water level logger that continuously monitors groundwater levels.

Wambo has also been monitoring standing water levels and quality in a number of private bores since 2005.

The groundwater monitoring network includes a number of bores that are part of the United Colliery monitoring network. At present there are 42 sites in the Wambo groundwater monitoring network, supplemented by another seven sites from the United Colliery monitoring network. Vibrating wire piezometers (VWPs) have been installed to monitor water levels in the Permian measures at nine Wambo sites and two United sites. These piezometers are downloaded on a quarterly basis.

Four bores in the Wambo network have hydrostatic level transducers fitted to monitor water levels in real time. These data are monitored in real time by the SCADA system and any rise in level outside normal levels is communicated via alarm emails sent to distribution lists of appropriate personnel.

In November 2017 a groundwater drilling program was undertaken in the vicinity of North Wambo Creek. The program consisted of 12 drill holes at 10 sites, four of which (two shallow and two deep) were constructed as permanent monitoring bores. The site locations were determined by WCPL and provided to DoI Water for consultation. DoI Water indicated that further drill holes may be required. The lack of groundwater identified during the drilling indicates that further drilling would provide limited additional information.

In late 2017 and early 2018, two additional monitoring bores (P316 and P319) were established adjacent to shallow piezometers P114 and P116 (as requested by DoI Water), with VWPs installed. Monitoring bore P317 was established and augmented with United monitoring bore UG 139 to monitor depressurisation above South Bates Extension.

Monitoring bores P320, P321 and UG166A were included in the program to monitor the effects of the open cut to the north-west. Monitoring bore P318 was included in the program to establish baseline groundwater conditions to the south prior to the commencement of South Wambo Underground.

Details of the groundwater bores at Wambo are summarised in **Table 8** and locations are shown in **Figure 7**.

Table 8 : Groundwater Monitoring Bore Details

Bore	Lithology	Easting	Northing
Wambo Monitoring Network			
P106	Wambo Creek Alluvium	311518	6391082
P109	Wambo Creek Alluvium & Underlying Interburden	311215	6390766
P114	Wambo Creek Alluvium (or regolith)	311205	6391271
P116	Wambo Creek Alluvium (or regolith)	311511	6391292
P202	Whybrow Interburden	311854	6391262
P203[7]	Whybrow Interburden	311777	6391261
P301	Whybrow Interburden	309360	6391466
P315	Stony Creek Alluvium/Regolith	309084	6391856
P316	Ref P114_116 - 10mBGL_Alluvium, 25mBGL_Regolith, 50.63mBGL_Regolith-Overburden, 72.26mBGL_Whybrow Seam	311252	6391128
P317	Ref SBUE_17ST_15a – RDH987_35m Regolith, RDH987_100m overburden, RDH987_174m_Whybrow (WWC), RDH987_213m_Wambo(WRC), RDH987_248.5m_Wambo (WMA)	307115	6394439
P318	Ref SW28_11m Regolith, SW28_150.79m Whybrow (D2), SW28_205.25m Wambo (WMA), SW28_357m Arrowfield (AFA)	312599	6388922
P319	Ref SW64_11 Regolith (RDH988), SW64_74.9m Whybrow, SW64_161.3m Wambo, SW64_265.3m Interburden sandstone	311125	6391412
P320	Ref A444_EX11A – WJ175_VWP1_344m Middle Barrett, WJ175_VWP2_305m Lower Arties, WJ175_VWP3_263m Pikes Gully, WJ175_VWP4_217.5m Bayswater, WJ175_VWP5_191m Vaux, WJ175_VWP6_92m Warkworth	307573	6398890
P321	Ref EX06_31.8m Arrowfield(AFA, AFB, AFC piles), EX06_72.1m Warkworth (WKD ply), EX06_161.15m Vaux, EX06 187.82m Bayswater	307999.8	6399498.9
GW02[1]	Wambo Creek Alluvium	309109	6389683
GW08	North Wambo Creek Alluvium	311792	6392268
GW09	North Wambo Creek Alluvium	311641	6392564
GW11[1]	Wambo Creek Alluvium	309232	6389704

Bore	Lithology	Easting	Northing
GW12[5]	Stony Creek Alluvium / Whybrow Interburden	309841	6391000
GW13	Wollombi Brook Alluvium	313695	6389545
GW14[2]	Regolith	312507	6391479
GW15	Wollombi Brook Alluvium	313330	6392747
GW16	North Wambo Creek Alluvium	306639	6396171
GW17	North Wambo Creek Alluvium	306889	6396100
GW18[2]	North Wambo Creek Alluvium	310061	6393202
GW19[2]	Alluvium/Whybrow Interburden	308426	6394516
GW21	Whybrow Coal Interburden	308647	6393375
GW22	Whybrow Coal Interburden	311341	6389535
N2[3]	Permian Overburden, Whybrow Seam, Redbank Creek Seam, Wambo Seam	308663	6393376
N3[3]	Permian Overburden, Whybrow Seam, Redbank Creek Seam, Wambo Seam	308314	6394575
N5[3]	Permian Overburden, Whybrow Seam, Redbank Creek Seam, Wambo Seam	306755	6395963
BH2A[4]	Whybrow Seam	308868	6390096
BH2[4]	Whybrow Seam	308867	6390147
BH4C[4]	Whybrow Seam	309323	6391080
BH1F	Whybrow Seam	310144	6391552
BH1G	Whybrow Seam	310104	6391551
WAMBORE SOUTH	Wambo Seam	311812	6392555
WAMBO-03[4]	Wambo Seam	311699	6392752
GW23	North Wambo Creek – Consolidated Bedrock (Deep)	305791	6395668
GW24	North Wambo Creek - Unconsolidated sediments (Shallow)	305789	6395670
GW25	North Wambo Creek – Consolidated Bedrock (Deep)	305299	6395288
GW26	North Wambo Creek –Unconsolidated sediments (Shallow)	305297	6395291
United Colliery Monitoring Network			
P1	Coal Measure Overburden	312198.64	6395839.7

Bore	Lithology	Easting	Northing
P3	Blakefield Seam	313411.79	6395006.3
P11	Blakefield Seam	312727.99	6395461.9
P16	Wollombi Brook Alluvium	313479.53	6394654.9
P20	Wollombi Brook Alluvium	313638.76	6394166.4
UG166A	South Bates Extension Area (263 - Unnamed D Seam; 281 - Unnamed E Seam; 319 - Interburden; 329 - Glen Munro Seam; 375 - Interburden; 382 - Arrowfield Seam; 402 – interburden)	306488	6398075
UG139	130 - Unnamed D Seam; 153 - Unnamed E Seam; 183 - Blakefield Seam; 200 - Glen Munro Seam; 238 - Arrowfield Seam; 254 - Bowfield Seam; 260 - Bowfield Seam	306665	6395172

Note:

1. Private Bores
2. GW14 has been dry since December 2011. GW18 has been dry since October 2010 and GW19 has been dry since monitoring began in 2009.
3. Contains a Vibrating Wire Piezometer (VWP).
4. Contains hydrostatic level transducers (monitored by SCADA system)
5. A number of alluvial bores are also screened within the underlying interburden
6. NWC – North Wambo Creek .
7. Also known as P206.

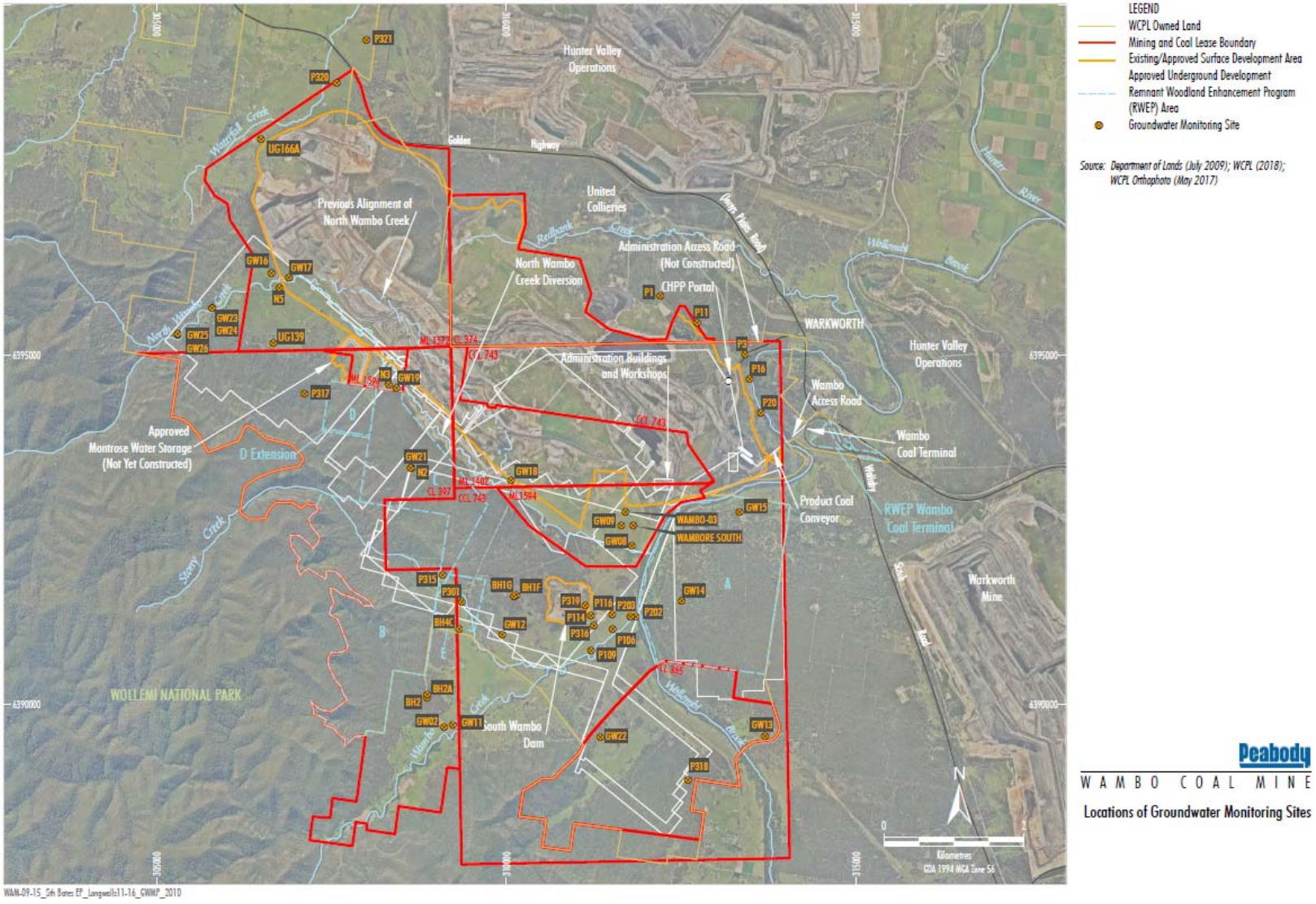


Figure 7: Wambo Groundwater Monitoring Bore Locations

2.2.2 Site Water Balance

A site water balance is undertaken annually to document the management of water at Wambo in accordance with Schedule 4, Condition 25 of DA 305-7-2003. Summary results are reported in the Annual Review report which is available on the Peabody Energy Australia website https://www.peabodyenergy.com/Operations/Australia-Mining/New-South-Wales-Mining/Wambo-Approvals,-Plans-Reports .

2.2.3 Hydrogeological Model

Recent Groundwater Assessments were completed by HydroSimulations for the South Wambo Modification (Modification 12 in April 2016) and South Bates Extension Modification (Modification 17 in July 2017) (HydroSimulations 2016a and 2017). Numerical modelling was undertaken to inform the Groundwater Assessment and to quantify the likelihood and magnitude of potential impacts. On each occasion the Groundwater Assessment was peer reviewed by Kalf and Associates (Dr Frans Kalf) who concluded that the hydrogeological description, conceptualisation, model design, simulations and reporting had been conducted in a professional manner.

The hydrogeological model predicts the lateral zone of impact of depressurisation of aquifers due to current and future mining activity. In addition, the hydrogeological model predicts groundwater inflows into the underground workings over the life of the mine.

Periodic re-calibration of the model will be undertaken based on observed piezometric heads and groundwater inflow data.

2.2.4 Groundwater Users

HydroSimulations (2016a) and previous groundwater assessments for Wambo predict that some privately-owned bores may experience more than 2 m cumulative drawdown as a result of the already approved operations at Wambo. These drawdowns are due to the cumulative effects of all mining in the Wambo district. In addition, it was predicted that there would be no additional privately-owned registered groundwater users affected as a result of Modification 12 or Modification 17.

Limited information is available on three privately owned bores in the vicinity of Wambo (**Figure 6**). Depending on the extraction depth and nature of bores, these bores may experience more than 2 m cumulative drawdown as a result of the approved Wambo operations.

3.0 Groundwater Triggers

Groundwater triggers for both groundwater levels and quality have been developed using statistical analysis of the baseline data (**Section 2.1.7**) and data acquired to April 2015, and the predicted effects presented in the EIS and subsequent EAs.

The trigger values are not assessment criteria but are used to initiate investigations into the groundwater levels or groundwater quality as reported by the monitoring program. Details of the monitoring program are included in **Section 4.0**. Reporting requirements for this GWMP are detailed in **Section 6.0**.

Triggers will be used to determine if the groundwater impact investigation procedure or Trigger Action Response Plan (TARP) in the SGWRP should be initiated. The SGWRP provides a protocol for the investigation, notification, and mitigation of identified exceedances of these assessment criteria.

3.1 Trigger Values for Groundwater Levels

3.1.1 Alluvial Monitoring Locations

Statistical analysis of groundwater levels in shallow bores has been undertaken in **Section 2.1.7.1**. The results of this analysis indicate that shallow groundwater levels are highly responsive to rainfall.

Trigger values have been adopted for shallow bores where predicted impacts are less than 2 metres. The trigger values adopted are equivalent to the 10th and 90th percentiles of recorded depths to groundwater in the historical dataset. Groundwater level trigger values are shown in Table 9. In order to avoid false triggering, as a trigger would be initiated 20% of the time due to natural causes, triggers for groundwater level are defined to occur when two consecutive bi-monthly observations (over a 2-month interval) exceed or fall below the specified depth to groundwater.

Table 9 Shallow Bores Water Level Trigger Values

Bore	Minimum (10th percentile)		Maximum (90th percentile)	
	Depth to Groundwater (mBTOC[4])	Level (m AHD)	Depth to Groundwater (mBTOC[4])	Level (m AHD)
P106	6.6	54.5	10.7	50.4
P109	4.6	57.8	6.7	55.7
P114	5.4	56.0	7.6	53.8
P116	4.8	54.2	7.3	51.7
P202	7.8	52.5	9.6	50.7
P203	16.1	44.1	21.6	38.6
P301[1]	NA	NA	NA	NA
P315	4.4	90.3	9.1	85.6
GW02	5.8	76.7	8.5	74.0
GW08[2]	NA	NA	NA	NA
GW09[2]	NA	NA	NA	NA
GW11	4.0	76.0	6.5	73.5
GW12	9.9	77.4	12.9	74.4
GW13	4.8	57.8	5.4	57.2
GW15	10.4	52.0	11.1	51.3
GW16[3]	NA	NA	NA	NA
GW17[3]	NA	NA	NA	NA

Bore	Minimum (10th percentile)		Maximum (90th percentile)	
	Depth to Groundwater (mBTOC[4])	Level (m AHD)	Depth to Groundwater (mBTOC[4])	Level (m AHD)
P16	7.1	50.4	7.8	49.7
P20	7.1	50.3	8.2	49.2

1. P301 is predicted to go dry by HydroSimulations (2014), therefore no trigger level has been established – i.e. the purpose of trigger levels is to identify unanticipated impacts.
2. WCPL will install replacement bores in the North Wambo Creek alluvium in areas that are not located above the old Wambo No 1 Seam workings. Trigger levels will be established for these bores based on modelled groundwater levels and will replace the GW08 and GW09 in this table.
3. GW16 and GW17 are located upstream of the North Wambo Creek Diversion and in close proximity to the approved open cut. There are no groundwater users located in the vicinity of North Wambo Creek upstream of the North Wambo Creek Diversion. Therefore, a trigger level for these two bores is not considered warranted. Monitoring data will be reviewed annually at these bores.
4. mBTOC = metres below top of casing

3.1.2 Chitter Dam and South Wambo Water Dam Monitoring Locations

As outlined in **Section 4.1.6**, WCPL is required to monitor impacts from the Chitter Dam and South Wambo Dam.

The Chitter Dam was drained and decommissioned by WCPL in 2016, and therefore monitoring in relation to this dam is no longer required. WCPL will monitor groundwater levels in P114, P116 and P202 (near South Wambo Water Dam). South Wambo Water Dam was constructed in August 2009 and is currently not in use.

Two additional monitoring bores have been included in the program from 2018 (P316 and P319). Data from these bores has not been included in analyses at this stage.

3.1.3 Permian Monitoring Locations

Given the lack of licensed water supply bores within the coal measures and generally poor water quality (EIS, 2003), no specific management measures are proposed. However groundwater levels and quality are monitored to assist in validation of the groundwater model and for review of general groundwater behaviour.

Therefore, groundwater level trigger values have not been established for Permian groundwater bores, since it is predicted by HydroSimulations (2014) that levels will fall below baseline levels. Hydrographs within these sources will be reviewed annually in combination with a review of subsidence parameters.

Further investigations within these sources are triggered if:

- An adjacent landholder complains about declining groundwater levels in their bore; or
- Higher than predicted inflows are recorded; or
- The groundwater drawdown is greater than predicted.

Groundwater monitoring data from the Permian monitoring bores will be assessed and reviewed as part of the Annual Review (**Section 6.2**). Data will also be used to validate the groundwater model.

3.2 Trigger Values for Groundwater Quality

There is considerable variability in groundwater pH and EC in both alluvial and Permian groundwater sources. In addition, the beneficial use category of Permian groundwater and alluvial groundwater along North Wambo Creek and Wambo Creek is limited due to naturally high salinity.

A water quality trigger for EC has been proposed based on the 90th percentile value observed in these bores (refer to statistical summary in). Although ANZECC and ARMCANZ (2000) recommend 80th percentile values as being suitable for trigger values, a trigger would be initiated 20% of the time due to natural causes. Therefore, a less stringent criterion is applicable so that the trigger would be a more meaningful indicator of a possible mining effect. Triggers for EC are to occur when *three* consecutive bi-monthly observations (that is, over a 6-month interval) exceed the specified trigger level (**Table 10**).

As described in **Section 2.1.7.1**, pH is consistently between 6 and 8 at the majority of alluvial monitoring locations. The 10th and 90th percentile values have been adopted as minimum and maximum exceedance values, where an investigation will not be triggered unless the value is exceeded on two consecutive bi-monthly monitoring events (over a 4-month interval) (**Table 10**).

Bores P16 and P20 provide suitable indicators near the Chitter Dam. Bores P116, P202 and P203 provide suitable indicators near the South Wambo Water Dam.

Table 10: Shallow Bores Water Quality Trigger Values

Bore	Conductivity (µS/cm)	pH	
	Maximum (Three Consecutive Bi-Monthly Exceedances)	Minimum (Two Consecutive Bi-Monthly Exceedances)	Maximum (Two Consecutive Bi-Monthly Exceedances)
P106	941	6.7	7.9
P114	6141	6.5	7.8
P116	5972	6.6	7.5
P202	8172	6.7	7.7
P203	2630	7.3	8.1
P301[1]	NA	NA	NA
P315	552	6.0	7.4
GW02	715	6.7	7.4
GW11	592	6.8	7.5
GW13	4370	6.9	7.1
GW15	730	6.7	7.2
GW16[2]	NA	NA	NA
GW17[2]	NA	NA	NA
P16	10832	7.0	7.7
P20	10625	7.0	7.6

1. P301 is predicted to go dry by HydroSimulations (2014), therefore no trigger level has been established – i.e. the purpose of trigger levels is to identify unanticipated impacts.
2. GW16 and GW17 are located upstream of the North Wambo Creek Diversion and in close proximity to the approved open cut. There are no groundwater users located in the vicinity of North Wambo Creek upstream of the North Wambo Creek Diversion. Therefore, a trigger level for water quality in these two bores is not considered warranted. Monitoring data will be reviewed annually at these bores.

3.3 Performance Indicators

Specific performance indicators have been developed for the subsidence impact performance measures relating groundwater in Section 3.1.3 of the Extraction Plan for North Wambo Underground Mine Longwalls 8 to 10A (NWU Extraction Plan). For further details of the monitoring conducted to inform the assessment of the extraction of Longwalls 8 to 10A against these performance indicators, refer to Section 3.8 of the NWU Extraction Plan.

The performance indicators outlined in the NWU Extraction Plan specific for groundwater, as outlined in **Table 11,** will be used to assess the performance of the Mine against the predicted impacts. North Wambo Underground operations were completed in December 2015.

Table 11: NWU Performance Indicators

Performance Indicator
The performance indicators will be considered to have been exceeded if Wambo receive complaints from groundwater users
The performance indicators will be considered to have been exceeded if monitoring data suggests significant divergences away from the modelled groundwater.
The performance indicators will be considered to have been exceeded if pumping of water from the North Wambo Underground Mine roadways requires regular pumping at rates higher than normal.
The performance indicators will be considered to have been exceeded if the groundwater levels in alluvial bores exceed the groundwater level criteria listed in **Table 9** of the GWMP
The performance indicators will be considered to have been exceeded if the groundwater quality in alluvial bores exceeds the groundwater quality criteria listed in **Table 10** of the GWMP

Specific performance indicators have been developed also for the subsidence impact performance measures relating groundwater in Section 3.1.3 of the Extraction Plan for South Bates Underground Mine Longwalls 11 to 16 (SBU Extraction Plan). For further details of the monitoring conducted to inform the assessment of the extraction of Longwalls 11 to 16 against these performance indicators, refer to Section 3.8 of the SBU Extraction Plan.

The performance indicators outlined in the SBU Extraction Plan specific for groundwater, as outlined in **Table 12**, will be used to assess the performance of the Mine against the predicted impacts.

Table 12: SBU Performance Indicators

Performance Indicator
Wollombi Brook
The performance indicators will be considered to have been exceeded if the groundwater levels in alluvial bores exceed the groundwater level criteria in the GWMP.
The performance indicators will be considered to have been exceeded if the groundwater quality in alluvial bores exceeds the groundwater quality criteria in the GWMP.

WCPL will report on progress against these performance indicators in the Annual Review (**Section 6.2**). In the event that a complaint is received relating to groundwater, it will be handled in accordance with the complaints management protocol (**Section 5.0**). Contingency plans for unpredicted groundwater impacts are discussed in the Extraction Plan and the SGWRP.

4.0 Groundwater Monitoring Program

The purpose of this GWMP is to monitor and manage groundwater quality and levels to detect potential impacts on surrounding groundwater users, assess the performance of the Mine against the performance indicators and to ensure that relevant legislative and policy requirements are met. Monitoring locations, parameters, frequency and methodology of monitoring are outlined in this section.

Data collected will:

- Enable verification and refinement (where necessary) of the hydrogeological model developed for Wambo;
- Be used in the continued development of groundwater investigation triggers (**Section** 3.0); and
- Provide input to annual reviews of groundwater monitoring data (**Section 4.4**).

4.1 Monitoring Network, Parameters and Frequency

Ongoing groundwater monitoring requirements at Wambo are as follows:

- Groundwater monitoring bores to monitor groundwater sources above and in close proximity to mine workings;
- Monitoring of potential groundwater leakage from Wollombi Brook and associated alluvial aquifers;
- Monitoring of groundwater inflows to underground and open cut mining operations; and
- Monitor for potential water loss from the Chitter Dam and Wambo South Water Dam, including potential migration of sub-surface water toward Wollombi Brook.

4.1.1 Groundwater Monitoring Bores

Wambo's groundwater monitoring network consists of purpose-constructed monitoring bores (also referred to as piezometers) and water supply bores. The GWMP includes the monitoring of water levels and water quality. **Table 13** provides a summary of WCPL's proposed groundwater monitoring program. Bore locations are described in **Table 8** and shown on **Figure 7 (Section 2.2.1)**.

Table 13: Groundwater Monitoring Program

Monitoring Locations	Parameters Monitored	Lithology Monitored	Monitoring Frequency*
P1, P3, P11	• Depth to water. • EC. • pH. • Temperature.	Alluvium	Bi-monthly [from December 2005]
P16, P20	• Depth to water. • EC. • pH. • Temperature.	Alluvium	Bi-monthly [from December 2005]

Monitoring Locations	Parameters Monitored	Lithology Monitored	Monitoring Frequency*
	• TDS, Na, K, Mg, Ca, Cl, HCO_3, $CaCO_3$, SO_4 and metals (Cu, Zn, Fe, Al, Ni, Mn, Ba, Pb, As, Se).		Annually [from July 2015]
P106, P109, P114, P116,	• Depth to water. • EC. • pH. • Temperature.	Alluvium/Colluvium	Bi-monthly [from July 2003]
	• TDS, Na, K, Mg, Ca, Cl, HCO_3, $CaCO_3$, SO_4 and metals (Cu, Zn, Fe, Al, Ni, Mn, Ba, Pb, As, Se).		Annually [from July 2015]
P202, P203	• Depth to water. • EC. • pH. • Temperature.	Shallow Permian, Overburden	Bi-monthly [from July 2003]
	• TDS, Na, K, Mg, Ca, Cl, HCO_3, $CaCO_3$, SO_4 and metals (Cu, Zn, Fe, Al, Ni, Mn, Ba, Pb, As, Se).		Annually [from July 2015]
P301, P315	• Depth to water. • EC. • pH. • Temperature.	Alluvium, Shallow Permian. Overburden	Bi-monthly [from March 2004]
P316	• Groundwater Pressure.	Alluvium/Regolith, Permian Overburden, Whybrow Seam	Continuous (downloaded quarterly) [from March 2018]
P317, P318 P319, P320, P321, UG166A, UG139	• Groundwater Pressure.	Various (Refer Section 2.2.1)	Continuous (downloaded quarterly) [from March 2018]
	•		
GW02^, GW08, GW09, GW11^	• Depth to water. • EC. • pH. • Temperature.	Alluvium	Bi-monthly [from July 2005]
	• TDS, Na, K, Mg, Ca, Cl, HCO_3, $CaCO_3$, SO_4 and metals (Cu, Zn, Fe, Al, Ni, Mn, Ba, Pb, As, Se).		Annually [from July 2015]
GW12, GW13, GW15, GW16, GW17, GW21, GW22	• Depth to water. • EC. • pH. • Temperature.	Alluvium, Shallow Permian. Overburden	Bi-monthly [from December 2009]
	• TDS, Na, K, Mg, Ca, Cl, HCO_3, $CaCO_3$, SO_4 and metals (Cu, Zn, Fe, Al, Ni, Mn, Ba, Pb, As, Se).		Annually [from July 2015]
GW23, GW24, GW25 and GW26	• Depth to water. • EC. • pH. • Temperature	Alluvium and consolidated bedrock	Bi-monthly [from March 2018]

Monitoring Locations	Parameters Monitored	Lithology Monitored	Monitoring Frequency*
N2, N3, N5	• Groundwater Pressure.	Alluvium, Permian Overburden, Whybrow Seam, Redbank Seam, Wambo Seam	Continuous (downloaded quarterly)
BH2, BH2A, BH4C, Wambo-03	• Depth to Water	Whybrow Seam, Wambo Seam	Continuous (real time)
BH1G, BH1E, Wambore South	• Depth to Water	Whybrow Seam, Wambo Seam	Monthly

Notes: ^ Private Bores
* Bi-monthly = every 2 months

The overall objectives of the GWMP are to establish baseline groundwater quality and water level data and implement a program of data collection that can be utilised to assess potential impacts of mining activities on the area's groundwater resources. From a hydrogeological perspective, the Wambo region is relatively complex. This is due to the various areas of alluvium, proximity to Wollemi National Park and number of historical and current mining developments.

A key component of the GWMP is the establishment of an effective network of long-term monitoring sites that will enable any impacts on groundwater to be readily identified. Particular areas of alluvium that will require monitoring are those associated with Wollombi Brook, Wambo Creek (also known as South Wambo Creek), North Wambo Creek and Stony Creek. Significant underground mining has already been undertaken above a large portion of WCPL's underground mining areas and depressurisation has extended above the historical workings.

The GWMP takes into account the existing site groundwater data, both from WCPL and the neighbouring United Colliery, as well as the historical and current mining operations. Furthermore, it incorporates the recommendations of an independent review of WCPL's GWMP in 2008 and the results of the 2008 Geophysical Report for the upper section of North Wambo Creek.

Additional monitoring bores may be required in the future as open cut and underground mining is undertaken in new areas. Any additional monitoring locations should target alluvial groundwater and areas where depth of cover above the seam is lowest. Any additional monitoring bores should be installed so that at least two years of monitoring data are collected prior to undermining. All new monitoring bores are to be constructed in accordance with the Minimum Construction Requirements for Water Bores in Australia (NUDLC, 2011).

4.1.2 Decommissioning of Bores

Decommissioning of monitoring bores will be undertaken in accordance with NUDLC (2011) requirements. In most cases, this will involve:

- Removal of above ground casing and monuments.

- Injection of a cement bentonite grout from the base of the bore to the surface with a tremie pipe.

4.1.3 Monitoring Parameters and Frequency

Bi-monthly monitoring of groundwater levels, pH and EC will be undertaken at all standpipe bores in the groundwater monitoring program. Comprehensive analysis of major ions will occur at each standpipe bore annually.

4.1.4 Inflows to Open Cut Pits

As reported in the Site Water Balance (WorleyParsons, 2014), Wambo open cut pits receive inflows from:

- Bates North open cut pit via the old creek alluvial material whenever the adjacent creek flows;
- Seepage into Bates South open cut pit from the Homestead Pits water storage. The Homestead Pits water storage receives underground dewatering.

Metering of daily dewatered volumes from each of the Wambo open cut pits will be undertaken. These dewatered volumes will be incorporated into the site water balance on an annual basis to determine the inflows from groundwater sources, including alluvial aquifers, and to verify whether WCPL holds sufficient groundwater licence entitlements.

The water quality of inflows to the open cut are measured indirectly through monthly water quality monitoring of mine water storages. This is the most practical method to routinely sample for water quality. An unexpected increase in water make or change in water quality of mine water storages would be investigated by Wambo. If warranted, direct measurement of water quality at the source of inflow may be conducted.

4.1.5 Inflows to Underground Workings

The active South Bates Underground Mine workings in the Whybrow and Wambo Seams are currently being dewatered.

Dewatering volumes and underground water levels will be recorded on a daily basis during pumping. This data will be incorporated into the site water balance on an annual basis to allow calculation of groundwater inflows including loss of groundwater from alluvium and to verify whether WCPL holds sufficient groundwater licence entitlements.

Where the annual assessment for mine inflows to the South Bates Underground Mine exceeds the peak estimate predicted by HydroSimulations (2017) (316 ML/year) by 50% or more (that is more than 474 ML/year), WCPL will:

- Investigate if there is a change in the predicted take of water from the Lower Wollombi Brook Water Source from mining related activities;
- Where there is an increased take from the Lower Wollombi Brook Water Source, investigate any influence on low flow cease-to-pump criteria specified in the HUA WSP;
- Define the Mine inflow volume value triggering this response procedure; and

- Submit a report summarising the assessment to DoI Water.

WCPL must notify DoI Water as soon as practicable on becoming aware of any take of water in excess of its licensed entitlement.

The water quality of inflows to the underground workings are measured indirectly through monthly water quality monitoring of mine water storages. This is the most practical method to routinely sample for water quality. An unexpected increase in water make or change in water quality of mine water storages would be investigated by Wambo. If warranted, direct measurement of water quality at the source of inflow may be conducted.

4.1.6 Chitter Dam and South Wambo Water Dam Monitoring Program

In accordance with Consent Condition 34(e), Schedule 4 of DA305-7-2003, WCPL has expanded the GWMP to investigate and monitor potential water loss from the Chitter Dam and South Wambo Water Dam, including potential migration of sub-surface water toward Wollombi Brook.

The Chitter Dam was drained and decommissioned by WCPL in 2016, and therefore monitoring in relation to this dam is no longer required.

To detect potential sub-surface water loss from South Wambo Dam, WCPL will monitor existing groundwater monitoring bores P114, P116 and P202 and surface water quality of the dam. Water quality analysis will include annual analysis of major cations (sodium, potassium, magnesium and calcium) and major anions (chloride, sulphate and alkalinity) in addition to bi-monthly monitoring of pH and EC. Water chemistry and water levels will be analysed to identify evidence of connection between dams and the shallow bores.

South Wambo Dam has been drained as far as practical since January 2015. South Wambo Dam will only be recommissioned after further geotechnical assessment, structural repairs and following relevant consultation with NSW Dams Safety Committee and NSW Department of Resources and Geosciences.

If, once the dam is recommissioned, the monitoring data from groundwater monitoring bores P16, P20, P114, P116 and P202 indicates that the dam is potentially leaking, WCPL will:

- Notify the relevant authorities, including the NSW Dams Safety Committee;
- Drain the dam as far as practical;
- Engage a suitably qualified person to undertake a technical assessment of the dam to determine the source and nature of the leak and develop an action plan to address the issue; and
- Investigate the risk of potential impact on water quality in Wollombi Brook, including undertaking necessary water quality testing as required.

4.1.7 Montrose Dam Monitoring Program

WCPL will develop a program to investigate and monitor potential water loss from the Montrose Dam prior to construction in accordance with Consent Condition 34(e), Schedule 4 of DA305-7-2003.

4.2 Methodology

Groundwater monitoring will consider the Murray-Darling Basin Groundwater Quality. Sampling Guidelines. Technical Report No 3 (Murray-Darling Basin Commission [MDBC, 1997]).

In general, the groundwater monitoring methodology will include the following:

- Gauging of groundwater levels;
- Grab sampling techniques using a bailer in accordance with WCPL instructions;
- Measurement of groundwater field parameters (pH, EC) using a calibrated water quality meter;
- If groundwater samples are to be collected, they are to be transferred into suitably preserved laboratory supplied sample containers once field parameters have stabilised;
- All sample containers are to be clearly labelled with sample number, sample location, sample depth and sample date. The sample containers are to be transferred to a chilled esky for sample preservation prior to and during shipment to the testing laboratory. A Chain-of-Custody (CoC) form should be forwarded with the samples to the testing laboratory; and
- Decontamination of all non-dedicated sampling equipment between monitoring locations.

4.3 Data Management Procedures

Validated data from the monitoring program will be entered into a digital database by an Environmental Advisor. This renders the data in a form suitable for analysis.

WCPL will record the following details for all groundwater monitoring samples:

- The date(s) on which the sample was taken;
- The point at which the sample was taken; and
- The name of the person who collected the sample.

In the event of an apparently anomalous result, WCPL will conduct a re-test as soon as is practicable to do so.

4.4 Data Review and Investigation

Upon receipt of monitoring results, the following review processes will be undertaken:

- Data will be compared to the specific trigger values where applicable (**Section 3.0**).
- If result(s) do not meet specified trigger values the response procedure will be initiated in accordance with the SGWRP.

WCPL will undertake an annual review of monitoring data to compare groundwater levels and quality to trigger levels. Recorded groundwater levels will also be compared to rainfall to identify trends. Modelled groundwater levels will be compared to monitored data and model re-calibration will be undertaken if necessary.

The annual review of data will also assess for lines of evidence for the seepage of mine water from the Chitter Dam and South Wambo Water Dam towards Wollombi Brook. Results of the review will be included in the Annual Review (**Section 6.2**).

When monitoring results exceed specified trigger values or the annual review identifies groundwater impacts, an investigation appropriate for the situation will be launched to determine the cause. The investigation will include comparison of monitoring results, meteorological patterns, mining activities and changes to land use.

Further details outlining the response procedures for exceedance of trigger values are outlined in SGWRP.

4.4.1 Investigation of Levels in GW08 and GW09

An investigation into the declining water levels in bores GW08 and GW09 has been undertaken to further investigate potential impacts on the North Wambo Creek alluvium in the vicinity of these bores and potential licensing implications (HydroSimulations, 2015a). The investigation report was provided to the DP&E and DoI Water.

The investigation concluded that the drawdown at GW08 and GW09 is due to pumping of water from (dewatering of) the old mine workings. The numerical model which was updated by HydroSimulations in 2015 to assess the South Bates underground operations (HydroSimulations, 2015b) was not optimised at the location of GW08 and GW09, despite being well-calibrated elsewhere. Since then, HydroSimulations (2016a) has updated and recalibrated the numerical model to better replicate shallow groundwater effects in the area around GW08 and GW09.

The status of the two bores has been reassessed in recent monitoring reviews. The simulated heads at GW08 and GW09 show a good match with the trends seen in the observed data. Although simulated initial heads are lower than observed, the drawn-down heads in 2017 were near the correct level, while overestimated. During the 2017 monitoring period, observed groundwater level at GW08 has continued to decline while modelled heads show a milder response. It should be noted that GW08 was nearly dry at the end of 2017. At GW09, the bore has gone dry due to mining related drawdown, so it is not possible to compare the performance of observed groundwater level with that modelled for 2017.

4.4.2 Investigation of Water Quality in P114

An investigation into the increased EC in shallow bore P114 has been initiated to further investigate the potential for impacts on this bore as a result of possible leakage from South Wambo Water Dam and potential remediation/mitigation measures.

As described in **Section 4.1.6**, South Wambo Water Dam has been disused following secondary extraction of Longwall 9, Longwall 10 and Longwall 10A at the North Wambo Underground Mine. South Wambo Water Dam has been drained as far as practical since January 2015. Therefore, any possible leakage mechanism that may have impacted bore P114 may no longer be present.

In a report currently under review, HydroSimulations has made assessments relating to the leakage of saline mine water from South Wambo Dam to the Wambo Creek alluvium. These assessments found no evidence for leakage from South Wambo Dam and instead show that increases in EC are associated with periods of lower groundwater level most likely related to the interception of saline Permian groundwater at the base of the Wambo Creek Alluvium.

Two additional monitoring bores in the vicinity of P114 have been included in the program from 2018 (P316 and P319). Data collected in these bores will assist with ongoing investigations into increased salinity in P114.

It is noted that South Wambo Water Dam can only be recommissioned after secondary extraction has been completed following receipt of relevant approvals from the NSW Dams Safety Committee.

5.0 Community Complaint Response

All groundwater related community complaints received by WCPL will be recorded within the Community Complaints Register. The E&C Manager will investigate the complaint, which will include, where possible, contacting the complainant within 24 hours to discuss the complaint. A review of the effectiveness of the corrective or preventative actions will be conducted within a month of the complaint and the relevant work procedures updated if required.

Preliminary investigations will commence as soon as practicable upon receipt of a complaint to establish if WCPL is responsible. All efforts will be made to determine the likely causes contributing to the complainant's concerns.

WCPL will attempt to address the complainants concerns such that a mutually acceptable outcome is achieved. However, if required, the Independent Dispute Resolution Process would be referred to (**Appendix A**).

Details of all community complaints will be included in the Monthly Environment Monitoring Report. WCPL will retain a copy of the Community Complaints Register for at least four years. The E&C Manager will ensure the latest Community Complaints Register is posted on the WCPL website.

6.0 Review and Reporting

6.1 Review

The performance of the groundwater monitoring program outlined in the GWMP is to be reviewed annually by the E&C Manager. A complete review of the GWMP will occur:

- Every two years;
- When there are changes to consent or licence conditions relating to groundwater monitoring;
- Prior to new underground mining areas being developed;
- Following significant groundwater related incidents at WCPL;
- Following continual exceedance of trigger values;
- Following an independent environmental audit which requires GWMP review; or
- If there is a relevant change in technology, practice or legislation.

The revised GWMP will be re-submitted to the Secretary for approval as required by Condition 30, Schedule 4 of DA305-7-2003.

6.2 Annual Review

Prior to the end of March each year, WCPL will review the environmental performance of the Mine and submit an Annual Review report to the DP&E. This report will:

- Describe the development (including any rehabilitation) that was carried out in the past year, and the development that is proposed to be carried out over the next year;
- Include a comprehensive review of the monitoring results and complaints records of the Project over the past year, which includes a comparison of these results against the:
    - relevant statutory requirements, limits or performance measures/criteria
    - monitoring results of previous years; and
    - relevant predictions in the EA;
- Identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;
- Identify any trends in the monitoring data over the life of the Project;
- Identify any discrepancies between the predicted and actual impacts of the Project, and analyse the potential cause of any significant discrepancies; and
- Describe what measures will be implemented over the next year to improve the environmental performance of the Project.

6.3 Website Updates

A comprehensive summary of the groundwater monitoring results will be made publicly available at WCPL website:

http://www.peabodyenergy.com/content/404/australia-mining/new-south-wales/wambo-mine)

Information on the website will be updated regularly as required by DA305-7-2003.

WCPL will also ensure that any information relevant to groundwater monitoring is uploaded to the website (and kept up to date). This includes:

- Current statutory approvals;
- Approved strategies, plans or programs required under the DA305-7-2003;
- A community complaints register;
- Minutes of Community Consultative Committee (CCC) meetings;
- Annual Reviews;
- A copy of any Independent Audits and WCPL's response to any recommendations in any audit; and
- Any other matter required by the Secretary.

6.4 Reportable Environmental Incidents

All reportable incidents will be reported via the EPA's Environmental Line on **131 555** by the E&C Manager in accordance with WCPL's Pollution Incident Response Management Plan (PIRMP).

In accordance with the PIRMP, WCPL must notify all relevant authorities of incidents causing or threatening material harm to the environment immediately after the person becomes aware of the incident in accordance with the requirements of *Part 5.7* of the *POEO Act.*

For all other incidents that do not cause threatening material harm to the environment associated with the Project, WCPL will notify the Secretary and any other relevant agencies as soon as practicable after WCPL becomes aware of the incident. This includes exceedance of the trigger levels defined in **Section 3.0.**

Within 7 days of the date of the incident, WCPL will provide the Secretary and any relevant agencies with a detailed report on the incident to include:

- The cause, time and duration of the event;
- Where possible the type, volume and concentration of every pollutant discharged as a result of the event;
- The name, address and business hours telephone number of employees or agents of the licensee who witnessed the event;
- The name, address and business hours telephone number of every other person (of whom the licensee is aware) who witnessed the event, unless the licensee has been unable to obtain that information after making reasonable effort;
- Action taken by the licensee in relation to the event, including any follow-up contact with any complainants;

- Implement remediation measures as directed by the Secretary, to the satisfaction of the Secretary;
- Details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event; and
- Any other relevant matters.

7.0 RESPONSIBILITIES

Table 14 below summarises responsibilities documented in the GWMP. Responsibilities may be delegated as required.

Table 14: Groundwater Monitoring Program Responsibilities

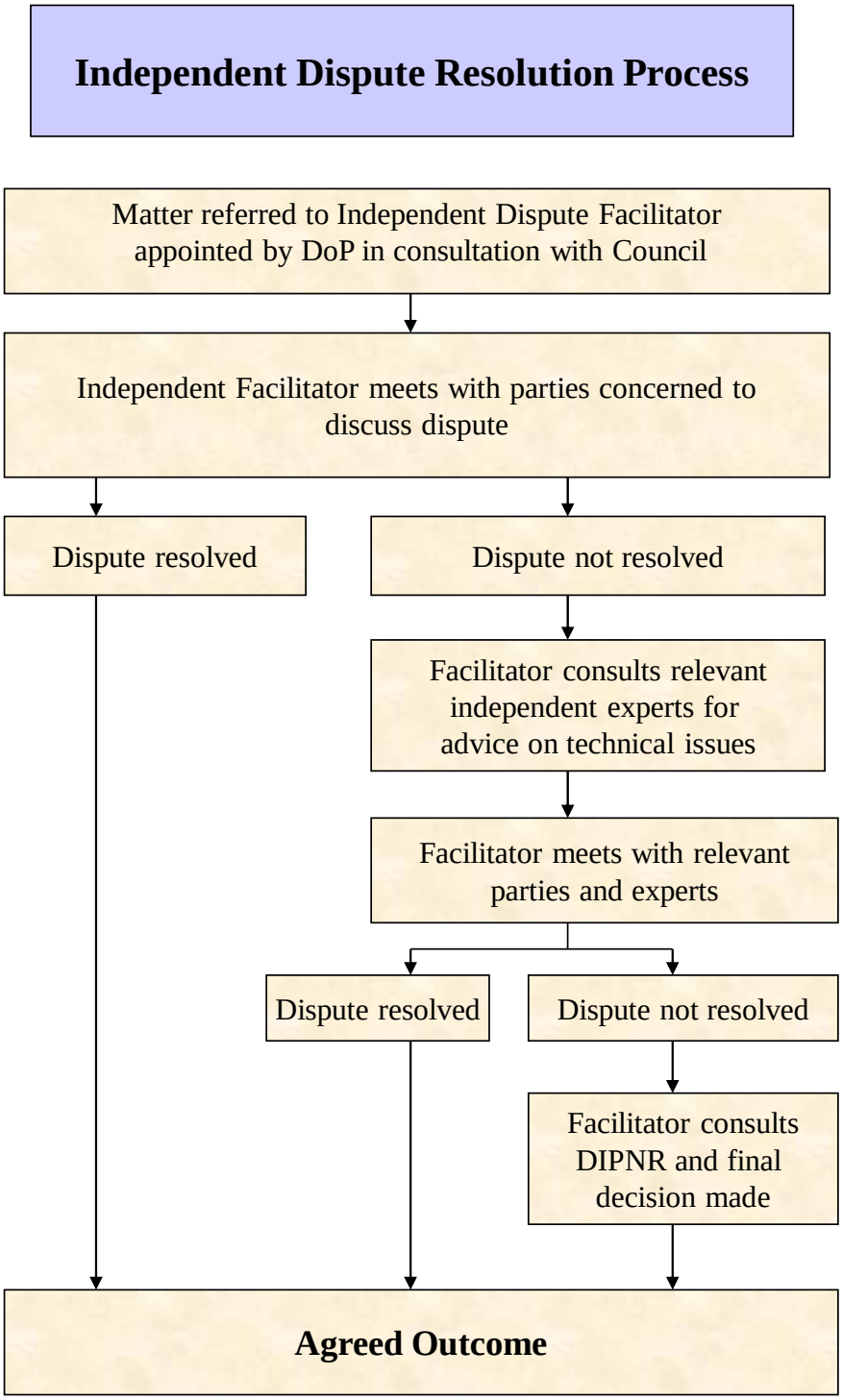
No	Task	Responsibility	Timing
1	Ensure groundwater monitoring is undertaken in accordance with **Section 4.0**.	Environmental Advisor	Bimonthly
2	Assess groundwater monitoring data against relevant trigger levels listed in **Section 3.0**	Environmental Advisor	As required
3	Review GWMP in accordance with **Section 6.0**.	Environmental Advisor	Annually
4	Undertake internal bi-monthly groundwater reporting.	Environmental Advisor	Bimonthly
5	Notify government departments if an incident occurs in accordance with **Section 6.4**	E&C Manager	As required
6	Submit updated GWMP to DP&E.	E&C Manager	As required
7	Groundwater related complaints to be responded to in accordance with **Section 5.0**	E&C Manager	As required
8	Annual Review to include groundwater monitoring results, complaints, mitigation measures undertaken and a review of the monitoring undertaken	E&C Manager	Annually
9	Regulator review to be undertaken of the GWMP	E&C Manager	As required
10	Prepare investigation reports and implementation of corrective actions in accordance with **Section 6.4**	E&C Manager	As required

8.0 References

- Development Consent (DA305-7-2003)
- Development Consent (DA177-8-2004)
- Wambo Development Project Environmental Impact Statement (EIS), July 2003
- Resource Strategies Pty Ltd (2003) Wambo Coal Mine Project Environmental Impact Statement. Report prepared for Wambo Coal Pty Ltd
- Wambo Environment Protection Licence (529)
- Bore licences 20BL173032, 20BL173033, 20BL173034 and 20BL173035
- Water Management Act 2000
- Water Act 1912
- Environmental Planning and Assessment Act 1979
- Hunter Unregulated and Alluvial Water Sources Water Sharing Plan
- North Coast Fractured and Porous Rock Groundwater Sources Water Sharing Plan
- NSW Aquifer Interference Policy
- Aquifer Interference Regulation 2011
- NSW State Groundwater Policy Framework Document 1997
- Bureau of Meteorology (2014) Atlas of Groundwater Dependent Ecosystems.
- DIPNR (2003) Groundwater Monitoring Guidelines for Mine Sites within the Hunter Region. Draft Report, Former NSW Department of Infrastructure, Planning and Natural Resources.
- Ferdowsian, R., Pannell, D., McCarron, C., Ryder, A. and Crossing, L. (2001) “Explaining groundwater hydrographs: Separating atypical rainfall events from time trends”, Australian Journal of Soil Research 39 (2001): 861-875.
- GHD Pty Ltd (2007) Report for Lower Section, North Wambo Creek Geophysical Survey.
- GHD Pty Ltd (2014) Groundwater Management Plan Monitoring Data. Wambo Coal Mine.
- Glen, R.A. and Beckett, J. (1993) Newcastle Coalfields Regional Geology 1:100,000 map, (Second Edition), NSW Department of Mineral Resources, Sydney.
- Groundwater Imaging Pty Ltd (2012) A Transient Electromagnetic Investigation of the Extent of the Wollombi Brook Alluvium at the Wambo Coal Mine Site.
- Heritage Computing (2012) North Wambo Underground Mine Modification Environmental Assessment: Appendix B Groundwater Assessment.
- HLA-Envirosciences Pty Ltd (1999) Effect of Longwall Panel 9 Mining on Surface and Groundwater – Homestead Underground Mine Warkworth NSW.
- HydroSimulations (2014) North Wambo Underground Longwall 10A Modification Groundwater Assessment. Report prepared for Wambo Coal Pty Limited.
- HydroSimulations (2015a) Assessment of Groundwater Trends in GW08 and GW09. Report prepared for Wambo Coal Pty Ltd. Report No. HC2015/39.

- HydroSimulations (2015b) South Bates (Wambo Seam) Underground Mine Modification Groundwater Assessment. Report for Wambo Coal Pty Ltd. Report No. HC2015/026.
- HydroSimulations (2016a) South Wambo Underground Mine Modification Groundwater Assessment. Report for Wambo Coal Pty Ltd Report No..HS2016/01.
- HydroSimulations (2016b) Wambo Annual Review Groundwater Analysis. Report for Wambo Coal Pty Ltd. Report No. HS2016/26
- HydroSimulations (2017) South Bates Underground Extension Modification Groundwater Assessment. Report for Wambo Coal Pty Ltd Report No. HS2016/51.
- NUDLC (2011) Minimum Construction Requirements for Water Bores in Australia. National Uniform Drillers Licensing Committee, 3rd Edition.
- Please, Patricia M & Murray-Darling Basin Commission (Australia) (1997). Murray-Darling Basin groundwater quality sampling guidelines. Murray-Darling Basin Commission, Canberra
- SLR Consulting (2017) Wambo Drilling Program – North Wambo Creek. Letter report prepared for Wambo Coal Pty Ltd. Ref 630.12300-L01-v0.1.docx
- Worley Parsons (2014) OPSIM Water Balance Model Initial Investigations – January 2014.

APPENDIX A
INDEPENDENT DISPUTE RESOLUTION PROCESS


Independent Dispute Resolution Process
Matter referred to Independent Dispute Facilitator appointed by DoP in consultation with Council
Independent Facilitator meets with parties concerned to discuss dispute
Dispute resolved
Dispute not resolved
Facilitator consults relevant independent experts for advice on technical issues
Facilitator meets with relevant parties and experts
Dispute resolved
Dispute not resolved
Facilitator consults DIPNR and final decision made
Agreed Outcome

APPENDIX B
CORRESPONDENCE WITH REGULATORY AGENCIES

Summary of Comments Received from DoI Water on the WMP (Revision F) December 2017

Comment	Consideration of Comment
DoI Water (CL&W)	
…CL&W recommends the following is undertaken prior to the Department of Planning's endorsement of the WMP	
The Department of Planning and Environment engages an independent expert to advise if leakage from South Wambo Dam has resulted in contamination of the alluvial aquifer of South Wambo Creek;	Noted. HydroSimulations has prepared a report (under review) titled Update on Possibility of Mine Water Seepage to Wollombi Brook (April 2018)
In consultation with Crown Lands and Water, WCPL expands the observation bore network within and beneath the area of alluvial aquifers and mapped GDEs. This is to ensure that future groundwater model revisions can capture and predict important localised impacts;	SLR completed installation of monitoring bores in the North Wambo Creek alluvium in 2017. The lack of alluvial groundwater present during the drilling (despite recent rain at the time of the drilling) does not support further drilling.
The WMP set a requirement to measure water quality for water seeping into the open cut and underground mine workings	WCPL conducts monitoring though an extensive network of boreholes. Further investigations will be conducted in 2018 to seek improvements to the overall site water management and direct monitoring of seepage into the open cut or underground workings.
The Surface and Ground Water Trigger Action Response Plan must link to monitoring bores with defined thresholds listed in the Groundwater Monitoring Plan. Observation sites listed for North Wambo Creek alluvium have no defined triggers that hold WCPL accountable to impacts and the licensable take of water.	The Mine is approved to have an impact on North Wambo Creek alluvium and the licensable take of water has been predicted by HydroSimulations (2016a, 2017). WCPL is held account to its licensing volumes through the monitoring of inflow volumes.

Summary of Comments Received from the Independent Expert Scientific Committee (July 2017) on the GWMP

Comment	Consideration of Comment
IESC – 31 July 2017	
Groundwater quality data for contaminants such as metals and other ions (e.g. sulfate) was not provided in the EA or in the proponent's environmental reporting (from July 2015 onwards (Peabody Energy 2017)) despite the proponent's groundwater monitoring plan stating that monitoring for these parameters had commenced in July 2015 (Peabody Energy 2015a). The current sampling frequency (i.e. annual) will not provide data that is suitable for use in calculating or applying trigger values.	Water quality triggers are defined for EC and pH as sufficient indicators of potential water quality impacts in the context of beneficial use, the criterion in the Aquifer Interference Policy.
The current groundwater monitoring network does not contain any bores that are able to detect and provide early warning of potential drawdown in private bores located to the north, northwest and west of the proposed project. There are no monitoring bores located to the southwest and south of the proposed project; therefore, potential drawdown propagation in the direction of the World Heritage-listed Wollemi National Park will not be monitored. The IESC recommends that monitoring bores be installed in these areas and that the proponent commits to replace or repair any current monitoring bores which are damaged due to the proposed project such as through subsidence.	Additional groundwater monitoring bores have been and are being installed to the north and north-west of the Modification 17 area (P320, P321 and UG166A). There are no groundwater users (environmental or third-party users) to the south-west and south of the Modification 17 area, and therefore no additional groundwater monitoring to the south-west and south is proposed.
Water quality monitoring (for contaminants such as metals and ions) should be expanded to include the Permian aquifer. Sampling frequency in the Permian aquifer should be at least six-monthly, with frequency increased to a minimum of three-monthly in the alluvial aquifer where higher hydraulic conductivity and connectivity to surface water will cause more rapid changes in water quality parameters.	Water quality sampling is conducted in Permian bores P202, P203, GW12, GW21, GW22. There is limited use of the Permian aquifers and therefore further sampling is not considered warranted.
Baseline water quality data should be collected from representative reference bores in areas of the aquifers where mining impacts have not occurred.	Bore holes GW23, GW24, GW25 and GW26 were drilled late 2017 in North Wambo Creek . These bores will provide representative data prior to the commencement of mining in the South Bates Underground Extension Area (LW18-25)
The data used to calculate trigger values for both groundwater levels and quality should be provided. The IESC is concerned that data from impacted sites was used to set trigger values. Data and associated metadata (including for reference bores) should be presented to show that only pre-impact data has been used in the calculation of the trigger values.	It is noted that mining first commenced in the Wambo area in 1969. Therefore, while the use of "pre-impact" data to characterise baseline conditions is ideal, it is not feasible at Wambo. A full statistical analysis for data up to April 2015 is included as Table 7.
Trigger values should be calculated using the 20th and 80th percentiles as outlined in the ANZECC/ARMCANZ Guidelines (2000), not the less conservative 10th and 90th percentiles used by the proponent. Trigger values and associated TARPs should be initiated based on a single recorded exceedance of the 20th or 80th percentile values and not multiple exceedances over numerous months. A subsequent consecutive exceedance should initiate another level of the TARP.	As described in Section 3.2 of the GWMP, although ANZECC and ARMCANZ (2000) recommend 80th percentile values as being suitable for trigger values, a trigger would be initiated 20% of the time due to natural causes. Therefore, for the trigger to be a meaningful indicator of a possible mining effect, an investigation is to be triggered when the 90th percentile value is exceeded on two or three consecutive monitoring events.

Comment	Consideration of Comment
The groundwater management plan should include commitments from the proponent to undertake a thorough review of the groundwater model given it has been revised over a number of years to accommodate multiple modifications to mining at the Wambo Mine Site. This makes it difficult to identify the calibration and parameterisation history of the model and hence to appraise its ability to accurately predict project-specific and cumulative impacts.	The regular reviews and updates to the numerical model undertaken as part of modifications to the Wambo Coal Mine has improved the performance of the numerical model through regular re-calibration and validation. The most recent calibration of the numerical model is documented in the MOD 12 Environmental Assessment (HydroSimulations, 2016a). The most recent validation and model run is documented in the MOD 17 Environmental Assessment (HydroSimulations, 2017). Both reports are in the public domain.
The groundwater management plan should include commitments from the proponent to regularly validate the groundwater model predictions. The groundwater management plan should include commitments from the proponent to regularly update the groundwater model as recommended by the Australian Groundwater Modelling Guidelines (Barnett et al. 2012).	WCPL undertakes a comprehensive review of groundwater monitoring results annually against the groundwater model predictions in the Annual Review (Condition 5, Schedule 6 of the Development Consent DA 305-7-2003). In addition, as part of each Extraction Plan application, WCPL is required to present a revised assessment of potential impacts and environmental consequences incorporating relevant monitoring data obtained since the approval (Condition 22D, Schedule 4 of the Development Consent DA 305-7-2003).
The groundwater management plan should include commitments from the proponent to clearly define the level of variance between groundwater observations and model predictions that will trigger a review of the groundwater model.	A review of monitoring results against the numerical model predictions is undertaken annually and presented in the Annual Review. It is not considered appropriate to define a set level of variance given the complexity of the natural environment and the influence of other potential factors (e.g. climatic conditions or changes in mine progression).

NSW GOVERNMENT | Planning & Environment

Contact: Scott Brooks
Phone: 6575 3401
Fax: 6575 3415
Email: scott.brooks@planning.nsw.gov.au
Our ref: 305-7-2003

The General Manager
Wambo Mine
PMB 1
SINGLETON NSW 2330

Attention: Steve Peart

Dear Steve

Wambo Coal – Approval of Water Management Plan

Thank you for forwarding the Wambo Water Management Plan and all its parts as required under project approval DA 305-7-2003 for the Department's consideration.

The Water Management Plan is required by Condition 30 Schedule 4 and the following 5 components of the Plan were reviewed:

- Site Water Balance (30)
- Erosion and Sediment Control Plan (32)
- Surface Water Monitoring Program (33)
- Ground Water Monitoring Program (34)
- Surface and Ground Water Response Plan (35).

The Department has reviewed these plans, and is satisfied that they generally address the requirements set out in the relevant conditions of the project approval. Consequently, I would like to advise you that the Secretary has approved the plans.

These plans come into force on the 30th November 2015 and remains in force until replaced by any future updated approved Plans.

I am aware that DPI Water are expected to comment on the Extraction Plan for the South Bates U/G (Wybrow seam) LW 11-13. Should this comment require significant changes to any component of the Water Management Plan, I ask if these changes could be made and the plans resubmitted for review and approval.

Could you please forward finalised copies of the above plan (preferably in PDF format with a copy of this approval letter appended) for the Department's records by the end of November 2015.

If you require further information or clarification in this matter please contact Scott Brooks on 6575 3401 or by email to scott.brooks@planning.nsw.gov.au.

Yours sincerely

Scott Brooks
Investigations (Lead), Compliance
27-11-2015
As Nominee for the Secretary, Planning & Environment

From: Scott.Brooks@planning.nsw.gov.au [mailto:Scott.Brooks@planning.nsw.gov.au]
Sent: Wednesday, 21 October 2015 1:22 PM
To: Peart, Steven D
Subject: RE: 3 of 3

Steve,
I had no comment on the EE&SC Plan

Scott

Scott Brooks
Investigations (lead), Compliance
Planning Services, Resources Assessments
Planning & Environment
Suite 14, Level 1, 1 Civic Av
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P: 02 6575 3401 | | **Office:** 6575 3405
M: 0419 970924 **F:** 02 6575 3415

Please consider the environment before deciding to print this e-mail.

From: Peart, Steven D [mailto:SPeart@peabodyenergy.com]
Sent: Wednesday, 21 October 2015 12:50 PM
To: Scott Brooks
Subject: RE: 3 of 3

Cheers Scott

The only other one was the Erosion and Sediment Control Plan if you had any comments on it.

Thanks again

Steven Peart
Manager: Environment & Community

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Please consider the environment before printing this email.

From: Scott.Brooks@planning.nsw.gov.au [mailto:Scott.Brooks@planning.nsw.gov.au]
Sent: Wednesday, 21 October 2015 11:46 AM
To: Peart, Steven D
Subject: RE: Wambo Coal_WMP's 1 of 3

Steve,
Comments on the 3 water management plans.

Please note we will need some type of water balance, and the info for the evaporation sprays if you want to use them.

Scott

Scott Brooks
Investigations (lead), Compliance
Planning Services, Resources Assessments
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Plan	Section	DP&E Comment
Surface and Ground Water Response Plan (WA-ENV-MNP-509.4) Version 8	2.7 North Wambo Creek Diversion Performance Criteria	Given the problems with the NWCD this section should refer to other management plans of have a section referring to erosion and the potential for sediment generation and loss from the system.
Surface Water Monitoring Program (WA-ENV-MNP-509.2) Version 8	1.4.1 Environmental Planning & Assessment Act 1979 (Table 3)	(NOW) Currently called DPI Water
	2.2.3.2 Stream Flow (Table 7)	(No flow data available) Is this because the SWC never runs?
	4.1 Monitoring Network, Parameters and Frequency	(Mine water monitoring is undertaken for operational management purposes only. This data is not reported publicly). This would appear to conflict with Schedule 6 Condition 12 requiring the publishing of monitoring results.
	4.1.5 Riparian Vegetation and Creek Bed Stability	The NWCD has its own rehab management plan. This management plan should refer to it and it may need to be updated.
	4.1.6 Monitoring of Discharge Flows in the North Wambo Creek Diversion	What did NOW ask for. This should be included.
	6.1 Review	(Review every two years) Usually 3 years
Groundwater Monitoring Program (WA-ENV-	2.2.3.1 Alluvial Water Sources	(Investigation into increase in EC) This will need to be reported in the AEMR

Plan	Section	DP&E Comment
MNP-509.1) Version 9	3.1.3 Permian Monitoring Locations	Need to discuss why we monitor if the results cannot result in action.
	3.2 Trigger Values for Groundwater Quality	(Bi-monthly monitoring) This will need to be defined. Twice a month or every 2 months
	4.1.6 Chitter Dam and Wambo South Water Dam Monitoring Program	Need some comment here if the dam will be recommissioned if it is found to be leaking.
	6.1 Review	(Review every two years) Review is normally every 3 years.

From: Joanna Webster [mailto:jwebster@ResourceStrategies.com.au]
Sent: Wednesday, 17 June 2015 1:05 PM
To: Jessie Evans; Brendan Liew
Cc: Joshua Hunt; Howard Reed; Alexander, Micheal G; Peart, Steven D
Subject: RE: Wambo 10A Extraction Plan - NOW comments
Importance: High

Hi Jessie/Brendan,

On behalf of Wambo Coal, please find attached a response to the recommendations made by NSW Office of Water.

Also attached is a revised Groundwater Monitoring Program that has been updated to address the recommendations made by the Office of Water.

Please consider Attachment 3 of the Water Management Plan for North Wambo Underground Mine Longwalls 8 to 10A Extraction Plan to be replaced by the attached revised Groundwater Monitoring Program.

Please don't hesitate to call if you would like to discuss.

Regards

Joanna Webster
Senior Environmental Manager
e jwebster@resourcestrategies.com.au
m 0414 664 532

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From: Jessie Evans [mailto:Jessie.Giblett@planning.nsw.gov.au]
Sent: Thursday, 4 June 2015 8:42 AM
To: Joanna Webster

Cc: Joshua Hunt; Howard Reed; Brendan Liew
Subject: RE: Wambo 10A Extraction Plan - NOW comments

Hi Joanna,

The Department has received comments from NOW in regards to the Wambo LW 8-10A Extraction Plan. I have attached these for your careful consideration and response. NOW has raised a number of issues, and in particular has concerns regarding the Groundwater Management Plan.

Could you please provide a response to NOWs concerns at your earliest possible convenience.

Thanks
Jessie

North Wambo Underground Mine Extraction Plan Longwalls 8 to 10A
Response to NSW Office of Water Comments (Dated 3 June 2015)

NOW Recommendation	Response
Groundwater Management It is recommended with respect to the exceedance of groundwater level triggers: • WCPL must investigate the drivers for declining water levels (rather than omitting bores from the monitoring program when bores go dry). Notification to the Office of Water is required as part of the response procedure within 3 months of such an event.	Five bores are proposed to be removed from the groundwater monitoring program (GW14, GW18, GW19, P5 and P6). Only two samples (August 2011 and December 2011) have been obtained from GW14 since its installation in 2011 (these samples may have been associated with groundwater levels stabilising following drilling). This bore is located to the east of Wollombi Brook and is far removed from mining activities associated with the Wambo Coal Mine. Only one sample (August 2010) has been obtained from GW18. GW19 has been consistently dry since installation and no valid samples have been obtained from this bore. GW18 and GW19 are located immediately downstream and upstream of the North Wambo Creek Diversion, respectively. The alluvial flow in North Wambo Creek has been altered by the historical and existing mining operations including the removal of alluvium across the full width of the channel with consequent desaturation of the adjacent upstream and downstream alluvium associated with the approved and constructed North Wambo Creek Diversion. Bores P5 and P6 have been covered by the approved Wambo Coal Mine waste rock emplacement. WCPL considers removal of these five bores from the groundwater monitoring program is justified as outlined above. Trigger levels are not proposed for a further four bores along North Wambo Creek (GW08, GW09, GW16 and GW17). WCPL has initiated an investigation for bores GW08 and GW09 as outlined further below. Trigger levels will not be developed for these bores until this investigation is complete. GW16 and GW17 are located upstream of the North Wambo Creek Diversion and in close proximity to the approved open cut. There are no groundwater users located in the vicinity of North Wambo Creek upstream of the North Wambo Creek Diversion. Therefore, a trigger level for these two bores is not considered warranted.

NOW Recommendation	Response
• Where the driver for declining shallow bore water levels exceeding trigger levels can not be linked to the prevailing climatic influence or miscellaneous sampling error, additional groundwater modelling is required to re-assess if there is a change in the predicted take of water from the Lower Wollombi Brook Water Source from mining related activities. As part of WCPL's response procedure, a report summarising the assessment is to be submitted to the Office of Water.	WCPL has initiated an investigation into the monitored declining water levels in GW08 and GW09. As described in Section 6.1.3 of the revised GWMP, a preliminary investigation report will be provided to the DP&E and NOW by 30 September 2015. This report will include preliminary conclusions regarding the potential licensing implications and a process and timetable for any further investigation work (including potential additional numerical hydrogeological modelling work).
• Where the updated modelled aquifer interference take of water from the Lower Wollombi Brook Water Source (encapsulating Wambo and North Wambo Creek) exceeds the estimates as predicted in WPCL's Groundwater Impact Assessment by 100% or more, WCPL must re-evaluate the associated ecological impacts and any influence on a low flow cease to pump criteria specified in the relevant WSP. The reference value triggering this response procedure must be clearly documented in the GWMP.	As described in Section 6.1.3 of the revised GWMP, Where the investigation for GW08 and GW09 indicates a revised predicted take from alluvial water sources that exceeds the previous estimates by more than 100%, WCPL would consider other potential associated impacts (e.g. on ecology) and any influence on a low flow cease to pump criteria specified in the HUA WSP.
• The trigger levels in Table 11 of the GWMP outlines a minimum and maximum depth to water level. These values, plus any new bores added to the list, and the bores proposed to be dropped, must be presented in Australian Height Datum.	Table 11 of the GWMP has been revised to include trigger levels presented in Australian Height Datum.
<u>It is recommended with respect to the exceedance of groundwater quality triggers</u> • Appropriate water quality baseline data has not been captured and presented in way that can be used for before and after impact. Salinity data for a number of bores has fluctuated considerably which is not consistent with a more stable groundwater environment. The use of major ion analysis and QA/QC procedures should be reviewed to inform if the salinity measurements reported are accurate and if so the drivers to cause such variability in the results.	The GWMP has been revised to include annual comprehensive analysis of major ions standpipe bores. A description of data management procedures has been included in Section 5.3.2.
• Due to the concerns with the potential for cross aquifer interconnection, water quality performance measures are essential to the impact assessment. Water quality performance measures should be defined and added to the GWMP.	The GWMP has been revised to include groundwater quality trigger levels in Section 5.4.
<u>It is recommended with respect to the exceedance of predicted mine inflows</u> • There is a discrepancy between the GWMP which outlines a monthly measurement and annual assessment of mine inflows, whilst the 'Subsidence Response Strategy' indicates metering of weekly dewatered volumes. It should be consistently reported weekly, in the GWMP as this will improve the understanding of inflow and assist with groundwater management and the triggers for exceedance.	Section 5.2.5 of the GWMP has been updated to clarify that dewatering values are recorded internally on a daily basis (during active pumping). As outlined in the North Wambo Creek Subsidence Response Strategy, these values are reviewed weekly for any indication that pumping rates are higher than normal (which would trigger an investigation). Dewatering values are also reviewed annually (as outlined in the GWMP) to determine the inflows from groundwater sources and to verify whether WCPL holds sufficient groundwater licence entitlements.

NOW Recommendation	Response
• Where the annual assessment for mine inflows exceeds the peak estimate as predicted in WCPL's Groundwater Impact Assessment by 50% or more, WCPL shall: – investigate if there is a change in the predicted take of water from the Lower Wollombi Brook Water Source from mining related activities; – where there is an increased take from the Lower Wollombi Brook Water Source, investigate any influence on a low flow cease to pump criteria specified in the relevant WSP. – define the mine inflow volume value triggering this response procedure within the GWMP. – As part of WCPL's response procedure, a report summarising the assessment is to be submitted to the Office of Water.	Section 5.2.5 of the GWMP has been updated to include the recommended response procedure. The mine inflow volume that would response procedure has been defined in the GWMP (563 ML/annum, which is 50% more than the peak estimate predicted by HydroSimulations (2014) [375 ML/annum] for the North Wambo Underground Mine).
• WCPL must notify the Office of Water as soon as practicable on become aware of any take of water in excess of its licensed entitlement	Section 5.2.5 of the GWMP has been updated to include this statement.
<u>It is recommended with respect to monitoring leakage from dams</u> • The closest bore to South Dam is Piezometer 114 representative of Wambo Creek alluvium. South Dam contains produced water from the mine and P114 shows a sharp rise in salinity to a level on par with water in the dam. This indicates probable leakage occurring from the dam that warrants further investigation. However, as the proponent proposes not to utilise water quality as a performance measures, no direct response is proposed. Significant leakage to the nearby alluvial aquifer could risk a change in the beneficial use of the aquifer. Trigger levels with regard to salinity must be set to investigate and determine if remediation is required.	WCPL has initiated an investigation into the monitored increasing salinity levels in P114. Wambo South Water Dam is currently not in use for the period of secondary extraction for Longwall 9, Longwall 10 and Longwall 10A at the North Wambo Underground Mine. Wambo South Water Dam has been drained as far as practical since January 2015. Therefore, any possible leakage mechanism that may have impacted bore P114 may no longer be present.
A report summarising any special assessment for the above recommendations should be provided within 6 months.	As described in Section 6.1.4 of the revised GWMP, a preliminary investigation report will be provided to the DP&E and NOW by 30 November 2015.
<u>Surface Water Management</u> • The Office of Water recommends the proponent and the Department of Planning and Environment develop a consultation process with affected landholders to address existing and potential degradation which occurs as a result of mining subsidence. This should focus on incorporating natural processes for channel recovery particularly using large timber controls to maintain bed level (bed sills), bank toe protection (timber bank revetment) and creation of scour pools by using 'forced' controls such as engineered log jams as an adjunct to revegetation of both banks of both watercourses.	All land above the North Wambo Underground Mine is owned by WCPL. Therefore there are no other affected landholders associated with the North Wambo Underground Mine Extraction Plan for Longwalls 8 to 10A. Advisian (2015) concluded it is unlikely Wambo Creek and Stony Creek would experience adverse impacts from the North Wambo Underground Mine, and mitigation measures are unlikely to be required. In the unlikely event that any mitigation measures are required, these would be developed in consultation with the Department of Planning and Environment and the NSW Office of Water, and would aim to incorporate natural processes for channel recovery.

Summary of Comments Received on the GWMP

Comment	Consideration of Comment
Department of Planning and Environment – 25 May 2017 and 5 July 2017	
Update the GWMP to reflect the modified layout for LWs 14-16 and the most up-to-date and recommended monitoring regime provided in Technical Report 2.	The GWMP has been revised to reflect the latest layout for LWs 14-16 (e.g. see Figure 3). There was no additional monitoring recommended by Technical Report 2 of the Extraction Plan for the South Bates Underground mine. It is noted that this report describes some sites that have been removed from the program due to disturbance by open cut operations (e.g. P5 and P6).
Replace Figure 3 with the approved longwall layout for LWs 11-16 (as approved by the Extraction Plan on 16 May 2017).	Figure 3 has been revised.
Provide evidenced of consultation with DRG and DPI-Water in relation to this version of the GWMP, and indicate how many matters raised have been addressed.	Section 1.5 and this Appendix have been revised to include further detail on consultation.
Replace Figure 5 with the location of the approved longwall layout for LWs 11-16.	Figure 5 has been revised to show the location of mapped alluvium in the lower reaches of the creeks over the latest approved underground mine layout.
Update Section 2.2.1 to include a discussion of the latest approved mining operations in the South Bates Underground Mine.	Section 2.2.1 has been revised to discuss the latest status of mining at Wambo.
Update Section 2.2.2 to describe the current groundwater monitoring network. Replace Figure 7 with Figure 4 in Technical Report 2.	Section 2.2.2 has been revised with the latest groundwater monitoring network.
Update the data summaries in Section 2.2.3 (including Table 8) to include the last 3 years of data.	The data in Table 8 (HARTT Analysis Results for Shallow Monitoring Bores) was used to generate the groundwater impact assessment criteria. It is not considered appropriate to continue to update baseline data during mining operations, as it may skew the impact assessment criteria. Monitoring results during operations are presented in Annual Reviews.
Update the discussion on the hydrogeological model in Section 2.2.5.	Section 2.2.5 has been revised to refer to the latest hydrogeological model for the approved mine.
Update the ground water triggers in Section 3.0 to reflect the latest data for the South Bates Underground.	The trigger levels in Section 3.0 are for bores with a broad spatial extent and are designed for all open cut and underground mining operations at Wambo. It is not considered appropriate to revise trigger levels to incorporate mine affected data.
Update Section 4.1.5 to reflect inflow estimates and triggers for South Bates Underground Mine inflows (based on 2015 HydroSimulations estimates). Liaise with DPI-Water in relation to the inflow "trigger", procedures for exceedances and licence implications.	Section 4.1.5 has been revised for the South Bates Underground Mine based on the same methodology that was used for North Wambo Underground Mine. This methodology was developed in consultation with DPI Water.
Update Section 4.0 and Table 12 to reflect the most up-to-date and current groundwater monitoring regime.	Table 12 reflects the latest groundwater monitoring network. Note that Table 6 includes a note that GW14 has been dry since December 2011, GW18 has been dry since October 2010 and GW19 has been dry since monitoring began in 2009.
Update Section 4.1.6 to reflect the current status of mining and monitoring results in the vicinity of these structures.	Section 4.1.6 has been revised to reflect that the Chitter Dam has been decommissioned.
DPI Water – 6 November 2015	
DPI Water recommended that the groundwater monitoring program be revised to address the loss of bores from the North Wambo Creek alluvium.	WCPL is installing additional groundwater monitoring locations in 2017.

Comment	Consideration of Comment
DPI Water noted that groundwater trigger levels in the GWMP are not referenced in Australian Height Datum (AHD).	Section 3.1.1 of the GWMP has been amended to include absolute trigger levels in m AHD.
DPI Water requested that P114 and P116 of the Wambo Creek alluvial trigger bores within the subsided area be nested or paired with deeper interburden bores to assess the direction of flow between Permian and alluvial aquifers during the post mining period.	WCPL is installing additional piezometers in this area in 2017.
DPI Water noted that Table 3 of the GWMP should be updated to reflect that: • the combined extraction limit of 20BL166910, 20BL173032, 20BL173033, 20BL173034 and 20BL173035 is 450 ML; • the combined extraction limit of 20BL173040, 20BL168017 and 20BL172061 is 750 ML; and • 20BL166906 has been cancelled.	The GWMP has been updated with the latest groundwater licence information.
DPI requested that Table 3 of the GWMP is updated to include all Water Access Licences (including regulated river access licences). DPI Water recommends that WCPL provide clarification regarding which licences relate to the operation of Wambo mine and which are used to account for passive water take.	Table 3 of the GWMP lists groundwater entitlements. Section 1.4.2 of the GWMP has been revised to include a reference to the SWMP for a list of surface water entitlements.
DPI Water indicated that the GWMP should address its previous comment that where the updated modelled aquifer interference take of water from the Lower Wollombi Brook Water Source exceeds the estimates as predicted in WPCL's Groundwater Impact Assessment by 100% or more, WCPL must re-evaluate the associated ecological impacts and any influence on a low flow cease to pump criteria specified in the relevant WSP. The reference value triggering this response procedure must be clearly documented in the GWMP.	This comment has been addressed in the SGWRP.
DPI Water referred to the Assessment of Groundwater Trends in GW08 and GW09 prepared by HydroSimulations (29 September 2015) and commented that vertical connection with North Wambo Creek and Wambo Creek is more significant than modelled. DPI Water recommended that an appropriate timeframe be set where the groundwater conceptualisation and numerical model will be updated.	The groundwater conceptualisation was reviewed as a result of monitoring results in GW08 and GW09. The numerical model was recalibrated to capture the monitoring data in GW08 and GW09 and reported in HydroSimulations (2016a).

APPENDIX C
SUMMARY OF COMMITMENTS

Note: The list of commitments in this appendix is in addition to those explicitly required by Development Consent or EPL conditions.

GWMP Section	Commitment	Timing
Groundwater Monitoring Program		
2.2.1	Quarterly download of the four vibrating wire piezometers, monitoring water levels in the Permian measures (Bores N2, N3, N5 and GW20).	Quarterly
2.2.1	Quarterly download of the four hydrostatic level transducers monitoring water levels in real time (Bores BH2A, BH2, BH4C and WAMBO-03, Bore 2 and 2A).	Quarterly
2.2.2	Undertake annual site water balance and present summary in the Annual Review.	Annually in February
2.2.3	Periodic re-calibration of the hydrogeological model, based on observed piezometric heads and groundwater inflow data	As required
3.0	Utilise trigger values outlined in Table 9 and Table 10, to determine if groundwater impact investigation procedure or Trigger Action Response Plan (TARP) in the SGWRP should be initiated	Monthly or following quarterly downloads
3.1.2	Monitor groundwater levels in P114, P116 and P202 (South Wambo Water Dam) against the trigger levels in Table 9 and Table 10.	Monthly or as data is available
3.1.3	Initiate further investigation of the Permian monitoring bores if : • An adjacent landholder complains about declining groundwater levels in their bore; or • Higher than predicted inflows are recorded; or • The groundwater drawdown is greater than predicted. (Note - specific groundwater trigger values have not been established for the Permian monitoring bores)	As required
3.3	Report on progress against the performance indicators in Table 11 in the Annual Review	Annually
4.0	Utilise data collected in the continued development of groundwater triggers and provide input into annual reviews of groundwater monitoring data	Annually
4.1.1	Install additional monitoring bores so that at least two years of monitoring data is collected prior to undermining.	2 years prior to mining
4.1.1	Construct all new monitoring bores in accordance with the Minimum Construction Requirements for Water Bores in Australia (NUDLC, 2011).	As required
4.1.2	Decommissioning of monitoring bores will be undertaken in accordance with NUDLC (2011) requirements.	As required
4.1.4	Metering of dewatered volumes from each of the Wambo open cut pits will be undertaken. Dewatered volumes will be incorporated into the annual site water balance to determine the inflows from groundwater sources, including alluvial aquifers, and to verify WCPL groundwater licence entitlements.	Annually
4.1.5	Dewatering volumes and underground water levels will be recorded on a daily basis during pumping.	Daily, during pumping
4.1.5	Data collected from the underground dewatering volumes will be incorporated into the site water balance on an annual basis	Annually

GWMP Section	Commitment	Timing
4.1.5	Where the annual assessment for mine inflows to the South Bates Underground Mine exceeds the peak estimate predicted by HydroSimulations (2017) (316 ML/year) by 50% or more (that is more than 474 ML/year), WCPL will: • Investigate if there is a change in the predicted take of water from the Lower Wollombi Brook Water Source from mining related activities; • Where there is an increased take from the Lower Wollombi Brook Water Source, investigate any influence on a low flow cease to pump criteria specified in the HUA WSP; • Define the mine inflow volume value triggering this response procedure; and • Submit a report summarising the assessment to DoI Water.	Annually
4.1.5	Notify DPI Water as soon as practicable on becoming aware of any take of water in excess of the licensed entitlement.	As required
4.1.6	Monitoring bores P114, P116 and P202 and surface water quality from Wambo South Water Dam will be analysed to detect potential sub-surface water loss. Water quality analysis will include major cations and major anions (annually) in addition to pH and EC (bi-monthly).	Bi-monthly and annually
4.1.6	South Wambo Dam will only be recommissioned after further geotechnical assessment, structural repairs and following relevant consultation NSW DSC and DRG.	If required
4.2	Groundwater monitoring methodology will consider the Murray-Darling Basin Groundwater Quality. Sampling Guidelines. Technical Report No 3 (Murray-Darling Basin Commission [MDBC, 1997]) and the Methodology outlined in Section 4.2.	Bi-monthly and as required
4.3	Validated data from the monitoring program will be entered into a digital database by an Environmental Advisor.	Monthly and as required
4.4	Upon receipt of monitoring results: • Data will be compared to the specific trigger values ; and • If result(s) do not meet specified trigger values the response procedure will be initiated in accordance with the SGWRP.	Monthly and as data is available
4.4	When monitoring results exceed specified trigger values or the annual review identifies groundwater impacts, an investigation will be launched to determine the cause.	As required
5.0	All groundwater related community complaints will be recorded within the Community Complaints Register.	As received
5.0	The Monthly Environment Monitoring Report will include details of all community complaints	Monthly
6.0	The performance of the groundwater monitoring program is to be reviewed annually by the E&C Manager.	Annually
6.2	Review the environmental performance of the Mine and submit an Annual Review to the DP&E prior to the end of March each year.	Annually
6.4	Groundwater monitoring results will be made publicly available on the WCPL website.	Monthly
6.4	All reportable incidents will be reported via the EPA's Environmental Line on 131 555 by the E&C Manager.	As required

ATTACHMENT 4

WAMBO COAL PTY LIMITED
SURFACE AND GROUNDWATER RESPONSE PLAN

WAMBO COAL
SURFACE AND GROUND WATER RESPONSE PLAN

Document No. WA-ENV-MNP-509.4
April 2018

Document Control

Document No.	WA-ENV-MNP-509.4
Title	Surface and Ground Water Response Plan
General Description	Responses to potential surface and ground water impacts at WCPL
Document Owner	Environment & Community Manager

Revisions

Rev No	Date	Description	By	Checked	Signature
0	October 2005	Original Draft	RS	JT	
1	October 2005	Revision 1	RS	JT	
2	November 2007	Revision 2	RS	JT	
3	March 2008	Revision 3	WCPL	JT	
4	October 2009	Revision 4	RS	SW	
5	February 2012	Revision 5	WCPL	SB	
6	September 2014	Revision 6	GHD / WCPL	TF	
7	April 2015	Revision 7	WCPL	TF	
8	September 2015	New management plan format and revision	WCPL/Palaris	SP	
9	October 2015	Revised following receipt of comments from DP&E on Rev 8	WCPL/Palaris	SP	
10	May 2016	Revised following receipt of comments from DPI Water on Rev 8	WCPL	SP	
11	July 2017	Revised to address DPE comments	WCPL		
12	April 2018	Revised to address CLWD and IESC comments, following MOD17 approval	WCPL		

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LIST OF APPENDICES

1.0 Introduction

1.1 Background

The Wambo Coal Mine (the Mine) is situated approximately 15 kilometres west of Singleton, near the village of Warkworth, New South Wales (**Figure 1**). Wambo is owned and operated by Wambo Coal Pty Limited (WCPL), a subsidiary of Peabody Energy Australia Pty Limited.

Several open cut and underground mine operations have been conducted at WCPL since mining operations commenced in 1969. Mining under the current Development Consent (DA 305-7-2003) commenced in 2004 and permits both open cut, underground operations and associated activities to be conducted.

The approved run-of-mine (ROM) coal production rate is 14.7 million tonnes per annum and all product coal is transported from WCPL by rail. A summary of the approved Wambo Coal Mine is provided in **Table 1**.

Table 1: Summary of the Approved Wambo Coal Mine

Component	Approved Wambo Coal Mine[1,2]
Life of Mine	Wambo Coal may carry out mining operations at the Wambo Mining Complex until 31 December 2039, except for open cut coal extraction, which may only be undertaken until 31 December 2020.
Open Cut Mining	Open cut mining at a rate of up to 8 Mtpa of ROM coal from the Whybrow, Redbank Creek, Wambo and Whynot Seams
	An estimated total open cut ROM coal reserve of 98 Mt
	Open cut mining operations under current approved MOP
	Open cut mining operations up to 31 December 2020
Underground Mining	Underground mining of up to 9.75 Mtpa of ROM coal from the Whybrow, Wambo, Woodlands Hill and Arrowfield Seams. Underground ROM coal reserves are estimated at 161.3 Mt. Underground mining operations up to 31 December 2039
Subsidence commitments and management.	The subsidence performance measures listed in Conditions 22 and 22A of the Development Consent (DA305-7-2003).
ROM Coal Production Rate	Up to 14.7 Mtpa of ROM coal
Total ROM Coal Mined	259.3Mt
Waste Rock Management	Waste rock deposited in open cut voids and in waste rock emplacements adjacent open cut operations
Total Waste Rock	640 million bank cubic metres (Mbcm)
Rail and Train Loading Infrastructure	Construction and operation of a rail spur, rail loop, coal reclaim area, product coal conveyor and train load out bin to enable the transport of coal (DA 177-8-2004)
Coal Washing	Coal handling and preparation plant (CHPP) capable of processing approximately 1,800 tonnes per hour (tph)
Product Coal	Production of up to 11.3 Mtpa of thermal coal predominantly for export
CHPP Reject Management	Coarse rejects and tailings would be incorporated, encapsulated and/or capped within open cut voids in accordance with existing Wambo management practices
Total CHPP Rejects	Approximately 40.3 Mt of coarse rejects and approximately 24.5 Mt of tailings
Water Supply	Make-up water demand to be met from runoff recovered from tailings storage areas, operational areas, dewatering, licensed extraction from Wollombi Brook and Hunter River
Mining Tenements	Coal Lease (CL) 365, CL374, CL397, Consolidated Coal Lease (CCL) 743, Mining Lease (ML) 1402, ML1572, ML1594, Authorisation (A) 444, Exploration Licence (EL) 7211.

Note: [1] Development Consent DA305-7-2003 (as modified December 2017) [2] Development Consent 177-8-2004

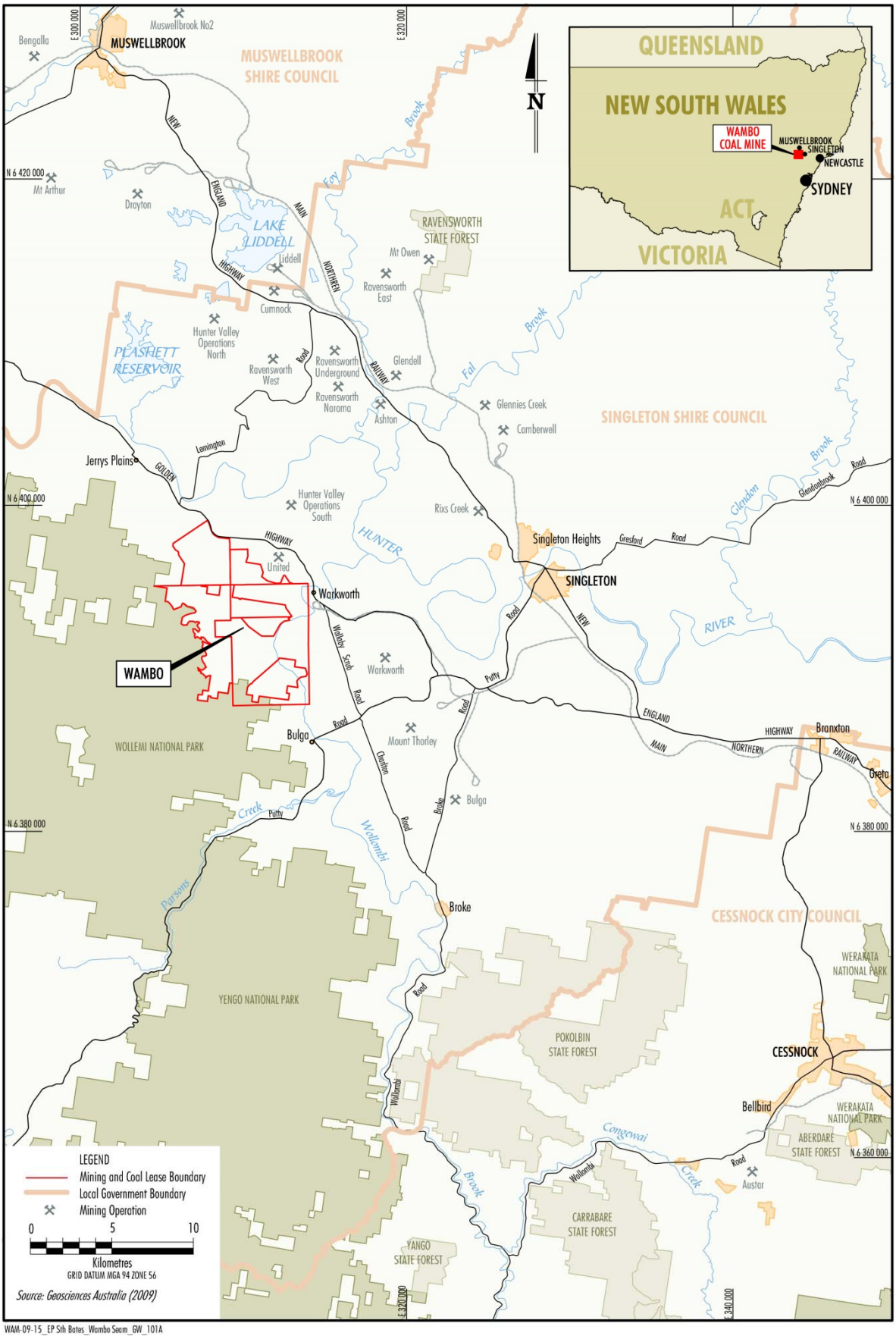

Figure 1: Wambo Coal Regional Location

In accordance with Schedule 4, Condition 30 of DA305-7-2003, WCPL are required to prepare a Site Water Management Plan (WMP). This Surface and Ground Water Response Plan (SGWRP) is a component of the WCPL Site Water Management Plan. **Figure 2** shows the components of the WCPL Site Water Management Plan. This SGWRP should be read in conjunction with the other components of the WCPL Site Water Management Plan.

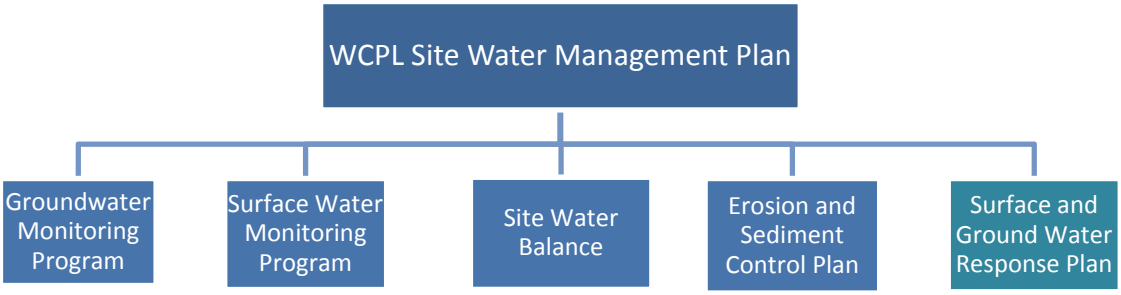

Figure 2: WCPL Site Water Management Plan

In accordance with WCPL's continuous improvement and review processes and Conditions 4 & 6, Schedule 6 of DA305-7-2003, a review of the SGWRP has been undertaken to ensure that surface and ground water impacts from the Mine are minimised, where possible, and that appropriate procedures are in place to respond to any unplanned impacts.

1.2 Purpose

This SGWRP has been developed to address the relevant requirements of relevant consent conditions and regulatory requirements. The SGWRP also addresses the relevant conditions of WCPL mining leases and Environmental Protection Licence (EPL). In accordance with Condition 35, Schedule 4 of DA305-7-2003, WCPL have prepared this SGWRP to provide:

- Measures to mitigate any adverse impacts on existing water supply bores or wells, including trigger levels for the provision of suitable compensatory water supplies (**Section 2.3**);
- Measures to mitigate the loss of surface water flows in the surface water streams or channel on the site (**Section 2.4**);
- Measures to mitigate the long term direct hydraulic connection between the backfilled open cut and the North Wambo Creek alluvium if the potential for any downstream adverse impact is detected (**Section 2.6**);
- Measures to address the decrease in through-flow rates caused by the development within the Wollombi Brook alluvium downstream of the open cut (**Section 2.4**);
- Measures to address any reduction in the stability or ecological quality of the North Wambo Creek Diversion below the established performance criteria (**Section 2.7**);
- Measures to minimise and/or offset potential groundwater leakage from Wollombi Brook and associated alluvial aquifers (**Section 2.8**);
- Measures to mitigate adverse impacts on groundwater dependent ecosystems or riparian vegetation and offset any impacts above the predicted impacts (**Section 2.9**);

- Trigger levels for the relinquishment of water extraction rights to compensate for surface and groundwater losses from streams, channels or alluvial to open cut and underground mining workings (**Section 2.11**);
- Procedures that would be followed if an unforseen impacts are detected during the development (**Section 2.12**); and
- Response times for undertaking the above measures.

1.3 Scope

This SGWRP applies to all surface and ground water monitoring/management activities undertaken within WCPL's mining authorisations and approved mining areas (**Figure 3**). This SGWRP outlines the response procedure that will be initiated if surface or ground water monitoring results exceed designated trigger levels. This SGWRP forms part of WCPL's Environmental Management System (EMS).

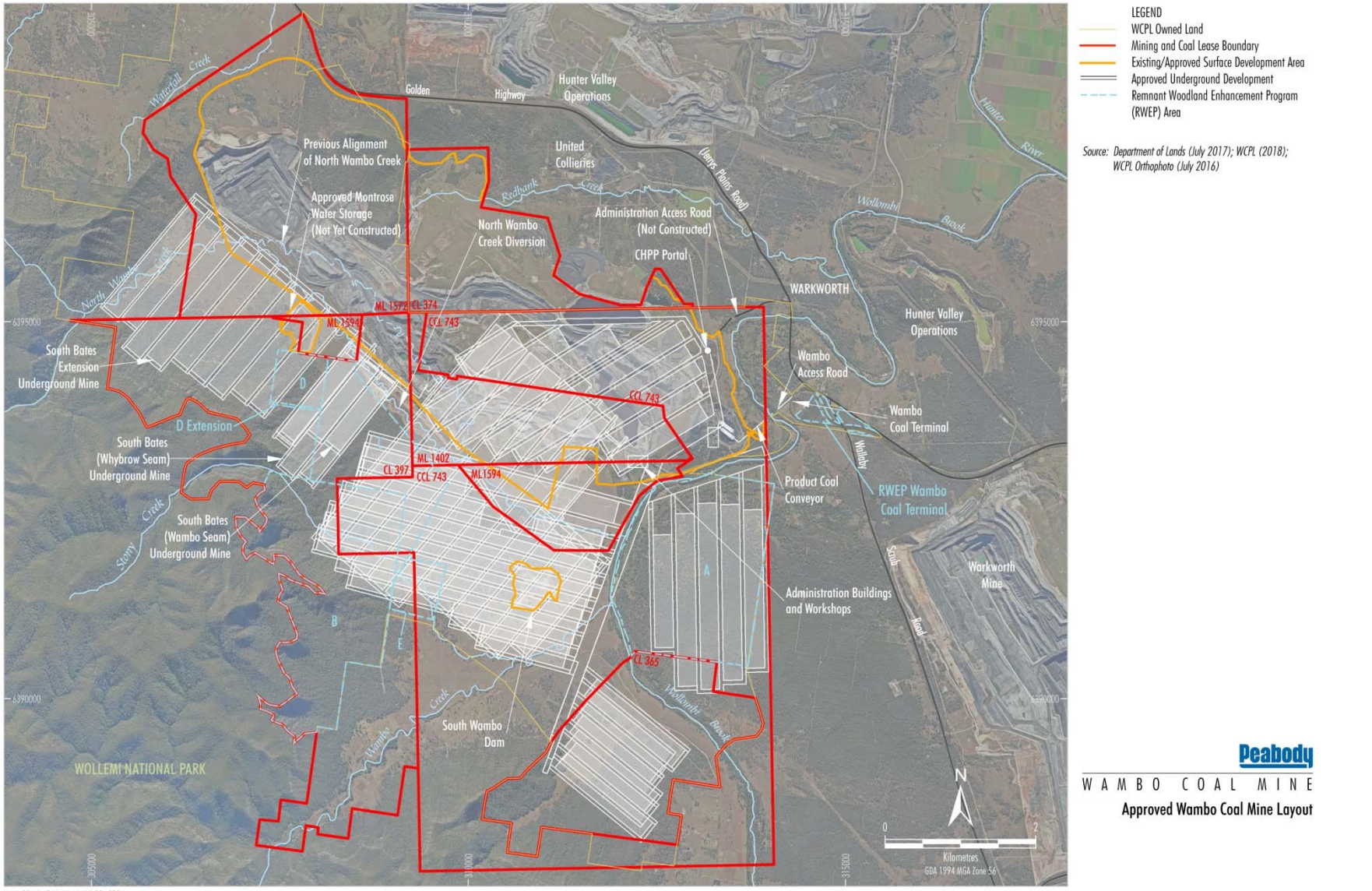

Figure 3: Approved Wambo Coal Mine Layout

1.4 Statutory Requirements

This SGWRP has been prepared to address the relevant Development Approval (DA) consent conditions within DA305-7-2003 (**Table 2**).

1.4.1 Environmental Planning & Assessment Act 1979

WCPL received Development Consent (DA305-7-2003) in accordance with the *Environmental Planning & Assessment Act 1979* (EP&A Act) from the NSW Department of Planning and Environment (DP&E), formerly NSW Department of Planning, on 4 February 2004. Conditions within DA305-7-2003 relevant to the SGWRP are summarised in **Table 2**.

Table 2: DA305-7-2003 Requirements for the Surface and Ground Water Response Plan

Schedule	Condition	Requirements	SGWRP Section
4	30	Before carrying out any development, the Applicant shall prepare a Site Water Management Plan for the development in consultation with DRE and CLWD, and to the satisfaction of the Secretary. This plan must include: … (g) a Surface and Ground Water Response Plan; *By the end of October 2009, the Applicant must revise the Site Water Management Plan in consultation with DRE, EPA, and CLWD, and to the satisfaction of the Sectretary.**	**This SGWRP**
4	35	The Surface and Ground Water Response Plan must include:	
		(a) measures to mitigate any adverse impacts on existing water supply bores or wells, including trigger levels for the provision of suitable compensatory water supplies;	**Section 2.3**
		(b) measures to mitigate the loss of surface water flows in the surface water streams or channel on the site;	**Section 2.4**
		(d) measures to mitigate the long term direct hydraulic connection between the backfilled open cut and the North Wambo Creek alluvium if the potential for any downstream adverse impact is detected;	**Section 2.6**
		(e) measures to address the decrease in through-flow rates caused by the development within the Wollombi Brook alluvium downstream of the open cut;	**Section 2.4**
		(f) measures to address any reduction in the stability or ecological quality of the North Wambo Creek Diversion, Wambo Creek and Stony Creek below the established performance criteria;	**Section 2.7**
		(g) measures to minimise and/or offset potential groundwater leakage from Wollombi Brook and associated alluvial aquifers;	**Section 2.8**
		(h) measures to mitigate adverse impacts on groundwater dependent ecosystems or riparian vegetation and offset any impacts above the predicted impacts;	**Section 2.9**
		(i) trigger levels for the relinquishment of water extraction rights to compensate for surface and groundwater losses from streams, channels or alluvial to open cut and underground mining workings;	**Section 2.11**
		(j) the procedures that would be followed if an unforseen impacts are detected during the development; and	**Section 2.12**
		(k) Response times for undertaking the above measures	**Included in relevant sections**
6	3	**Adaptive Management** The Applicant must assess and manage project-related risks to ensure that there are no exceedances of the criteria and/or	**Section 2.1**

Schedule	Condition	Requirements	SGWRP Section
		performance measures in schedule 4. Any exceedance of these criteria and/or performance measures constitutes a breach of this consent and may be subject to penalty or offence provisions under the EP&A Act or EP&A Regulation. Where any exceedance of these criteria and/or performance measures has occurred, the Applicant must, at the earliest opportunity: (a) take all reasonable and feasible steps to ensure that the exceedance ceases and does not recur; (b) consider all reasonable and feasible options for remediation (where relevant) and submit a report to the Department describing those options and any preferred remediation measures or other course of action; and (c) implement remediation measures as directed by the Secretary, to the satisfaction of the Secretary.	
6	4	**Management Plan Requirements** The Applicant must ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include: (a) detailed baseline data;	**N/A to SGWRP**
		(b) a description of: - the relevant statutory requirements (including any relevant consent, licence or lease conditions);	**Section 1.4**
		- any relevant limits or performance measures/criteria;	**Refer SWMP & GWMP**
		- the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;	**Refer SWMP & GWMP**
		(c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/ criteria;	**Section 2.0**
		(d) a program to monitor and report on the: - impacts and environmental performance of the Wambo Mining Complex; - effectiveness of any management measures (see c above);	**Section 4.0**
		(e) a contingency plan to manage any unpredicted impacts and their consequences;	**Section 2.12**
		(f) a program to investigate and implement ways to improve the environmental performance of the Wambo Mining Complex over time;	**Section 4.2**
		(g) a protocol for managing and reporting any: - incidents;	**Section 4.4**
		- complaints;	**Section 3.0**
		- non-compliances with statutory requirements; and	**Section 2.1**
		- exceedances of the impact assessment criteria and/or performance criteria; and	**Section 2.1**
		(h) a protocol for periodic review of the plan.	**Section 4.1**

* In September 2009, DP&E granted WCPL an extension to the submission date to 30/4/2010 to allow for DRE and EPA review and comment.

1.5 Stakeholder Consultation

In accordance with Conditions 22C and 30, Schedule 4 of DA 305-7-2003, the SGWRP has been prepared in consultation with DoI Water (formerly CLWD, DPI Water and NOW), NSW Division of Resources and Geoscience (DRG, formerly the Division of Resources and Energy [DRE]) and the Environment Protection Authority (EPA), prior to submitting to the Secretary of the DP&E for approval.

Consultation on recent versions of the SGWRP has included:

- Version 8 of the SGWRP was provided to DPI Water, DRE, EPA and DP&E as part of an Extraction Plan submission in October 2015.
- Comments were received from DPE on Version 8 of the SGWRP in October 2015.
- Version 9 of the SGWRP was approved by DPE in November 2015.
- Comments were received from DPI Water on Version 8 of the SGWRP in November 2015.
- Version 10 of the SGWRP was provided to DPI Water and EPA in December 2016 for consultation.
- Version 10 of the SGWRP was provided to DPI Water, DRG, EPA and DP&E as part of an Extraction Plan submission in January 2017.
- Comments were received from DP&E on Version 10 of the SGWRP in May 2017 and July 2017.
- No comments have been received from DPI Water, DRG or EPA on Version 10 of the SGWRP in over 6 months.

Changes to Version 11 of the SGWRP included:

- Updating the format and layout of the SGWRP, consistent with WCPL's current document management procedures and templates;
- Reflecting the latest underground mine layout; and
- Addressing comments received from DP&E on the SGWRP (Revision 10).

Version 11 of the SWMP was submitted to DP&E for approval as a component of the Extraction Plan for South Bates Underground LW11-16. Following receipt of the Extraction Plan in January 2017, DoI Water provided comments on the SWMP in correspondence dated 17 December 2017. In addition, in providing advice on MOD 17 to DA 305-7-2003, the Independent Expert Scientific Committee (IESC) made comments on the SWMP in correspondence dated 31 July 2017. This revision (Revision 12) addresses those comments.

A copy of draft Revision 12 was provided to the DoI Water and EPA on 9 April 2018. Correspondence in relation to the SGWRP is attached as Appendix B. A summary of how comments from DoI Water and DP&E have been addressed in this SGWRP is also provided in Appendix B.

2.0 Surface and Ground Water Response Plan

2.1 Adaptive Management

Potential surface and groundwater impacts are detailed in the Wambo Development Project Environmental Impact Statement (EIS) (Wambo Coal, 2003) and in the North Wambo Underground Mine Modification Environmental Assessment (Resource Strategies, 2012).

WCPL's Site Water Management Plan has been developed to manage and monitor water-related risks associated with the Wambo Coal Mine, to ensure there are no exceedances of the criteria and/or performance measures detailed in the relevant development consents and licences. If an exceedance of these criteria and/or performance measures occurs, WCPL will, at the earliest opportunity:

- Take all reasonable and feasible steps to ensure that the exceedance ceases and does not recur;
- Consider all reasonable and feasible options for remediation (where relevant) and submit a report to DP&E describing those options and any preferred remediation measures or other course of action; and
- Implement remediation measures as directed by the Secretary,

to the satisfaction of the Secretary.

2.2 Incident Management

An incident is defined as "a set of circumstances that:

- Causes or threatens to cause material harm to the environment; and/or
- Breaches or exceeds the limits or performance measures/criteria in the development consent"

Incident reporting will be undertaken in accordance with **Section 4.4**.

2.3 Impacts on Groundwater

A network of bores and piezometers is monitored to quantify any effect of the open cut and underground workings on the local groundwater system (refer to GWMP).

Groundwater depth and quality (pH and EC) trigger levels are specified in the GWMP. Following the receipt of groundwater monitoring results a data review will be undertaken. In the event that a trigger level is exceeded, or a complaint is received in relation to loss of groundwater supply, an investigation will be undertaken as soon as possible. The investigation will include a detailed review of monitoring data trends and climatic information along with operational activities and surrounding land uses, to determine if the impact on groundwater is a result of Wambo's activities.

If the investigation identifies actual groundwater impacts and attributes those impacts to Wambo's activities, WCPL will implement the adaptive management process in **Section 2.1**. Appropriate remediation measures will be developed and implemented in consultation with relevant government agencies and affected landowners, as required.

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Measures may include:

- Modification to the groundwater monitoring program;
- Review of the water balance modelling for relevant underground / open cut mining activities;
- Review of mine plan and/or methodology; or
- Implementation of mitigation measures, especially where use of groundwater resources are interrupted.

The outcomes of this process will be reported in the Annual Review (**Section 4.2**). If an incident is deemed to have occurred (**Section 2.2**), WCPL will notify and report to DP&E and any other relevant government departments in accordance with **Section 4.4**.

2.3.1 TARP for Impacts on Private Bores

WCPL has developed a Trigger Action Response Plan (TARP) that must be implemented in the event that:

- A complaint is received from a private bore holder in relation to decreasing levels in a private bore; or
- Groundwater monitoring of private bores (including GW02 or GW11) identifies a decreasing trend approaching 2 metres below the modelled statistical trends.

This TARP is summarised in **Table 3**.

Table 3: TARP for Impacts on Private Bores

TARP Code	Level 1 Response Management Measures	Level 2 Response Contingency Phase
Trigger	•Groundwater monitoring of Private Bores including GW02 and GW11 (where access granted) for standing water levels, identifies a decreasing trend approaching 2m below the modelled statistical trends.	•Groundwater monitoring of Private Bores (where access granted) for standing water levels, identifies a decreasing trend greater than 2m below modelled statistical trends for three consecutive sampling events. •Wambo receives a community complaint in relation decreasing water levels in a Private Bore.
Action	•Maintain monitoring of Private Bores to identify if decreasing trends has stabilised and displays signs of increasing trends. •Review recent rainfall data to identify potential correlation between decreasing water level trends and extended dry periods. •If decreasing trends are maintained and eventually exceed 2m below modelled statistical trends then go to Level 2 Response.	•Initiate consultation with the affected Landowner/s of the Private Bore to commence preliminary investigations on receipt of complaint. •Maintain monitoring of Private Bore to identify if decreasing trend has stabilised and displays signs of increasing trend. •Review recent rainfall data to identify potential correlation between decreasing water level trend and extended dry periods. •If decreasing trend is maintained and remains 2m below statistical trends for three consecutive monitoring events, initiate consultation with affected owner of Private Bore. •Undertake preliminary investigation as soon as possible and engage groundwater specialist for a review of relevant groundwater monitoring results in conjunction with site activities being undertaken at the time, baseline groundwater monitoring results, groundwater observations at nearby locations, the prevailing and preceding meteorological conditions and changes to the landuse/ activities being undertaken in the contributing hydrogeological regime.

TARP Code	Level 1 Response Management Measures	Level 2 Response Contingency Phase
		Notify DP&E and DoI Water of contingency response.
Plan		•If preliminary or subsequent investigations indicate that compensatory water supplies are to be initiated, as a direct result from Wambo's operations, then Wambo will commence consultation with the affected Landowners to establish an agreed suitable compensatory supply of water, until further monitoring can establish these are no longer required. •Review and update the WMP and resubmit to DP&E within 3 months, or as otherwise agreed.

2.4 Impacts on Surface Water

Surface water is monitored at over 20 locations across Wambo, including flow monitoring and water quality. Monitoring of mine water storage dams is also undertaken on a monthly basis. WCPL has developed a number of triggers for water quality and flow (refer Section 3.0 of the SWMP). Licensed discharges from site must also meet the Discharge Criteria specified in EPL 529.

As detailed in Wambo's 2003 EIS, the potential surface water impacts include:

- Connective cracking between North Wambo Creek and the underground workings;
- Reduction in water quality due to increased sedimentation; and
- Reduction of contributing catchments to North Wambo Creek, Waterfall Creek and Redbank Creek due to open cut mining.

Connective cracking was identified in the EIS as the highest risk to surface water flows. However, there has been no evidence of connecting cracking following the subsiding of North Wambo Creek by Longwall panels 1 and 2. In 2008, prior to Longwall 1, a specific North Wambo Creek Subsidence Response Strategy (NWCDSRS) was prepared in consultation with DRE, EPA and DP&E. Wambo will continue to monitor in accordance with the NWCSRS (**Appendix C**).

If routine monitoring (in accordance with SWMP) identifies evidence of potential surface water impacts, an investigation will be undertaken as soon as possible. The investigation will include a detailed review of relevant monitoring data trends and climatic information along with operational activities, to determine if the impact on surface water is a result of Wambo's activities.

If the investigation identifies actual surface water impacts and attributes those impacts to Wambo's activities, WCPL will implement the adaptive management process in **Section 2.1**. Appropriate remediation measures will be developed and implemented in consultation with relevant government agencies and affected landowners, as required.

The outcomes of this process will be reported in the Annual Review (**Section 4.2**). If an incident is deemed to have occurred (**Section 2.2**) WCPL will notify and report to DP&E and any other relevant government departments in accordance with **Section 4.4.**

The loss of catchment area due to open cut mining will have a temporary impact until rehabilitation has been completed and the catchment area is progressively reinstated. This

impact has been predicted and assessed in the 2003 EIS and no additional responses are proposed.

2.4.1 TARP for Impacts on Surface Water Flows

WCPL has developed a TARP that must be implemented in the event that:

- After rainfall exceeding 20mm in 24hr, visual observations during flow events within either North Wambo Creek, South Wambo Creek or Stony Creek, identifies a potential variance in flow rates between upstream and downstream flow monitoring stations; or
- The initial calculated theoretical flow rates identifies a potential loss of flow between upstream and downstream flow monitoring stations within either North Wambo Creek, South Wambo Creek or Stony Creek.

This TARP is summarised in **Table 4.**

Table 4: TARP for Impacts on Surface Water Flows

TARP Code	Level 1 Response Management Measures	Level 2 Response Contingency Phase
Trigger	•After rainfall exceeding 20mm in 24hr, visual observations during flow events within either North Wambo Creek, South Wambo Creek or Stony Creek, identifies a potential variance in flow rates between upstream and downstream flow monitoring stations.	•The initial calculated theoretical flow rates identifies a potential loss of flow between upstream and downstream flow monitoring stations within either North Wambo Creek, South Wambo Creek or Stony Creek.
Action	•Confirm actual flow event by observing creek flows at upstream and downstream locations. •Download flow monitoring data from flow monitoring stations at the completion of the flow event. •Check flow monitoring equipment for functionality; •Review recent climatic conditions and rainfall data recorded from meteorological station. •Calculate theoretical flow rates from flow monitoring stations to compare upstream and downstream flow rates. •If the initial calculation of the theoretical flow rates identifies a potential loss of flow when comparing the upstream and downstream flow rates, then go to Level 2 Response.	•Maintain surface flow monitoring to identify if creek flow rates have returned to statistical trends. •Undertake preliminary investigation as soon as possible, including: -Engaging a suitable qualified hydrologist to confirm if a loss of the calculated theoretical flow rates between upstream and downstream flow monitoring stations has occurred; -Review location of rainfall event/s that may have contributed to creek flow variability within the creek catchment; -Check flow monitoring equipment for functionality; -Review pumping volumes from the North Wambo Underground/South Bates Underground to examine pumping trends; and -Review pumping volumes from the old Homestead workings to examine pumping trends. -Provide pumping volumes from underground workings to groundwater specialists for review.
Plan		•If confirmation of a flow loss which is greater than modelled has occurred Wambo will notify the relevant government agencies and in consultation develop appropriate measures to mitigate the loss of surface water flows in the surface water streams (e.g. stream remediation techniques) as soon as possible. •Review and update the WMP and resubmit to DP&E within 3 months, or as otherwise agreed.

2.4.2 TARP for Impacts on Surface Water Quality

WCPL has developed a TARP that must be implemented in the event that:

- Surface water monitoring of Wollombi Brook, North Wambo Creek, South Wambo Creek, Stoney Creek or Waterfall Creek for pH, EC and TSS, identifies water quality results exceeding the 80th Percentile Trigger Value, as identified in the SWMP, after two consecutive sampling events.

This TARP is summarised in **Table 5.**

Table 5: TARP for Impacts on Surface Water Quality

TARP Code	Level 1 Response Management Measures	Level 2 Response Contingency Phase
Trigger	•Surface water monitoring of Wollombi Brook, North Wambo Creek, South Wambo Creek, Stoney Creek or Waterfall Creek for pH, EC and TSS, identifies water quality results exceeding the 80th Percentile Trigger Value, as identified in the SWMP, after two consecutive sampling events.	•Surface water monitoring of Wollombi Brook, North Wambo Creek, South Wambo Creek, Stoney Creek or Waterfall Creek for pH, EC and TSS, identifies water quality results exceeding the 80th Percentile Trigger Value, as identified in the SWMP, after three consecutive sampling events.
Action	•Increase monitoring of surface water site(s) to fortnightly to identify if water quality results are trending back to long term averages as identified in the SWMP. •If any water quality exceeds the 80th Percentile Trigger Value (three consecutive samples), then go to Level 2 Response.	•Maintain monitoring of surface water sites to identify if water quality results are trending back to long term averages as identified in the SWMP. •Undertake preliminary investigation as soon as possible, including: -Determine contributing factors including meteorological conditions, if an incident has potentially occurred, review location of operational activities etc. -Where appropriate, engage a suitable qualified aquatic ecologist or similar to investigate the aquatic environment; -Increase monitoring frequency where relevant; and -Develop corrective/preventative actions based on the outcomes of the investigation and/or additional monitoring.
Plan		•If confirmation of a results above confirms impacts to water quality have occurred as a direct result from Wambo's operations, Wambo will notify the relevant government agencies and in consultation develop appropriate remedial measures as soon as possible. •Review and update the WMP and resubmit to DP&E within 3 months, or as otherwise agreed.

2.4.3 TARP for Breach of EPL 529 Limits

WCPL has developed a TARP that must be implemented in the event that:

- Monitoring at the Licenced Discharge Point (LDP) confirms pH, EC, TSS or discharge volumes are approaching or have exceeded discharge limits as identified in the SWMP and EPL 529; and/or
- There is potential evidence of an unauthorised discharge or an uunauthorised discharge event has occurred; or
- Wambo has failed to monitor at the LDP as identified in the SWMP and EPL 529.

This TARP is summarised in **Table 6.**

Table 6: TARP for Breach of EPL 529 Limits

TARP Code	Level 1 Response Management Measures	Level 2 Response Contingency Phase
Trigger	•Monitoring at Licence Discharge Point (LDP) confirms pH, EC, TSS or discharge volumes are approaching discharge limits as identified in the SWMP and EPL 529; and/or •Potential evidence of an unauthorised discharge	•A Level 2 Response has been triggered if: -Exceedance of EPL 529 pollution concentration limits; -Unauthorised discharge event has occurred; -Exceedance of EPL 529 discharge volume limit; or -Failure to monitor at LDP as identified in the SWMP and EPL 529.
Action	•Maintain monitoring at LDP to confirm pH, EC, TSS remain within discharge limits. •Prepare to cease discharging: -If water quality values for pH, EC and TSS continue to trend towards an exceedence of their respective discharge water quality criteria; and -If daily discharge volumes continue to trend towards an exceedence of the daily discharge water volume criteria. •If there is an exceedence of the pH, EC, TSS criteria and/or discharge volume limit then go to Level 2 Response. •If there is evidence of an unauthorised discharge go to Level 2 Response.	•If monitoring at Licence Discharge Point (LDP) confirms any of the Level 2 Responses have been triggered, Wambo will: -Cease discharge immediately; -Initiate Pollution Incident Response Management Plan (PIRMP); -Initiate an investigation to determine contributing factors including meteorological conditions, if an incident has potentially occurred, review location of operational activities , equipment failure etc; -Provide report within seven days to the EPA and DP&E and other relevant government agencies; -Increase monitoring frequency where relevant; -Develop corrective/preventative actions based on the outcomes of the investigation and/or additional monitoring; and -Undertake additional monitoring (stream health monitoring, etc.) if necessary.
Plan		•Implement appropriate contingency and remedial measures, including follow-up monitoring, auditing and advice from relevant government agencies. •Communicate results of investigation and subsequent contingency and remedial measures to relevant government agencies. •Review and update the WMP and resubmit to DP&E within 3 months, or as otherwise agreed.

2.5 Direct Hydraulic Connection between Open Cut and Alluvium

If scheduled monitoring detects a long-term direct hydraulic connection between the backfilled open cut and the North Wambo Creek alluvium, with the potential to cause an associated downstream adverse impact, then an investigation will be undertaken to determine the nature and extent of the impact.

If the investigation identifies downstream adverse impacts and attributes those impacts to Wambo's activities, WCPL will implement the adaptive management process in **Section 2.1**. Appropriate management measures will be developed and implemented in consultation with relevant government agencies and may include the relinquishment of an equivalent portion of water access licences as a direct offset for potential groundwater inflows into the Mine (HydroSimulations, 2014) (i.e. in addition to licences already held to account for water take).

The outcomes of this process will be reported in the Annual Review (**Section 4.2**). If an incident is deemed to have occurred (**Section 2.2**) WCPL will notify and report to DP&E and any other relevant government departments in accordance with **Section 4.4.**

2.6 Impacts on North Wambo Creek Alluvium

WCPL has developed a TARP that must be implemented in the event that:

- Groundwater monitoring of standing water levels in the proposed replacement bores within the North Wambo Creek alluvium, identifies standing water trigger levels, beyond predicted modelled impacts; and/or
- Monitoring of aquatic ecosystems in accordance with the Biodiversity Management Plan identifies a potential or actual decline in aquatic health, beyond natural fluctuations; and/or
- Monitoring of Land Function Analysis (LFA) of riparian areas in accordance with the Biodiversity Management Plan identifies a potential or actual decline in creek stability, beyond natural fluctuations; and/or
- Visual observations and/or pumping rates from Montrose Pit confirm alluvium inflows into the open cut have increased above normal seepage rates.

This TARP is summarised in **Table 7.**

This TARP is also supported by the TARP in **Section 2.10** related to water licensing.

Table 7: TARP for Impacts on North Wambo Creek Alluvium

TARP Code	Level 1 Response Management Measures	Level 2 Response Contingency Phase
Trigger	•Groundwater monitoring of standing water levels the proposed replacement bores within the North Wambo Creek alluvium, identifies a groundwater level below the minimum observed groundwater level during the first 12 months of monitoring; and/or •Monitoring of aquatic ecosystems in accordance with the Biodiversity Management Plan identifies a potential decline in aquatic health, beyond natural fluctuations; and/or •Monitoring of Land Function Analysis (LFA) of riparian areas in accordance with the Biodiversity Management Plan identifies a potential decline in creek stability, beyond natural fluctuations; and/or •Visual observations and/or pumping rates from Montrose Pit confirm alluvium inflows into the open cut have not increased above normal seepage rates.	•Groundwater monitoring of standing water levels in the proposed replacement bores within the North Wambo Creek alluvium, identifies more than two consecutive groundwater levels below the minimum observed groundwater level during the first 12 months of monitoring; and/or •Monitoring of aquatic ecosystems in accordance with the Biodiversity Management Plan identifies a decline in aquatic health in consecutive monitoring events, beyond natural fluctuations; and/or •Monitoring of Land Function Analysis (LFA) of riparian areas in accordance with the Biodiversity Management Plan identifies a decline in creek stability in consecutive monitoring events, beyond natural fluctuations. •Visual observations confirm alluvium inflows into the open cut have increased significantly above normal seepage rates.
Action	•Maintain monitoring of bores within the North Wambo Creek alluvium, for standing water levels, to identify if decreasing trends have stabilised and bores display signs of increasing trends. •Maintain visual monitoring to confirm alluvium inflows into the open cut have ceased or have returned to	•Maintain monitoring of GW08, GW09, GW16 and GW17 within the North Wambo Creek alluvium, for standing water levels to identify if decreasing trends have stabilised and bores display signs of increasing trends. •Continue annual LFA and aquatic ecosystems monitoring to determine if decline trends have stabilised and displaying signs of improving trends in consecutive monitoring periods. •Continue visual monitoring and/or pumping rates in the Montrose Pit to confirm alluvium inflows into the open cut

TARP Code	Level 1 Response Management Measures	Level 2 Response Contingency Phase
	normal seepage rates. •Review recent rainfall data to identify potential correlation between decreasing water level trends and extended dry periods. •Continue annual LFA and aquatic ecosystems monitoring to determine if decline trends have stabilised and displaying signs of improving trends in consecutive monitoring periods. •If standing water levels exceed standing water trigger values (consecutively) as provided in the GWMP, then go to Level 2 Response. •If consecutive LFA and aquatic ecosystems monitoring events show continued decline trends and are displaying no signs of improving trends, then go to Level 2 Response. •If visual observations and/or pumping rates from Montrose Pit confirm alluvium inflows into the open cut are increased above normal seepage rates, then go to Level 2 Response.	have ceased or have returned to normal seepage rates. •If decreasing standing water level trends are maintained and/or LFA and aquatic ecosystems are in decline and/or a significant increase of alluvium flows into the open cut has been identified, Wambo will undertake preliminary investigation, including: -An investigation and engage groundwater specialist to review relevant groundwater monitoring results in conjunction with site activities being undertaken at the time, baseline groundwater monitoring results, groundwater results at nearby locations, the prevailing and preceding meteorological conditions and changes to the landuse/ activities being undertaken in the contributing hydrogeological regime; -Review the site water balance and groundwater model; -An investigation and engage ecologist to review LFA and aquatic monitoring results in conjunction with site activities being undertaken at the time, the prevailing and preceding meteorological conditions and changes to the landuse/ activities being undertaken. -Develop corrective/preventative actions based on the outcomes of the investigation.
Plan		•If confirmation of a results above and investigations confirms impacts to alluvium are greater than modelled, Wambo will notify the relevant government agencies and in consultation develop appropriate remedial measures. •Develop corrective/preventative actions based on the outcomes of the investigation for example: -Backfilling to seal the affected highwall areas with suitable material selected from the open cut; -Secure additional water licences to account for the estimated future inflows (if applicable). •Review and update the WMP and resubmit to DP&E within 3 months, or as otherwise agreed.

2.7 North Wambo Creek Diversion Performance Criteria

WCPL manages the North Wambo Creek Diversion in accordance with the North Wambo Creek Diversion Rehabilitation Plan. Management controls have been designed and implemented to minimise erosion and the potential for sediment generation and loss from the system however there is still a risk that erosion and sediment generation may impact on North Wambo Creek water quality. Management controls are discussed in detail in WCPL's Erosion and Sediment Control Plan and the North Wambo Creek Diversion Rehabilitation Plan.

WCPL has developed a TARP that must be implemented in the event that:

- Surface water monitoring of North Wambo Creek, for pH, EC and TSS, identifies water quality results exceeding the 80th Percentile Trigger Value, as identified in the SWMP after three consecutive sampling events; and/or
- Monitoring of Land Function Analysis (LFA) of riparian areas in accordance with the Biodiversity Management Plan identifies a potential decline in creek stability, beyond natural fluctuations.

This TARP is summarised in **Table 8.**

Table 8: TARP for North Wambo Creek Diversion Performance

TARP Code	Level 1 Response Management Measures	Level 2 Response Contingency Phase
Trigger	•Surface water monitoring of North Wambo Creek, for pH, EC and TSS, identifies water quality results exceeding the 80th Percentile Trigger Value, as identified in the SWMP after two consecutive sampling events; and/or •Monitoring of Land Function Analysis (LFA) of riparian areas in accordance with the Biodiversity Management Plan identifies a potential decline in creek stability, beyond natural fluctuations.	•Surface water monitoring of North Wambo Creek for pH, EC and TSS, identifies water quality result exceeding the 80th Percentile Trigger Value, after three consecutive sampling events. •Monitoring of Land Function Analysis (LFA) of riparian areas in accordance with the Biodiversity Management Plan identifies a decline in creek stability in consecutive monitoring events, beyond natural fluctuations.
Action	•Review recent rainfall data to identify potential correlation between decreasing water level trends and extended dry periods. •Continue annual LFA and aquatic ecosystems monitoring to determine if decline trends have stabilised and displaying signs of improving trends in consecutive monitoring periods. •Maintain monitoring of surface water sites to identify if water quality results are trending back to long term averages as identified in the SWMP. •If consecutive LFA and aquatic ecosystems monitoring events show continued decline trends and displaying no signs of improving trends, then go to Level 2 Response. •If any water quality exceeds the 80th Percentile Trigger Value (three consecutive periods), then go to Level 2 Response.	•Continue annual LFA and aquatic ecosystems monitoring to determine if decline trends have stabilised and displaying signs of improving trends in consecutive monitoring periods. •Wambo will undertake preliminary investigation as soon as possible, including: -As above for Surface Water Quality -An investigation and engage ecologist specialist to review LFA monitoring results in conjunction with site activities being undertaken at the time, the prevailing and preceding meteorological conditions and changes to the landuse/ activities being undertaken.
Plan		•If confirmation of a results and investigations from above confirms impacts, Wambo will notify the relevant government agencies and in consultation develop appropriate remedial measures if required. •Review and update the WMP and resubmit to DP&E within 3 months, or as otherwise agreed.

2.8 Groundwater Leakage from Wollombi Brook

WCPL has developed a TARP that must be implemented in the event that:

- Groundwater monitoring of standing water levels in bores P106, P109, P114, P116 within the Wambo Creek alluvium and GW13 and GW15 within the Wollombi Creek alluvium, identifies a decreasing trend, beyond natural fluctuations and predicted modelled impacts.

This TARP is summarised in **Table 9.**

Table 9: TARP for Wollombi Brook and Wambo Creek Alluvium

TARP Code	Level 1 Response Management Measures	Level 2 Response Contingency Phase
Trigger	•Groundwater monitoring of standing water levels in bores P106, P109, P114, P116 (within the Wambo Creek alluvium) and GW13 and/or GW15 (within the Wollombi Creek alluvium), identifies a decreasing trend, beyond natural fluctuations and predicted modelled impacts	•Groundwater monitoring of standing water levels in bores P106, P109, P114, P116 GW13 and/or GW15, exceed the standing water trigger values as provided in the GWMP, beyond natural fluctuations, for more than two consecutive monitoring events.
Action	•Maintain monitoring of bores within the Wollombi and Wambo Creek alluvium, for standing water levels, to identify if decreasing trends have stabilised and bores display signs of increasing trends. •If standing water levels exceed standing water trigger values as provided in the GWMP, then go to Level 2 Response.	•Maintain monitoring of P106, P109, P114, P116 within the Wambo Creek alluvium and GW13 and GW15 within the Wollombi Creek alluvium, for standing water levels to identify if decreasing trends have stabilised and bores display signs of increasing trends. •If decreasing standing water level trends are maintained, Wambo will undertake preliminary investigation as soon as possible, including: -An investigation and engage groundwater specialist to review relevant groundwater monitoring results in conjunction with site activities being undertaken at the time, baseline groundwater monitoring results, groundwater observations at nearby locations, the prevailing and preceding meteorological conditions and changes to the landuse/ activities being undertaken in the contributing hydrogeological regime. -Review the site water balance and groundwater model; -Develop corrective/preventative actions based on the outcomes of the investigation.
Plan		•If confirmation of results and investigations from above confirms impacts to alluvium are greater than modelled, Wambo will notify the relevant government agencies and in consultation develop appropriate remedial measures. •Develop corrective/preventative actions based on the outcomes of the investigation for example: -Secure additional water licences to account for the estimated future inflows (if applicable). -Measures to offset the potential groundwater leakages. •Review and update the WMP and resubmit to DP&E within 3 months, or as otherwise agreed.

2.9 Impacts on Groundwater Dependent Ecosystems or Riparian Vegetation

An aquatic ecosystems monitoring program has been developed to detect any potential changes in aquatic biology in accordance with the Biodiversity Management Plan within North Wambo Creek, Wambo Creek and Stoney Creek and the North Wambo Creek Diversion.

Annual channel stability surveys are also undertaken to monitor the quantity and quality of riparian vegetation along North Wambo Creek and North Wambo Creek Diversion to determine the need for any maintenance and/or contingency measures. This program and the development of stream health triggers (for water quality, stability and alluvium) are discussed above and within the Biodiversity Management Plan and SWMP.

In the event that deterioration is identified in groundwater dependent ecosystems during stream health monitoring or annual channel stability surveys, the processes outlined above will be implemented.

2.10 Exceedance of Licensed Extraction Limit

As part of annual reporting and data review WCPL is required to compare annual extractions from alluvium water sources to WCPL's licenced extraction volume under the Water Management Act 2000 (WM Act). If extraction from alluvial water sources exceeds the licensed volume, consultation will be entered into with the relevant government authorities to develop ameliorative measures. Where the take exceeds the estimates by 100% or more, WCPL will re-evaluate associated ecological impacts and any influence on any low-flow cease-to-pump criteria specified in a relevant Water Sharing Plan.

Additional information regarding the WM Act is available in the GWMP. WCPL will ensure there are sufficient licensed volumes under the WM Act to account for the predicted extraction of water from alluvial water sources for the upcoming water year.

2.11 Trigger Levels for the Relinquishment of Water Extraction Limits

Trigger values for the relinquishment of water extraction rights to compensate for post-mining closure (end of the approved mine life) for surface and groundwater losses from streams, channels or alluvials to the open cut and underground mine workings will be refined and further developed as an outcome of future groundwater models and as the mine progresses towards closure.

The outcomes of future groundwater modelling to determine post-mining trigger values for the relinquishment of water extraction rights will be provided in subsequent reviews of this SGWRP and resubmitted to DP&E.

2.12 Unforeseen Impacts

In the event that any unforeseen surface water or groundwater impacts are detected, the following general response procedure will be initiated:

- Check and validate the data/information which indicates an unforeseen impact;
- Notify DP&E, EPA and other relevant agencies immediately after becoming aware of the impact;
- In the event of an apparently anomalous monitoring result, conduct a resample/retest where possible;
- Review the unforeseen impact, including consideration of:
    - Any relevant monitoring data; and
    - Current mine activities and land management practices in the relevant catchment, including other mining activities;
- Commission an investigation by an appropriate specialist into the unforeseen impact;
- Provide a preliminary investigation report to DP&E, EPA and relevant agencies within 7 days of identifying the unforeseen impact;
- Implement appropriate contingency/remedial measures;
- Implement additional monitoring to measure the effectiveness of the mitigation measures, where necessary;

- Communicate results of investigation and subsequent contingency and remedial measures to government agencies as required; and
- Review and update the WMP and resubmit to DP&E.

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3.0 Community Complaint Response

All water related community complaints received by WCPL will be recorded within the Community Complaints Register. The E&C Manager will investigate the complaint, which will include, where possible, contacting the complainant within 24 hours to discuss the complaint. A review of the effectiveness of the corrective or preventative actions will be conducted within a month of the complaint and the relevant work procedures updated if required.

Preliminary investigations will commence as soon as practicable upon receipt of a complaint to establish if WCPL is responsible. All efforts will be made to determine the likely causes contributing to the complainants concerns.

WCPL will attempt to address the complainants concerns such that a mutually acceptable outcome is achieved. However, if required, the Independent Dispute Resolution Process would be referred to (**Appendix A**).

Details of all community complaints will be included in the Monthly Environment Monitoring Report. WCPL will retain a copy of the Community Complaints Register for at least four years. The E&C Manager will ensure the latest Community Complaints Register is posted on the WCPL website.

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4.0 Review and Reporting

4.1 Review

The SGWRP is to be reviewed annually by the E&C Manager. A complete review of the SGWRP will occur:

- Every two years;
- When there are changes to consent or licence conditions relating to the SGWRP;
- Prior to new underground mining areas being developed;
- Following significant water related incidents at WCPL;
- Following continual exceedance of the impact assessment criteria;
- Following an independent environmental audit which requires SGWRP review; or
- If there is a relevant change in technology, practice or legislation.

The revised SGWRP will be re-submitted to the Secretary for approval as required by Condition 30, Schedule 4 of DA305-7-2003.

4.2 Annual Review

Prior to the end of March each year, WCPL will review the environmental performance of the Mine and submit an Annual Review report to the DP&E. This report will:

- Describe the development (including any rehabilitation) that was carried out in the past year, and the development that is proposed to be carried out over the next year;
- Include a comprehensive review of the monitoring results and complaints records of the Project over the past year, which includes a comparison of these results against the:
    - Relevant statutory requirements, limits or performance measures/criteria
    - Monitoring results of previous years; and
    - Relevant predictions in the EA;
- Identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;
- Identify any trends in the monitoring data over the life of the Project;
- Identify any discrepancies between the predicted and actual impacts of the Project, and analyse the potential cause of any significant discrepancies; and
- Describe what measures will be implemented over the next year to improve the environmental performance of the Project.

4.3 Website Updates

A comprehensive summary of surface and ground water monitoring results will be made publicly available at WCPL website:
https://www.peabodyenergy.com/Operations/Australia-Mining/New-South-Wales-Mining/Wambo-Approvals,-Plans-Reports

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Information on the website will be updated regularly as required by DA305-7-2003.

WCPL will also ensure that any information relevant to the SGWRP is uploaded to the website (and kept up to date). This includes:

- Current statutory approvals;
- Approved strategies, plans or programs required under the DA305-7-2003;
- A community complaints register;
- Minutes of Community Consultative Committee (CCC) meetings;
- Annual Reviews;
- A copy of any Independent Audits and WCPL's response to any recommendations in any audit; and
- Any other matter required by the Secretary.

4.4 Reportable Environmental Incidents

All reportable incidents will be reported via the EPA's Environmental Line on **131 555** by the E&C Manager in accordance with WCPL's Pollution Incident Response Management Plan (PIRMP).

In accordance with the PIRMP, WCPL must notify all relevant authorities of incidents causing or threatening material harm to the environment immediately after the person becomes aware of the incident in accordance with the requirements of *Part 5.7* of the *POEO Act.*

For all other incidents that do not cause threatening material harm to the environment associated with the Project, WCPL will notify the Secretary and any other relevant agencies as soon as practicable after WCPL becomes aware of the incident.

Within 7 days of the date of the incident, WCPL will provide the Secretary and any relevant agencies with a detailed report on the incident to include:

- The cause, time and duration of the event;
- Where possible the type, volume and concentration of every pollutant discharged as a result of the event;
- The name, address and business hours telephone number of employees or agents of the licensee who witnessed the event;
- The name, address and business hours telephone number of every other person (of whom the licensee is aware) who witnessed the event, unless the licensee has been unable to obtain that information after making reasonable effort;
- Action taken by the licensee in relation to the event, including any follow-up contact with any complainants;
- Implement remediation measures as directed by the Secretary, to the satisfaction of the Secretary;
- Details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event

5.0 RESPONSIBILITIES

Table 10 below summarises responsibilities documented in the SGWRP. Responsibilities may be delegated as required.

Table 10: Surface and Ground Water Response Plan Responsibilities

No	Task	Responsibility	Timing
1	Identify triggers and initiate appropriate response in accordance with the SGWRP	E&C Manager	As required
2	Implementation of mitigation measures in accordance with the relevant response process.	E&C Manager	As required
3	Review SGWRP in accordance with **Section 4.0**.	E&C Manager	As specified in **Section 4.0**.
4	Notify government departments if an incident occurs in accordance with **Section 4.4**	E&C Manager	As required
5	Submit updated SGWRP to DP&E.	E&C Manager	As required
6	Water related complaints to be responded to in accordance with **Section 3.0**	E&C Manager	As required
7	Annual Review to include water monitoring results, complaints, mitigation measures undertaken and a review of the monitoring undertaken	E&C Manager	Annually
8	Regulator review to be undertaken of the SGWRP	E&C Manager	As required
9	Prepare investigation reports and implementation of corrective actions in accordance with **Section 4.4**	E&C Manager	As required

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6.0 REFERENCES

- Development Consent (DA305-7-2003)
- Development Consent (DA177-8-2004)
- Wambo Development Project Environmental Impact Statement (EIS), July 2003
- Resource Strategies Pty Ltd (2003) Wambo Coal Mine Project Environmental Impact Statement. Report prepared for Wambo Coal Pty Ltd
- Wambo Environment Protection Licence (529)
- Environmental Planning and Assessment Act 1979
- Australasian Groundwater and Environmental Consultants (AGE) (2003) Wambo Development Project Groundwater Impact Assessment.
- Gilbert & Associates (2006) Wambo Coal Mine Hydrological Assessment of Staged Diversion and Temporary Pipeline – North Wambo Creek.
- HydroSimulations (2014) North Wambo Underground Mine Longwall 10A Modification Groundwater Assessment
- HydroSimulations (2018) 2017 Annual Review of Groundwater for Wambo Coal Operations
- Resource Strategies (2012) North Wambo Underground Mine Modification Environmental Assessment.
- SP Solutions (2006) Review of North Wambo Underground SMP Proposed Controls – North Wambo Creek.
- Wambo Coal (2003) Wambo Development Project Environmental Impact Statement.
- Wambo Coal (2006) Wambo Coal Mine Modification Statement of Environmental Effects.
- Wambo Coal (2007) Wambo Coal North Wambo Creek Diversion Plan.
- Wambo Coal (2016) South Bates Underground Mine Modification Environmental Assessment - Modification of DA 305-7-2003 (MOD 12)
- Wambo Coal (2017) South Bates Extension Modification Environmental Assessment - Modification of DA 305-7-2003 (MOD 17)

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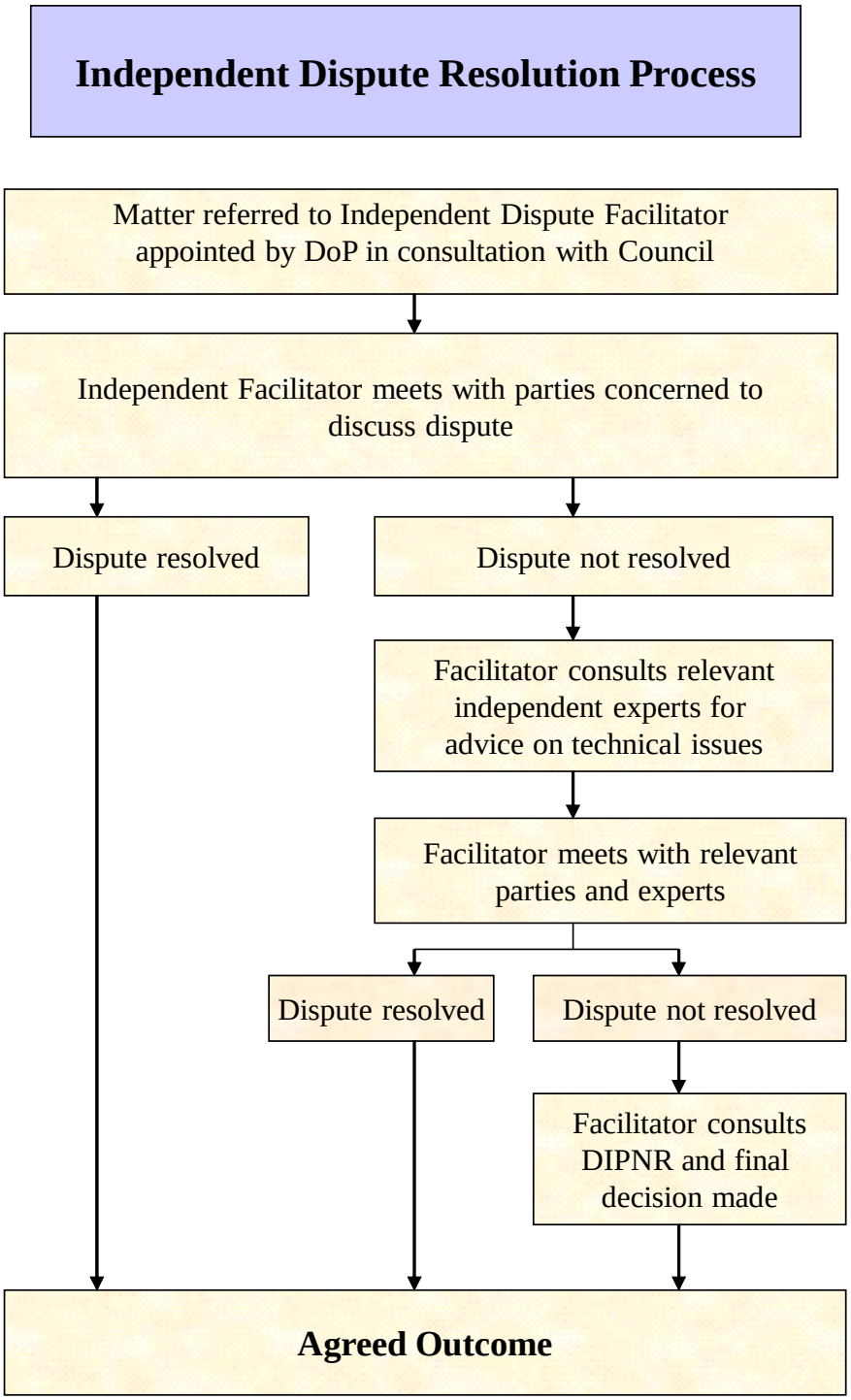
APPENDIX A
INDEPENDENT DISPUTE RESOLUTION PROCESS

DRAFT


Independent Dispute Resolution Process
Matter referred to Independent Dispute Facilitator appointed by DoP in consultation with Council
Independent Facilitator meets with parties concerned to discuss dispute
Dispute resolved
Dispute not resolved
Facilitator consults relevant independent experts for advice on technical issues
Facilitator meets with relevant parties and experts
Dispute resolved
Dispute not resolved
Facilitator consults DIPNR and final decision made
Agreed Outcome

APPENDIX B
CORRESPONDENCE WITH REGULATORY AGENCIES

DRAFT

Summary of Comments Received from DoI Water (formerly CLWD) on the WMP (Revision F, Revision 11) December 2017

Comment	Consideration of Comment
CLWD	
…CL&W recommends the following is undertaken prior to the Department of Planning's endorsement of the WMP	
The Department of Planning and Environment engages an independent expert to advise if leakage from South Wambo Dam has resulted in contamination of the alluvial aquifer of South Wambo Creek;	Noted. Addressed in the Groundwater Monitoring Program (WA-ENV-MP-509.1), a component of the site Water Management Plan.
In consultation with Crown Lands and Water, WCPL expands the observation bore network within and beneath the area of alluvial aquifers and mapped GDEs. This is to ensure that future groundwater model revisions can capture and predict important localised impacts;	Addressed in the Groundwater Monitoring Program (WA-ENV-MP-509.1), a component of the site Water Management Plan.
The WMP set a requirement to measure water quality for water seeping into the open cut and underground mine workings	The water quality of inflows to the underground workings and the open cut are measured indirectly through monthly water quality monitoring of mine water storages. This is the most practical method to routinely sample for water quality. An unexpected increase in water make or change in water quality of mine water storages would be investigated by Wambo. If warranted, direct measurement of water quality at the source of inflow may be conducted. (Refer to Section 4.1.9 of the Surface Water Monitoring Program)
The Surface and Ground Water Trigger Action Response Plan must link to monitoring bores with defined thresholds listed in the Groundwater Monitoring Plan. Observation sites listed for North Wambo Creek alluvium have no defined triggers that hold WCPL accountable to impacts and the licensable take of water.	The Mine is approved to have an impact on North Wambo Creek alluvium and the licensable take of water has been predicted by HydroSimulations (2016a, 2017). WCPL is held account to its licensing volumes through the monitoring of inflow volumes.

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Summary of Comments Received on the SGWRP from the IESC (31 July 2017)

Comment	Consideration of Comment
IESC – 31 July 2017	
When the initiation of a TARP relies on the exceedance of a trigger value, these trigger values must be clearly defined. For example, the current Surface and Ground Water Response Plan has a TARP for impacts to the North Wambo Creek Alluvium that cannot be initiated based on changes to groundwater levels in the alluvium because no trigger values have been defined for the four sites to which the TARP relates.	Trigger levels are now defined for the four sites.
The initiation of a TARP should not rely on changes being identified at a large number of sites simultaneously. For example, the current TARP for groundwater leakage from Wollombi Brook appears to require the identification of declining head trends in six separate bores concurrently. Different levels of this TARP could be initiated based on the number of bores in which the declining head trend is identified. This would be more likely to provide early detection of a potential impact rather than requiring all sites to be impacted before any investigations are undertaken.	The TARP in Section 2.8 has been revised to clarify that only one of the bores needs an exceedance of the standing water trigger values as provided in the GWMP, beyond natural fluctuations, for more than two consecutive monitoring events to trigger a response.
TARPs need to be made clearer and less repetitive. Actions and responses should be linked to mine operations and should identify and address the causes of the impacts where possible rather than only managing impacts.	Noted.
A commitment is needed by the proponent to compare field data with associated trigger values promptly upon receipt of the field data, and when necessary, to initiate TARPs in a timely manner.	WCPL has initiated the data repository system Equis to assist in this process. Equis will alert when compliance values or trigger values are exceeded. Roll out of Equis will continue throughout 2018.

DRAFT

Peabody

NSW GOVERNMENT | Planning & Environment

Contact: Scott Brooks
Phone: 6575 3401
Fax: 6575 3415
Email: scott.brooks@planning.nsw.gov.au
Our ref: 305-7-2003

The General Manager
Wambo Mine
PMB 1
SINGLETON NSW 2330

Attention: Steve Peart

Dear Steve

Wambo Coal – Approval of Water Management Plan

Thank you for forwarding the Wambo Water Management Plan and all its parts as required under project approval DA 305-7-2003 for the Department's consideration.

The Water Management Plan is required by Condition 30 Schedule 4 and the following 5 components of the Plan were reviewed:

- Site Water Balance (30)
- Erosion and Sediment Control Plan (32)
- Surface Water Monitoring Program (33)
- Ground Water Monitoring Program (34)
- Surface and Ground Water Response Plan (35).

The Department has reviewed these plans, and is satisfied that they generally address the requirements set out in the relevant conditions of the project approval. Consequently, I would like to advise you that the Secretary has approved the plans.

These plans come into force on the 30th November 2015 and remains in force until replaced by any future updated approved Plans.

I am aware that DPI Water are expected to comment on the Extraction Plan for the South Bates U/G (Wybrow seam) LW 11-13. Should this comment require significant changes to any component of the Water Management Plan, I ask if these changes could be made and the plans resubmitted for review and approval.

Could you please forward finalised copies of the above plan (preferably in PDF format with a copy of this approval letter appended) for the Department's records by the end of November 2015.

If you require further information or clarification in this matter please contact Scott Brooks on 6575 3401 or by email to scott.brooks@planning.nsw.gov.au.

Yours sincerely

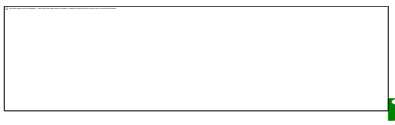
Scott Brooks
Investigations (Lead), Compliance
27 - 11 - 2015
As Nominee for the Secretary, Planning & Environment

From: Scott.Brooks@planning.nsw.gov.au [mailto:Scott.Brooks@planning.nsw.gov.au]
Sent: Wednesday, 21 October 2015 1:22 PM
To: Peart, Steven D
Subject: RE: 3 of 3

Steve,
I had no comment on the EE&SC Plan

Scott

Scott Brooks
Investigations (lead), Compliance
Planning Services, Resources Assessments
Planning & Environment
Suite 14, Level 1, 1 Civic Av
PO Box 3145
Singleton NSW 2330
http://www.planning.nsw.gov.au
E: scott.brooks@planning.nsw.gov.au
P: 02 6575 3401 | | **Office:** 6575 3405
M: 0419 970924 **F:** 02 6575 3415



Please consider the environment before deciding to print this e-mail.

From: Peart, Steven D [mailto:SPeart@peabodyenergy.com]
Sent: Wednesday, 21 October 2015 12:50 PM
To: Scott Brooks
Subject: RE: 3 of 3

Cheers Scott

The only other one was the Erosion and Sediment Control Plan if you had any comments on it.

Thanks again

Steven Peart
Manager: Environment & Community

Wambo Coal Pty Ltd
Peabody Energy Australia
PMB 1, Singleton NSW 2330
Phone: +61 (0)2 6570 2209
Fax: +61 (0)2 6570 2290
Mob: +61 (0)448 082 987
Email: speart@peabodyenergy.com
www.peabodyenergy.com.au
Please consider the environment before printing this email.

DRAFT

From: Scott.Brooks@planning.nsw.gov.au [mailto:Scott.Brooks@planning.nsw.gov.au]
Sent: Wednesday, 21 October 2015 11:46 AM
To: Peart, Steven D
Subject: RE: Wambo Coal_WMP's 1 of 3

Steve,
Comments on the 3 water management plans.

Please note we will need some type of water balance, and the info for the evaporation sprays if you want to use them.

Scott

Scott Brooks
Investigations (lead), Compliance
Planning Services, Resources Assessments
Planning & Environment
Suite 14, Level 1, 1 Civic Av
PO Box 3145
Singleton NSW 2330
http://www.planning.nsw.gov.au
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M: 0419 970924 **F:** 02 6575 3415

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Plan	Section	DP&E Comment
Surface and Ground Water Response Plan (WA-ENV-MNP-509.4) Version 8	2.7 North Wambo Creek Diversion Performance Criteria	Given the problems with the NWCD this section should refer to other management plans of have a section referring to erosion and the potential for sediment generation and loss from the system.
Surface Water Monitoring Program (WA-ENV-MNP-509.2) Version 8	1.4.1 Environmental Planning & Assessment Act 1979 (Table 3)	(NOW) Currently called DPI Water
	2.2.3.2 Stream Flow (Table 7)	(No flow data available) Is this because the SWC never runs?
	4.1 Monitoring Network, Parameters and Frequency	(Mine water monitoring is undertaken for operational management purposes only. This data is not reported publicly). This would appear to conflict with Schedule 6 Condition 12 requiring the publishing of monitoring results.
	4.1.5 Riparian Vegetation and Creek Bed Stability	The NWCD has its own rehab management plan. This management plan should refer to it and it may need to be updated.
	4.1.6 Monitoring of Discharge Flows in the North Wambo Creek Diversion	What did NOW ask for. This should be included.

Plan	Section	DP&E Comment
	6.1 Review	(Review every two years) Usually 3 years
Groundwater Monitoring Program (WA-ENV-MNP-509.1) Version 9	2.2.3.1 Alluvial Water Sources	(Investigation into increase in EC) This will need to be reported in the AEMR
	3.1.3 Permian Monitoring Locations	Need to discuss why we monitor if the results cannot result in action.
	3.2 Trigger Values for Groundwater Quality	(Bi-monthly monitoring) This will need to be defined. Twice a month or every 2 months
	4.1.6 Chitter Dam and Wambo South Water Dam Monitoring Program	Need some comment here if the dam will be recommissioned if it is found to be leaking.
	6.1 Review	(Review every two years) Review is normally every 3 years.

From: Joanna Webster [mailto:jwebster@ResourceStrategies.com.au]
Sent: Wednesday, 17 June 2015 1:05 PM
To: Jessie Evans; Brendan Liew
Cc: Joshua Hunt; Howard Reed; Alexander, Micheal G; Peart, Steven D
Subject: RE: Wambo 10A Extraction Plan - NOW comments
Importance: High

Hi Jessie/Brendan,

On behalf of Wambo Coal, please find attached a response to the recommendations made by NSW Office of Water.

Also attached is a revised Groundwater Monitoring Program that has been updated to address the recommendations made by the Office of Water.

Please consider Attachment 3 of the Water Management Plan for North Wambo Underground Mine Longwalls 8 to 10A Extraction Plan to be replaced by the attached revised Groundwater Monitoring Program.

Please don't hesitate to call if you would like to discuss.

Regards

Joanna Webster
Senior Environmental Manager
e jwebster@resourcestrategies.com.au
m 0414 664 532

Resource Strategies Pty Ltd
Suite 2 Level 3, 24 McDougall Street
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From: Jessie Evans [mailto:Jessie.Giblett@planning.nsw.gov.au]
Sent: Thursday, 4 June 2015 8:42 AM
To: Joanna Webster
Cc: Joshua Hunt; Howard Reed; Brendan Liew
Subject: RE: Wambo 10A Extraction Plan - NOW comments

Hi Joanna,

The Department has received comments from NOW in regards to the Wambo LW 8-10A Extraction Plan. I have attached these for your careful consideration and response. NOW has raised a number of issues, and in particular has concerns regarding the Groundwater Management Plan.

Could you please provide a response to NOWs concerns at your earliest possible convenience.

Thanks
Jessie

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North Wambo Underground Mine Extraction Plan Longwalls 8 to 10A
Response to NSW Office of Water Comments (Dated 3 June 2015)

NOW Recommendation	Response
Groundwater Management It is recommended with respect to the exceedance of groundwater level triggers: • WCPL must investigate the drivers for declining water levels (rather than omitting bores from the monitoring program when bores go dry). Notification to the Office of Water is required as part of the response procedure within 3 months of such an event.	Five bores are proposed to be removed from the groundwater monitoring program (GW14, GW18, GW19, P5 and P6). Only two samples (August 2011 and December 2011) have been obtained from GW14 since its installation in 2011 (these samples may have been associated with groundwater levels stabilising following drilling). This bore is located to the east of Wollombi Brook and is far removed from mining activities associated with the Wambo Coal Mine. Only one sample (August 2010) has been obtained from GW18. GW19 has been consistently dry since installation and no valid samples have been obtained from this bore. GW18 and GW19 are located immediately downstream and upstream of the North Wambo Creek Diversion, respectively. The alluvial flow in North Wambo Creek has been altered by the historical and existing mining operations including the removal of alluvium across the full width of the channel with consequent desaturation of the adjacent upstream and downstream alluvium associated with the approved and constructed North Wambo Creek Diversion. Bores P5 and P6 have been covered by the approved Wambo Coal Mine waste rock emplacement. WCPL considers removal of these five bores from the groundwater monitoring program is justified as outlined above. Trigger levels are not proposed for a further four bores along North Wambo Creek (GW08, GW09, GW16 and GW17). WCPL has initiated an investigation for bores GW08 and GW09 as outlined further below. Trigger levels will not be developed for these bores until this investigation is complete. GW16 and GW17 are located upstream of the North Wambo Creek Diversion and in close proximity to the approved open cut. There are no groundwater users located in the vicinity of North Wambo Creek upstream of the North Wambo Creek Diversion. Therefore, a trigger level for these two bores is not considered warranted.

NOW Recommendation	Response
• Where the driver for declining shallow bore water levels exceeding trigger levels can not be linked to the prevailing climatic influence or miscellaneous sampling error, additional groundwater modelling is required to re-assess if there is a change in the predicted take of water from the Lower Wollombi Brook Water Source from mining related activities. As part of WCPL's response procedure, a report summarising the assessment is to be submitted to the Office of Water.	WCPL has initiated an investigation into the monitored declining water levels in GW08 and GW09. As described in Section 6.1.3 of the revised GWMP, a preliminary investigation report will be provided to the DP&E and NOW by 30 September 2015. This report will include preliminary conclusions regarding the potential licensing implications and a process and timetable for any further investigation work (including potential additional numerical hydrogeological modelling work).
• Where the updated modelled aquifer interference take of water from the Lower Wollombi Brook Water Source (encapsulating Wambo and North Wambo Creek) exceeds the estimates as predicted in WPCL's Groundwater Impact Assessment by 100% or more, WCPL must re-evaluate the associated ecological impacts and any influence on a low flow cease to pump criteria specified in the relevant WSP. The reference value triggering this response procedure must be clearly documented in the GWMP.	As described in Section 6.1.3 of the revised GWMP, Where the investigation for GW08 and GW09 indicates a revised predicted take from alluvial water sources that exceeds the previous estimates by more than 100%, WCPL would consider other potential associated impacts (e.g. on ecology) and any influence on a low flow cease to pump criteria specified in the HUA WSP.
• The trigger levels in Table 11 of the GWMP outlines a minimum and maximum depth to water level. These values, plus any new bores added to the list, and the bores proposed to be dropped, must be presented in Australian Height Datum.	Table 11 of the GWMP has been revised to include trigger levels presented in Australian Height Datum.
<u>It is recommended with respect to the exceedance of groundwater quality triggers</u> • Appropriate water quality baseline data has not been captured and presented in way that can be used for before and after impact. Salinity data for a number of bores has fluctuated considerably which is not consistent with a more stable groundwater environment. The use of major ion analysis and QA/QC procedures should be reviewed to inform if the salinity measurements reported are accurate and if so the drivers to cause such variability in the results.	The GWMP has been revised to include annual comprehensive analysis of major ions standpipe bores. A description of data management procedures has been included in Section 5.3.2.
• Due to the concerns with the potential for cross aquifer interconnection, water quality performance measures are essential to the impact assessment. Water quality performance measures should be defined and added to the GWMP.	The GWMP has been revised to include groundwater quality trigger levels in Section 5.4.
<u>It is recommended with respect to the exceedance of predicted mine inflows</u> • There is a discrepancy between the GWMP which outlines a monthly measurement and annual assessment of mine inflows, whilst the 'Subsidence Response Strategy' indicates metering of weekly dewatered volumes. It should be consistently reported weekly, in the GWMP as this will improve the understanding of inflow and assist with groundwater management and the triggers for exceedance.	Section 5.2.5 of the GWMP has been updated to clarify that dewatering values are recorded internally on a daily basis (during active pumping). As outlined in the North Wambo Creek Subsidence Response Strategy, these values are reviewed weekly for any indication that pumping rates are higher than normal (which would trigger an investigation). Dewatering values are also reviewed annually (as outlined in the GWMP) to determine the inflows from groundwater sources and to verify whether WCPL holds sufficient groundwater licence entitlements.

NOW Recommendation	Response
• Where the annual assessment for mine inflows exceeds the peak estimate as predicted in WCPL's Groundwater Impact Assessment by 50% or more, WCPL shall: – investigate if there is a change in the predicted take of water from the Lower Wollombi Brook Water Source from mining related activities; – where there is an increased take from the Lower Wollombi Brook Water Source, investigate any influence on a low flow cease to pump criteria specified in the relevant WSP. – define the mine inflow volume value triggering this response procedure within the GWMP. – As part of WCPL's response procedure, a report summarising the assessment is to be submitted to the Office of Water.	Section 5.2.5 of the GWMP has been updated to include the recommended response procedure. The mine inflow volume that would response procedure has been defined in the GWMP (563 ML/annum, which is 50% more than the peak estimate predicted by HydroSimulations (2014) [375 ML/annum] for the North Wambo Underground Mine).
• WCPL must notify the Office of Water as soon as practicable on become aware of any take of water in excess of its licensed entitlement	Section 5.2.5 of the GWMP has been updated to include this statement.
It is recommended with respect to monitoring leakage from dams • The closest bore to South Dam is Piezometer 114 representative of Wambo Creek alluvium. South Dam contains produced water from the mine and P114 shows a sharp rise in salinity to a level on par with water in the dam. This indicates probable leakage occurring from the dam that warrants further investigation. However, as the proponent proposes not to utilise water quality as a performance measures, no direct response is proposed. Significant leakage to the nearby alluvial aquifer could risk a change in the beneficial use of the aquifer. Trigger levels with regard to salinity must be set to investigate and determine if remediation is required.	WCPL has initiated an investigation into the monitored increasing salinity levels in P114. Wambo South Water Dam is currently not in use for the period of secondary extraction for Longwall 9, Longwall 10 and Longwall 10A at the North Wambo Underground Mine. Wambo South Water Dam has been drained as far as practical since January 2015. Therefore, any possible leakage mechanism that may have impacted bore P114 may no longer be present.
A report summarising any special assessment for the above recommendations should be provided within 6 months.	As described in Section 6.1.4 of the revised GWMP, a preliminary investigation report will be provided to the DP&E and NOW by 30 November 2015.
Surface Water Management • The Office of Water recommends the proponent and the Department of Planning and Environment develop a consultation process with affected landholders to address existing and potential degradation which occurs as a result of mining subsidence. This should focus on incorporating natural processes for channel recovery particularly using large timber controls to maintain bed level (bed sills), bank toe protection (timber bank revetment) and creation of scour pools by using 'forced' controls such as engineered log jams as an adjunct to revegetation of both banks of both watercourses.	All land above the North Wambo Underground Mine is owned by WCPL. Therefore there are no other affected landholders associated with the North Wambo Underground Mine Extraction Plan for Longwalls 8 to 10A. Advisian (2015) concluded it is unlikely Wambo Creek and Stony Creek would experience adverse impacts from the North Wambo Underground Mine, and mitigation measures are unlikely to be required. In the unlikely event that any mitigation measures are required, these would be developed in consultation with the Department of Planning and Environment and the NSW Office of Water, and would aim to incorporate natural processes for channel recovery.

Comment	Consideration of Comment
Department of Planning and Environment – 25 May 2017 and 5 July 2017	
Update the SGWRP to reflect the modified layout for LWs 14-16.	The SGWRP has been revised to reflect the latest layout for LWs 14-16 (e.g. see Figure 3).
Replace Figure 3 with the approved longwall layout for LWs 11-16 (as approved by the Extraction Plan on 16 May 2017).	Figure 3 has been revised.
Revise TARPs to reflect revisions to the SWMP and GWMPs and make relevant to mining in LW14-16.	The TARPs in Sections 2.3 and 2.4 are designed to account for all open cut and underground mining operations at Wambo (including Longwalls 14 to 16). A North Wambo Creek Subsidence Response Strategy is appended to the SGWRP that deals specifically with the South Bates Underground Mine.
Discuss acceptable triggers for the relinquishment of water extraction rights with DPI-Water and include SGWRP.	It is most appropriate to consider the relinquishment of water extraction rights to compensate for post mining closer to the end of the mine life. WCPL understands that this staged approach is available under the Development Consent. DPI Water did not express any concerns with this approach in its review of the SGWRP.
Include response times for key actions within the TARPs.	Additional clarification on the timing of actions has been included. Section 4.4 outlines response times for reportable environmental incidents.
DPI Water – 6 November 2015	
In relation to Table 3 of the SGWRP, DPI Water requested further detail on the triggers and responses for impacts on private bores, in particular: • DPI Water expressed concerns about the trigger for a Level 2 Contingency Response, in particular if private bores are unable to sustain extraction for licensed and basic rights purposes with a 2 m drawdown. • DPI Water expressed concerns about the trigger for a Level 2 Contingency Response, in particular that action (i.e. a Level 2 Contingency Response) may only be initiated when three consecutive monitoring rounds show a decline at the trigger level. • DPI Water recommended that relevant agencies be notified of trigger exceedances as part of regular reporting requirements. • DPI Water expressed concerns about the timing for provision of compensatory water supplies to affected landholders.	WCPL recognises that bores in some circumstance (e.g. in shallow aquifers) may not be able to maintain a sustainable yield for a drawdown less than 2 m. WCPL also recognises that three months of drawdown greater than 2 m would be significant in some circumstances. The Trigger Action Response Plan (TARP) for private bores has been structured so that receipt of a new complaint from a landholder in relation to decreasing levels in a private bore automatically initiates a Level 2 Contingency Response. WCPL considers that this mitigates the risks identified by DPI Water. In response to DPI Water's comment regarding notification of relevant agencies, Table 3 of the SGWRP has been revised to include the following Action for a Level 2 Response Contingency Phase: *•Notify DP&E and DPI water of contingency response.* The Plan phase for a Level 2 Response Contingency Phase in Table 3 of the SGWRP has been revised to address DPI Water's comments as follows: *•If preliminary or subsequent investigations ~~determine~~ indicate that compensatory water supplies are to be initiated, as a direct result from Wambo's operations, then Wambo will commence consultation with the affected Landowners to establish an agreed suitable compensatory supply of water, until further monitoring can ~~determine signs of increasing water levels~~ establish these are no longer required.* *•Review and update the WMP and resubmit to DP&E.*

Comment	Consideration of Comment
In relation to Table 4 of the SGWRP, DPI Water expressed concern that the TARP for impacts on surface water flows does not include mitigation measures only further monitoring.	The Action phase of the TARP for impacts on surface water flows outlines the process for undertaking a preliminary investigation, including engaging a suitably qualified hydrologist. The Plan phase of the TARP includes developing appropriate mitigation measures in consultation with relevant government agencies (including DPI Water) where it is shown that a flow loss has occurred that is greater than modelled. The Plan phase of the TARP for a Level 2 Response Contingency Phase in Table 4 of the SGWRP has been revised to clarify that mitigation measures may include stream remediation works: *•If confirmation of a flow loss which is greater than modelled has occurred Wambo will notify the relevant government agencies and in consultation develop appropriate measures to mitigate the loss of surface water flows in the surface water streams (e.g. stream remediation techniques).* WCPL considers that detail on mitigation measures for unforeseen impacts should not be foreshadowed in detail but developed at the time in consultation with relevant government agencies.
In relation to Table 5 of the SGWRP, DPI Water recommended that after detection of an exceedance during one surface water quality sampling event, the frequency of monitoring is increased to weekly and that contingency actions be implemented following two further exceedances. DPI Water notes that sampling could return to monthly once sampling indicates that parameters are within trigger levels.	The impact assessment criteria for surface water quality have been set based on the 20th and 80th percentile of the available dataset for each site. The surface water quality impact assessment criteria seek to identify persistent statistical variation from baseline data, and therefore there are triggers for two and three consecutive exceedances of the criteria. Initiating additional monitoring in response to one exceedance would add significant additional monitoring burden for reasonably regular events that could be associated with natural water quality variations. In response to the comment from DPI Water, WCPL has amended the Action phase for a Level 1 Response Management Measures (i.e. two consecutive exceedances of the surface water impact assessment criteria) in Table 5 of the SGWRP as follows: *•Increase ~~Maintain~~ monitoring of surface water site(s) to fortnightly to identify if water quality results are trending back to long term averages as identified in the SWMP.* *•If any water quality exceeds the 80th Percentile Trigger Value (three consecutive samples), then go to Level 2 Response.*

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Comment	Consideration of Comment
In relation to Section 2.5 of the SGWRP, DPI Water noted that all loss of surface flow needs to be accounted for through appropriate licences during operation of the mine and prior to the take of water.	WCPL recognises that use of licensing as an offset measure would be in addition to the licence required for other operational purposes. Section 2.5 of the SGWRP has been clarified as follows: *Appropriate management measures will be developed and implemented in consultation with relevant government agencies and may include the relinquishment of an equivalent portion of water access licences as a direct offset for potential groundwater inflows into the Mine (HydroSimulations, 2014) (i.e. in addition to licences already held to account for water take).*

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APPENDIX C
NORTH WAMBO CREEK SUBSIDENCE RESPONSE STRATEGY

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WAMBO COAL
NORTH WAMBO CREEK DIVERSION SUBSIDENCE RESPONSE STRATEGY – SBU AND SBU EXTENSION MINE

Document No. WA-ENV-MNP-509.7
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Document Control

Document No.	WA-ENV-MNP-509.7
Title	North Wambo Creek Diversion Subsidence Response Strategy – SBU Mine
General Description	Responses to potential subsidence impacts on North Wambo Creek Diversion
Document Owner	Environment & Community Manager

Revisions

Rev No	Date	Description	By	Checked	Signature
1	May 2016	Updated for SBU LW11-LW13	WCPL	SP	
2	July 2017	Revised to address DPE comments and incorporate LW14-16	WCPL		
3	March 2018	Revised following MOD17 approval for SBUEx (Longwalls 17-25)	WCPL		

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1.0 Introduction

1.1 Background

The Wambo Coal Mine (the Mine) is situated approximately 15 kilometres west of Singleton, near the village of Warkworth, New South Wales (**Figure 1**). The Mine is owned and operated by Wambo Coal Pty Limited (WCPL), a subsidiary of Peabody Energy Australia Pty Limited.

The South Bates (Whybrow Seam) Underground Mine is a component of the approved Wambo Coal Mine. The South Bates (Whybrow Seam) Underground Mine commenced in February 2016 and involves extraction of coal by longwall mining methods from the Whybrow Seam within Coal Lease (CL) 397 and Mining Lease (ML) 1594 (**Figure 2**).

The potential environmental impacts of the existing Wambo Coal Mine (including the approved South Bates [Whybrow Seam] Underground Mine) were assessed in the Wambo Development Project Environmental Impact Statement (the Wambo Development Project EIS) (WCPL, 2003). Development Consent DA 305-7-2003 for the Wambo Coal Mine was granted on 4 February 2004 by the then NSW Minister for Urban Affairs and Planning under Part 4 of the *NSW Environmental Planning and Assessment Act, 1979*.

An application to modify the Development Consent (DA 305-7-2003 MOD 15) was lodged in July 2015 to allow an extension to the South Bates Underground Mine to include three additional longwalls (Longwalls 14 to 16) in the Wambo Seam and was approved on 10 November 2015. The application was accompanied by the South Bates (Wambo Seam) Underground Mine Modification Environmental Assessment (WCPL, 2015).

Underground mining at North Wambo Underground Mine commenced in 2005 was completed in early 2016 with the completion of Longwall 8b. Underground mining operations moved to South Bates (Whybrow Seam) Underground Mine with the commencement of Longwalls 11 to 16 (approved as part of the Development Consent DA 305-7-2003).

The SBU Mine has an Extraction Plan for LW11 to LW16 (the Extraction Plan) that outlines the proposed management, mitigation, monitoring and reporting of potential subsidence impacts and environmental consequences from the secondary extraction of Longwalls 11 to 16 at the South Bates Underground Mine in the Whybrow and Wambo Seams.

In December 2017, the DP&E granted approval for Wambo Coal Mine to conduct secondary extraction of nine additional longwall panels (LW17 to LW25) in the Whybrow Seam of the South Bates Underground Extension (SBUE) area (DA 305-7-2003 MOD 17). An Extraction Plan is currently being prepared for longwall panels 17 to 20. The Extraction Plan will outline proposed management, mitigation, monitoring and reporting of potential subsidence impacts and environmental consequences.

1.2 Overview of Predicted Impacts - North Wambo Creek Diversion

Potential environmental consequences to the North Wambo Creek Diversion (NWCD)[1] above the Longwalls 11 to 16 from the Extraction Plan, include:

- In-channel ponding up to 1.4 metres (m) deep and up to 250 m long;
- Potential for increased scour (and associated suspended solids) prior to the implementation of scour protection works; and
- Potential for increased leakage from the North Wambo Creek Diversion prior to crack remediation works.

HydroSimulations (2015) estimates that increased leakage from the North Wambo Creek Diversion to the underground workings could be in the order of approximately 12.5 megalitres per day (ML/day) prior to remediation during periods of flow. Advisian notes that flows in excess of 10 ML/day can be expected on approximately 22 days per year, comprising events of 2 to 3 days duration.

An additional 120 m of the NWCD will be directly undermined by the SBUE area longwalls. Subsidence from mining is predicted to impact a small section of the NWCD in the north-eastern corner of Longwall 17 (refer to Figure 2), where a shallow pool estimated to be 0.1 m deep and 25 m long is predicted to form. Pools are an existing feature of the NWCD and therefore the small pool that is predicted to form as a result of mining of Longwall 17 is proposed to be retained and would possibly contribute to the local ecology of the area in the future. The adjoining floodplain near the upstream edge of the pool is the area most vulnerable to scour. Cracking of the surface soil and underlying rock is predicted (Advisian, 2016). Subsidence impacts are predicted to be similar to those observed at the adjacent Longwalls 11 to 16 (Resource Strategies, 2017).

Management and remediation measures to mitigate the risk of scour and leakage associated with Longwalls 11 to 16 are outlined in **Section 2**. Additional measures are currently being developed for the Extraction Plan for Longwalls 17 to 20. Following approval of this document, relevant measures will be included in the next revision the North Wambo Creek Subsidence Response Strategy (NWCSRS).

1.3 Purpose

The purpose of this revised NWCSRS is to provide monitoring and management response strategies as a result of subsidence impacts on the NWCD (**Figure 3**) from the subsequent underground mining operations at SBU for LW11 to LW16 and SBUE area LW17-20.

[1] North Wambo Creek has now been completely diverted around the active Bates South Open Cut Pit. The creek diversion is located adjacent to the finishing (i.e. north-eastern) ends of the proposed South Bates (Wambo Seam) Underground Mine Longwalls 14 to 16 (WMLW14 to WMLW16) and is partially located above the three longwalls in the Whybrow Seam, now referred to as WYLW11 to WYLW13 at the South Bates (Whybrow Seam) Underground Mine.

1.4 Scope

The NWCSRS applies to all WCPL employees, contractors and sub-contractors, undertaking activities within the vicinity of North Wambo Creek Diversion, within WCPL's mining authorisations and approved mining areas. The North Wambo Creek Diversion is located adjacent to the proposed LW11 to LW16 and LW17 to LW20 as shown in **Figure 3**.

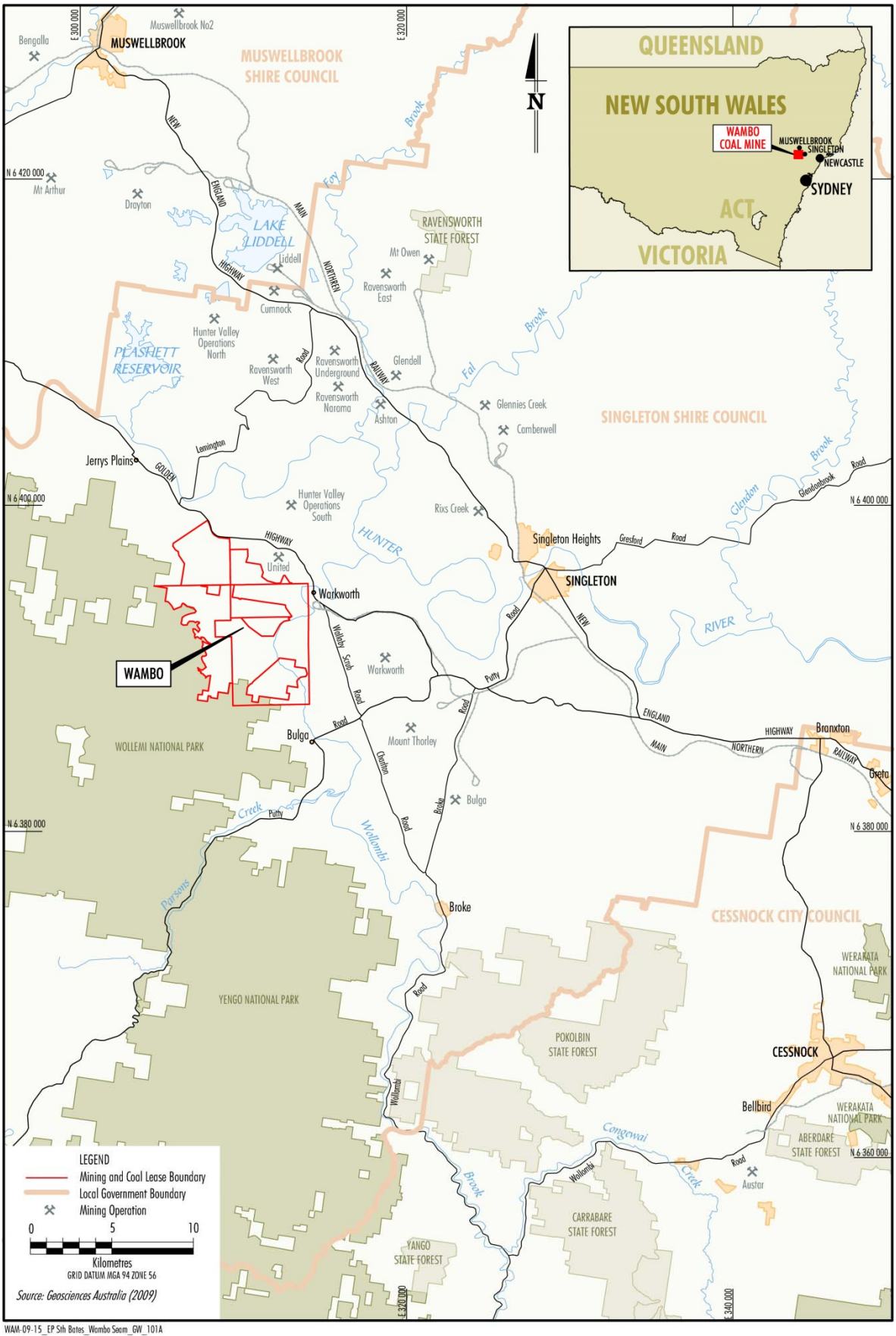

Figure 1: Wambo Coal Regional Location

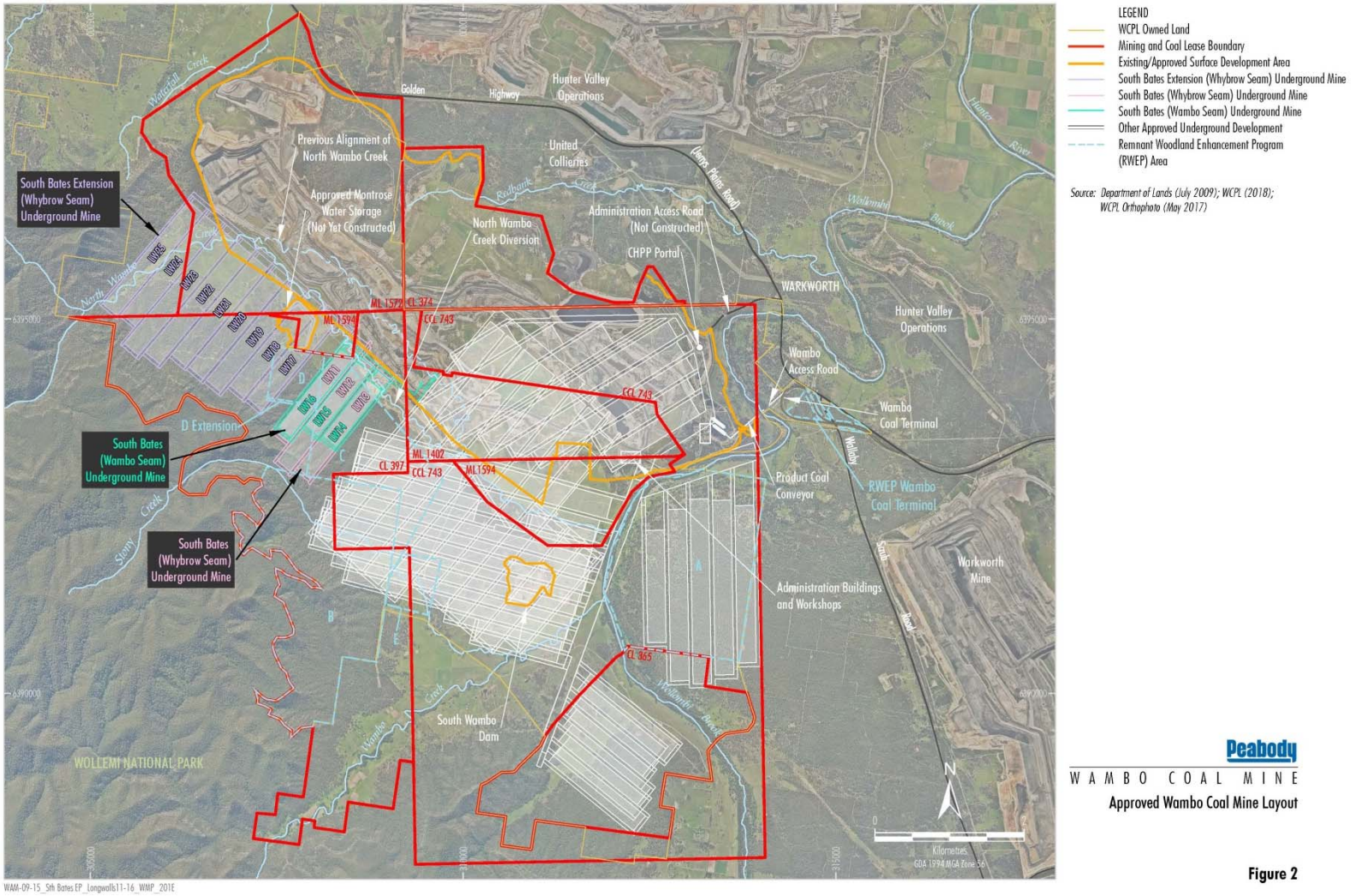

Figure 2 – Location of SBU LW11 to LW16 and SBUE LW17 to LW25

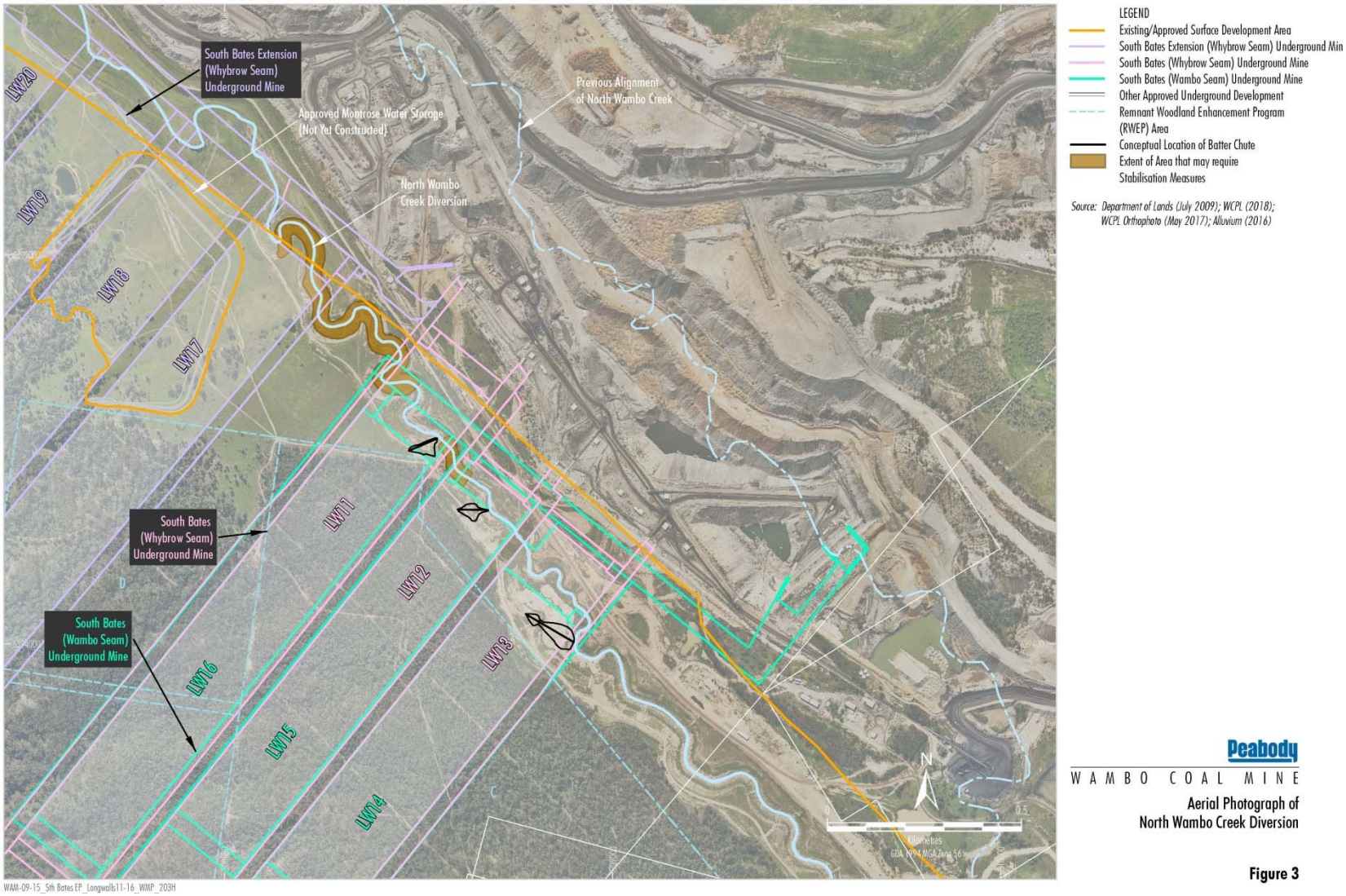

Figure 3 – Location of SBU LW11 to LW16, SBUE LW17 to LW20 and NWCD

2.0 Management Strategies

2.1 Monitoring

The monitoring strategies to identify the proposed impacts within the NWCD as described in **Section 1** (from the Extraction) are detailed and summarised in **Table 1**.

Table 1 Monitoring Program for NWCD

Monitoring Component	Parameter	Timing/Frequency	Responsibility
Pre-Mining			
Bed and bank stability monitoring of North Wambo Creek Diversion and Stony Creek.	In accordance with the SWMP.	In accordance with the SWMP.	Environment and Community Manager
Monitoring of surface water quality and flow monitoring sites (SW04, SW27a, SW08, FM2, FM3).	In accordance with the SWMP.	In accordance with the SWMP.	Environment and Community Manager
Monitoring of groundwater sites (GW21, N2, N3).	In accordance with the GWMP.	In accordance with the GWMP.	Environment and Community Manager
During Mining			
Longwalls 11 to 16 and LW17 to LW25 subsidence monitoring lines as described in the Subsidence Monitoring Program.	Monitoring parameters include: • subsidence; • tilt; • tensile strain; • compressive strain; and • absolute horizontal translation.	Monitoring during secondary extraction of Longwalls 11 to 16 and LW17, in accordance with the Subsidence Monitoring Program.	Mine Surveyor
Diversion and subsidence monitoring program.	As outlined in the SWMP.	In accordance with the SWMP.	Environment and Community Manager
Visual inspection of the North Wambo Creek Diversion.	Surface cracks. Surface ponding.	Daily inspections when extraction is occurring directly beneath North Wambo Creek Diversion.	Environment and Community Manager
Visual inspection of drainage line flow paths.	Evidence of erosion or channelisation.	Following a rainfall event of greater than 40 mm in 24 hours.[1]	Environment and Community Manager
Bed and bank stability monitoring of Stony Creek.	In accordance with the SWMP.	In accordance with the SWMP.	Environment and Community Manager
Monitoring of surface water quality and flow monitoring sites (SW04, SW27a, SW08, FM2, FM3).	In accordance with the SWMP.	In accordance with the SWMP.	Environment and Community Manager
Monitoring of groundwater sites (GW21, N2, N3).	In accordance with the GWMP.	In accordance with the GWMP.	Environment and Community Manager
Inflows to underground workings.	Dewatering volumes and underground water levels in accordance with the GWMP.	Recorded on a daily basis during pumping.	Environment and Community Manager

2.2 Management Responses

The management response strategies to address the proposed impacts within the NWCD as described in **Section 1** (from the Extraction Plan) are detailed and summarised in **Table 2**.

Table 2 Management Response Strategies for NWCD

Management Measure	Timing/Frequency	Responsibility
Pre-Mining		
Stockpile sufficient materials and make equipment and necessary resources available for: • sealing any surface cracks (particularly in areas that are predicted to be ponded); and • installation of scour protection works.	Prior to commencement of secondary extraction of Longwalls 11 to 16 and 17 to 25.	Environment and Community Manager
Management Measure	Timing/Frequency	Responsibility
During Mining		
Remediation of all visible surface cracks in the North Wambo Creek Diversion low flow channel as soon as practicable. Cracks would be infilled with alluvial/colluvial material that may be blended with bentonite to achieve a level of seal consistent with the surrounding host material.	As soon as practicable following observation (nominally within two weeks).	Environment and Community Manager
Remediation of surface cracks[1] in areas outside the North Wambo Creek Diversion low flow channel where practicable using conventional earthmoving equipment (e.g. a backhoe) including: • infilling of surface cracks with soil or other suitable materials; or • locally re-grading and re-compacting the surface.	When required during secondary extraction of Longwalls 11 to 16 and 17 to 25.	Environment and Community Manager
Review of areas that may be vulnerable to scour along the North Wambo Creek Diversion (as shown on Figure 3) and installation of appropriate scour protection (e.g. vegetation planting, placement of woody debris, localised rock armouring).	The timing for installation of scour protection is currently being reviewed in consultation with external consultant.	Environment and Community Manager
Construction of new batter chutes to manage concentrated overland flow entry to the North Wambo Creek Diversion (see conceptual locations on Figure 3).	The timing for construction is currently being reviewed in consultation with external consultant.	Environment and Community Manager
Stabilisation of any areas of surface cracking or erosion using erosion protection measures (e.g. vegetation planting).	When required during secondary extraction of Longwalls 11 to 16 and 17 to 25.	Environment and Community Manager
Review of remediation measures and implementation of additional measures if required, in accordance with the TARP (Attachment 1).	Ongoing during mining.	Environment and Community Manager

Table 2 Management Response Strategies for NWCD (cont..)

Post-Mining		
Review of remediation measures and implementation of additional measures if required, in accordance with the TARP (**Attachment 1**).	Following completion of secondary extraction of Longwalls 11 to 16 and 17 to 25.	Environment and Community Manager
Post-subsidence assessment of impacts to Stony Creek and drainage lines and implementation of any minor remedial works.	Following completion of secondary extraction of Longwalls 11 to 16 and 17 to 25.	Environment and Community Manager

Notes: [1]

- Minor cracks that develop are not expected to require remediation as geomorphic processes will result in natural filling of these cracks over time;
- Remediate surface cracks as required by the MOP i.e.:
  - No subsidence surface cracks remaining that present a risk to the environment, safety and the final land use objectives; and/or
  - Remediation of surface cracks >50 mm.
- Remediation of surface cracks, where practicable using conventional earthmoving equipment (e.g. a backhoe) including:
  - Infilling of surface cracks with soil or other suitable materials; and
  - Locally re-grading and re-compacting the surface.
- Ensure sufficient stockpiles of suitable material (i.e. sandy-silt and/or alluvium material that has been confirmed by soil specialist) have been either placed or identified within the vicinity of the NCWD prior to longwall within the NWCD;
- Ensure equipment and necessary resources available for remediation prior to longwall within the NWCD;
- Whilst the methods of remediation would not be expected to change, infilling the larger surface cracking with cohesive materials and by regrading and re-compacting the surface soils; and
- WCPL will consider the addition of bentonite to the alluvial material used in crack remediation in the low flow channel (i.e. where the bedrock is exposed) based on geotechnical advice. The addition of bentonite could be beneficial due to its ultra fine particle size, expansive and sealing properties and could assist with the natural process of capturing fines. If required, a percentage of bentonite will be blended with the alluvial material where required to supplement its fines content to achieve a level of seal consistent with the surrounding host material.

2.3 NWCD Trigger Action Response Plan

A trigger action response plan (TARP) (**Table 3**) from the Extraction Plan has been developed if additional remediation measures and responses are required. **NOTE:** This TARP must be read in conjunction with the approved *Water Management Plan – South Bates (Whybrow Seam) Underground Mine Longwalls 11-16* (**Appendix 1**). Table 3 will be reviewed following the approval of the Extraction Plan for LW17 to LW20.

Table 3 NWCD Trigger Action Response Plan

Condition	Normal	Level 1	Level 2
	Normal Conditions	**Management Measures**	**Restoration/Contingency Phase**
Trigger	• No visible cracks along North Wambo Creek Diversion. • Dewatering volumes and underground water levels at normal conditions and not significantly influenced by climatic conditions. • Predicted impacts on other surface water and groundwater as described in **Section 3**.	• Cracks observed along North Wambo Creek Diversion. • Dewatering volumes and underground water levels are elevated and responding significantly to climatic conditions. • Impacts requiring remediation observed on Stony Creek or other ephemeral drainage lines/overland flow paths. • Groundwater or surface water impacts greater than expected.	• Functionality of North Wambo Creek Diversion materially affected. • Dewatering volumes and underground water levels continue to respond significantly to climatic conditions following remediation. • The Wollombi Brook performance measure has been exceeded, or is likely to be exceeded.
Action	• Conduct monitoring, consistent with **Tables 4 and 7**, the GWMP, SWMP and the Subsidence Monitoring Program (Appendix H of the Extraction Plan). • Assess the environmental consequences of the subsidence in accordance with **Section 6** and the SGWRP. • Assess the need for management measures in accordance with **Section 5** and the SGWRP.	• Implement management measures, as required, in accordance with **Section 5** and the SGWRP.[1] • Continue monitoring, consistent with **Tables 4 and 7**, the GWMP, SWMP and the Subsidence Monitoring Program (Appendix H of the Extraction Plan).	• Implement Contingency Plan described in **Section 7**. • Develop action plan for additional measures, including consideration of: - additional scour protection, crack remediation and/or stabilisation; and/or - isolation sealing of the diversion cutting, for example through injection grouting or installation of low permeability material.
Frequency	• Frequency consistent with **Table 5**, the GWMP, SWMP and SGWRP.	• As required, in accordance with **Section 6** and the SGWRP.	• As required, in accordance with **Section 7**.
Position of Decision Making	• Environment and Community Manager.	• Environment and Community Manager.	• General Manager. • Implementation of additional management measures will be undertaken in consultation with DRG and CLWD.

1 With regard to the specific circumstances of the subsidence impact [e.g. the location, nature and extent of the impact] and the assessment of environmental consequences, in accordance with **Sections 5 and 6** and the SGWRP.

Note: GWMP refers to the Wambo Coal Groundwater Monitoring Program.
SWMP refers to the Wambo Coal Surface Water Monitoring Program.
SGWRP refers to the Wambo Coal Surface Water Groundwater Response Plan.
DRG refers to the NSW Department of Environment and Planning - Division of Resources and Geoscience.
CLWD - refers to the Water division in the Department of Primary Industries, Crown Lands and Water

3.0 Monitoring and Reporting

3.1 Monitoring

Detailed longitudinal geomorphological surveys should be conducted along creek reaches affected by subsidence. The surveys should include a photographic record with location co-ordinates, with any areas of potential instability noted. Monitoring (as outlined in **Table 1**) should be undertaken:

- Prior to subsidence;
- During subsidence;
- Post subsidence; and
- Following the completion of any restoration or remediation works.

3.2 Reporting

All reporting requirements will be in accordance with Section 4.2 of the Extraction Plan. The reporting requirements include:

- Incident Reporting;
- Subsidence Management Status Report;
- Six Monthly Report; and
- Annual Review.

The Annual Review (AR) will include:

- Summary of subsidence effects monitoring and a comparison to predicted subsidence effects; and
- Summary of all environmental and subsidence monitoring results and a comparison of actual impacts with predicted subsidence impacts and the subsidence impact performance measures.

4.0 Audit/Review

The NWCSRS will be reviewed by the Environmental and Community Manager:

- On an annual basis;
- When there are changes to consent or licence conditions relating to aspects of this NWCSRS;
- In response to an Independent Environmental Audit conducted in accordance with Consent Condition 7, Schedule 6 of DA 305-7-2003;
- Following an incident at SBU in relation to water; or
- In response to a relevant change in technology or legislation.

5.0 Responsibilities

Table 4 below summarises responsibilities documented in the NWCSRS. Responsibilities may be delegated as required.

Table 4: NWCSRS Responsibilities

No	Task	Responsibility	Timing
1	Subsidence monitoring as identified in **Section 2** of this Strategy.	Environmental and Community Advisor	As required
2	Implementation of mitigation strategies and monitoring measures in accordance with this Strategy and in consultation with relevant agencies.	Environment and Community Manager and Underground Manager	As required
3	Ensure that all process and procedures under this Strategy and all other relevant management plans in relation to this Strategy are followed.	Environment and Community Manager	As required
4	Ensure that all relevant personnel have reviewed the Strategy and any amendments.	Environment and Community Manager	As required
5	Ensure Strategy is implemented across all relevant personnel.	Environment and Community Manager	As required

6.0 References

- *Gilbert & Associates (2003) Wambo Development Project – Surface Water Assessment.*
- *Resource Strategies (January 2017) Extraction Plan – South Bates (Whybrow Seam) Underground Mine Longwalls 11 to 16;*
- *Resource Strategies (March 2017)* Environmental Assessment for the Modification of DA305-7-2002 (MOD17) Extension of the Approved South Bates Mine
- *SP Solutions (2006) Review of North Wambo Underground SMP Proposed Controls - North Wambo Creek.*
- *SCT Operations Pty Ltd (2015) Assessment of Inflow Potential Associated with Mining Under the North Wambo Creek Diversion.*
- *WCPL (2006) Wambo Coal Mine Modification Statement of Environmental Effects.*
- *WCPL (2015) South Bates (Wambo Seam) Underground Mine Modification Environmental Impact Statement.*
- *Water Management Plan – South Bates (Underground Mine Longwalls 11-16)*